SECONDARY PRESERVICE AGRICULTURAL EDUCATION TEACHERS' PROFESSIONAL KNOWLEDGE BASES & COLLECTIVE PEDAGOGICAL CONTENT KNOWLEDGE

by

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Dedicated to first, and most importantly, God for giving me the inspiration, wisdom, strength, and endurance to complete this thesis. I would also like to dedicate this thesis to my loving family: Mom, Dad, Grandi, Pappy, Dalen, Tempo, and Hoss, for always supporting me through the journey of struggles and moments of success!

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LIST OF ABBREVIATIONS

CoRe:	Content Representation (CoRe)
cPCK:	Collective Pedagogical Content Knowledge
ePCK:	Enacted Pedagogical Content Knowledge
FFA:	Future Farmers of America, now known as National FFA Organization
LPAE:	Laboratory Practices in Agricultural Education
PCK:	Pedagogical Content Knowledge
PKB:	Professional Knowledge Bases
pPCK:	Personal Pedagogical Content Knowledge
RCM:	Refined Consensus Model
SBAE:	School-Based Agricultural Education
STEM:	Science, Technology, Engineering, and Math

ABSTRACT

School-based agricultural education programs use laboratories to develop cognitive, psychomotor, and procedural skills (Phipps et al., 2008). It is important to help preservice teachers develop the ability to design instruction to cultivate skills that are taught in laboratory settings. Shulman (1986) authored a term called Pedagogical Content Knowledge (PCK), which is a teacher's knowledge of teaching. Animal science dissection was the topic chosen for this study, as PCK is topic-specific (Chan & Hume, 2018). There are many interpretations of PCK. The Refined Consensus Model (RCM) of PCK in Science Education (Carlson et al., 2019) was the conceptual model used in this study, as it is the most recent PCK model, and was developed by experts in science education from multiple countries. This model asserts that PCK is comprised of three realms: Collective PCK (cPCK), Personal PCK (pPCK), and Enacted PCK (ePCK). The first purpose of this study was to describe preservice agriculture teachers' Professional Knowledge Bases (which informs pPCK), before and after instruction, on the topic of animal science dissection in a Laboratory Practices in Agricultural Education (LPAE) course. The second purpose was to describe preservice agriculture teachers' cPCK, after instruction, on animal science dissection in an LPAE course. Content Representations (CoRes), a common tool used for PCK research, were used identify evidence of the Professional Knowledge Bases (PKBs) in preservice agriculture teachers' instructional planning. Results from this study showed elevated descriptions of Professional Knowledge Bases, and participants collectively gained new ideas and collaboration skills. Overall LPAE dissection experience appeared to push the depth of student thinking and ability to make connections with future learning. Future research recommendations include using the RCM of PCK (Carlson et al., 2019) and CoRes in agricultural education; more PCK research, specifically exploring the development of Curricular Knowledge, on preservice teachers in agricultural education; and PCK research on other topics in agricultural education. It is recommended to not only include PCK development in teacher preparation programs but also have more than one exposure to PCK development.

CHAPTER 1. INTRODUCTION

1.1 Introduction

School-based agricultural education (SBAE) programs use laboratories to develop cognitive, psychomotor, and procedural skills (Phipps et al., 2008). A fundamental element of SBAE programs is laboratory instruction (Shoulders & Myers, 2012). It is important to help preservice teachers develop the ability to design instruction to cultivate skills that are taught in laboratory settings. A variety of content and pedagogical courses are combined in preservice teacher preparation programs to prepare preservice teachers (Darling-Hammond, 2010). Teachers' instructional practices and how they think about learning, teaching, and curriculum are all influenced by their content knowledge (Stodolsky & Grossman, 1995). Furthermore, teacher knowledge plays a vital role in establishing quality teaching and learning in the classroom. Shulman (1986) authored a term called Pedagogical Content Knowledge (PCK), which is a teachers' knowledge of teaching content. Since the 1980s, the research studying PCK has flourished, with a variety of models and definitions describing the phenomenon across a range of fields in education (Chan & Hume, 2019). Chan and Hume (2019) defined PCK as both knowledge and skills, specifically an interchange between content knowledge, pedagogical knowledge, and the learning context. Moreover, Morrison and Luttenegger (2015) argued that the core of PCK relies on the teacher's ability to convey knowledge to students and promote a deeper understanding of what they are learning. It is essential that PCK, which is a fundamental part of teachers' daily work, is a part of teacher education to help inexperienced teachers increase their competence (Rollnick et al., 2008).

1.2 Problem Statement

Preservice agricultural education teachers enrolled in a laboratory practices course should have the opportunity to develop their PCK for laboratory instruction. Preservice agricultural education teachers enrolled in a teacher preparation program that is typically completed in four years hope to graduate with the “knowledge needed and the skills necessary to effectively teach their future students” (Rice & Kitchel, 2015a as cited in Wooditch et al., 2018 p. 2). When preparing preservice teachers, teacher educators cultivate both content knowledge for many

disciplines, and pedagogical knowledge to be ready for the classroom (Wooditch et al., 2018). Teachers who are not knowledgeable or literate with the teaching material run the risk of passing on misconceptions and incorrect information to their students (Ball & McDiarmid, 1990; Darling-Hammond & Bransford, 2005). Moreover, teachers, who are either unfamiliar or not experienced with the content they are teaching, lack the confidence to effectively communicate information to their students (Blackburn & Robinson, 2008).

School-based agricultural education programs rely on laboratory-based instruction to provide students with hands-on experience with agriculture (Shoulders & Myers, 2012); therefore, preservice agricultural education teachers must be prepared to provide such instruction (Phipps et al., 2008). By understanding development of PCK in laboratory instruction, we may better understand ways to support teacher development at the individual level for secondary preservice agricultural education teachers (Carlson et al., 2019). Teacher educators across the country focus on appropriately preparing preservice teachers for all they will confront in their future classrooms (Stuart & Thurlow, 2000). The Laboratory Practices in Agricultural Education (LPAE) course used for this study was developed to prepare preservice agricultural education teachers for the challenges and knowledge needed specifically for laboratory instruction in SBAE classes.

Pedagogical Content Knowledge is topic-specific and centered on content, focusing on a particular subject matter (Chan & Hume, 2019). For this study, animal science dissection was the topic that was studied. By understanding preservice agricultural education teachers' PCK, specifically in animal science dissection laboratory instruction, we may better understand ways to improve teacher preparedness for laboratory-based instruction in agricultural education.

1.3 Significance of Study

This study is important for describing the sources of preservice agricultural education teachers' PCK when entering into an LPAE course, specifically in animal science dissection lab-based instruction. This study is also important for describing if the LPAE course helped develop participants' PCK. Results will help describe what preservice agricultural education teachers still need in their development of their PCK. Results will also help describe their experiences in the process of cultivating PCK with the use of a Content Representations (CoRe).

PCK is developed over a career (Chan & Hume, 2019), and preservice teachers need valuable experiences and programs to prepare them for careers as teachers. Learning how PCK

develops will enable us to design those programs and experiences more effectively. The LPAE course was a new course being offered at a land-grant university in the fall of 2021. Describing the areas of need of preservice teachers' ability to design, facilitate, and assess dissection instruction after taking the LPAE course could help improve the structure and effectiveness of the course. Supporting the educational experiences for preservice agricultural education teachers could lead to better educational experiences for their future students and improve their students' PCK (Ekiz-Kiran et al., 2021).

Pedagogical Content Knowledge does not only refer to what teachers know about a subject area, but also how they implement that knowledge in the classroom. A quality teacher is both knowledgeable about their discipline and capable of communicating that knowledge to their students (Okpala & Ellis, 2005). Specifically, teachers of agriculture should be knowledgeable of its content to effectively teach it (Edwards & Thompson, 2010). It has been demonstrated that teachers who receive better preparation are twice as likely to remain in their profession (Gardner, 2006).

Teachers who strengthen their PCK to teach various agricultural topics likely will have a ripple effect of positive outcomes for the agricultural industry. However, agricultural education teachers do not just affect the agriculture industry, they affect students as humans, learners, future workers, and community members (Oliveri et al., 2017). Some of the major initiatives that agricultural education contributes to in terms of student development include 21st Century Skills, STEM skills, and career readiness (Geisinger, 2016; Wang & Knobloch, 2020). Teachers need to develop their PCK early and use it effectively because they are teaching future leaders and policymakers in agriculture, as well as future consumers of agricultural products and services, making a positive change in the agriculture industry. Positive changes in the agriculture industry may lead to a strengthened relationship between consumers and producers.

1.4 Need for Study

Cultivating PCK in preservice agricultural education teachers is not a new effort. However, there is a need for focusing on PCK explicitly with clear opportunities for teachers to think about, experience, and reflect on how to think about each aspect of PCK (Schneider & Plasman, 2011). A 2018 study that focused on preservice teachers in a greenhouse management course suggested that since only one unit was represented in their study, the same findings may not hold true for

other units in the course (Wooditch et al., 2018). This study could be replicated with similar units and courses that engage in agriculture teacher preparation. It is also possible that the development for PCK does not occur until later in the teacher education program.

Preliminary data shows that animal science is the most popular course taught in Indiana (LaRose et al., 2021), but most schools do not have the facilities for teaching hands-on labs with live animals (LaRose et al., 2021; Shoulders & Myers, 2012). Dissection was the topic selected for this study because it is a lesson that could also cross over into biology, which could lead preservice teachers to incorporate integrated STEM into their future lessons (Wang & Knobloch, 2020). To complete state standards for animal science, some of the content lends itself to be taught through dissection (Indiana Department of Education, 2018). Preservice agricultural education teachers at the study institution are required to take Introduction to Animal Agriculture in their plan of study, which does expose preservice agricultural education teachers to animal tracts and animal anatomy, but no dissection occurs in the course. This has led to a gap in student preparation and opportunities to engage in dissection across participant's four-year degree program. According to LaRose et al. (2021), Indiana agricultural education teachers teach animal science, but many do not have access to animal facilities as a part of their lab facilities. It is important to prepare future teachers to teach animal science without depending upon having live animals at the school. Furthermore, dissection is one way to engage students in development of psychomotor skills in learning about animal science (Phipps et al., 2008).

This study utilized the Refined Consensus Model of Pedagogical Content Knowledge in Science Education (Carlson et al., 2019) to explore the development of PCK in preservice agriculture teachers. An international team of education researchers developed this model to illustrate development of PCK in science teachers. There is a need for the Refined Consensus Model to be used in agricultural education PCK research. The most recent study of PCK development in agricultural education teachers or preservice teachers was published in 2018, before the Refined Consensus Model of PCK (Carlson et al., 2019) was published. Furthermore, this model allows the opportunity to specifically look at Professional Knowledge Bases (PKB) and Collective Pedagogical Content Knowledge (cPCK) of preservice agricultural education teachers. The development of PKBs is primarily a result of academic experiences, most notably teacher preparation programs (Chan & Hume., 2019), but in what ways do preservice teachers enrolled in an LPAE class describe these Professional Knowledge Bases? Cultivation of Collective PCK

(cPCK), a realm of PCK, prepares students to enter a profession that has a high level of collaboration (Carlson et al., 2019). Thus, how is cPCK described by agricultural preservice teachers who are taking an LPAE course?

1.5 Purpose of Study

There were two purposes of this study. The first purpose was to describe preservice agricultural education teachers' Professional Knowledge Bases, before and after instruction, on the topic of animal science dissection in a Laboratory Practices in Agricultural Education (LPAE) course. The second purpose was to describe preservice agricultural education teachers' cPCK, after instruction, on the topic of animal science dissection in an LPAE course.

1.6 Research Questions

Five research questions guided this study:

1. What were secondary preservice agricultural education teachers' previous experiences before taking a Laboratory Practices in Agricultural Education course?
2. How was secondary preservice agricultural education teachers' Professional Knowledge Bases regarding the topic of animal science dissection lab described before and after participating in a Laboratory Practices in Agricultural Education course in the areas of:
    a. Content Knowledge?
    b. Pedagogical Knowledge?
    c. Knowledge of Students?
    d. Curricular Knowledge?
    e. Assessment Knowledge?
3. How comfortable do secondary preservice agricultural education teachers feel in their ability to design, facilitate, and assess student knowledge described regarding the topic of animal science dissection lab before and after participating in a Laboratory Practices in Agricultural Education course?

4. How was secondary preservice agricultural education teachers' Collective Pedagogical Content Knowledge (cPCK) for the topic of animal science dissection described at the end of a Laboratory Practices in Agricultural Education course?
5. How did preservice teachers describe their experiences when comparing Individual CoRe versus Group CoRe discussion?

1.7 Assumptions of Study

The paradigm for this research fits into the area of pragmatism. Pragmatism is founded on the idea that researchers should utilize the methodological approach that is most appropriate for the particular research being explored (Kaushik & Walsh, 2019). According to the pragmatic paradigm, knowledge is both constructed and founded on reality (Johnson & Onwuegbuzie, 2004). The pragmatist paradigm directed the researcher to develop their approach based on the study taking place in a classroom (real-world setting) instead of a laboratory. What was collected and studied happened based on what the preservice teachers in the LPAE course described instead of researchers influencing the outcomes (Merriam & Tisdell, 2016). CoRes, surveys with Content Knowledge Assessment, and Individual Reflection Questions were used to collect data regarding the development of participants' PCK. Therefore, the approach that aligns most with the paradigm and methodology is qualitative research with some quantitative research. The surveys collected quantitative research with some qualitative open-ended questions, and CoRes and Individual Reflection Questions are qualitative because it allowed us to view rich details of the perspectives of the participants, rather than exclusively numerical responses on the quantitative instrument (Secor, 2010). Some common assumptions that can be made from this study include:

- Preservice agricultural education teachers enrolled in the LPAE course are classified as upper-class students.
- Preservice agricultural education teachers enrolled in the LPAE course have had at least one educational experience in their educational career with dissections.
- Participants in the study completed the questionnaire according to the instructions and gave accurate responses to all the questions.
- The study is associated with the study university, and the LPAE course did not affect or bias the responses given by the participants.
- Researcher biases were minimal, and the research was carried out objectively.

- Participants completed the individual assignments by themselves.
- The data collected from the participants accurately reflected their honest thoughts, perceptions, and experiences.
- All data were collected using reliable and valid instruments.

1.8 Limitations of Study

Some limitations to the study were the validity and accuracy of the data depending on the participant's willingness to complete the surveys, the CoRes, and the Individual Reflection Questions. Participants may have decided to not to complete the survey after starting. Participants may also have chosen to not complete the Post-Survey and/or Post-Core that follows the animal science dissection lab lesson. Lastly, participants may have chosen not to complete the Individual Reflection Questions at the end of the course. To minimize this occurrence, the surveys, CoRes, and reflection questions were offered at the beginning of class to ensure that the surveys and CoRes could be completed thoroughly and with ample time. At any point, there may have been respondent fatigue with the surveys and CoRes, which could make the responses reflect inaccurately (Lavrakas, 2008). The sample size for this study was limited to how many preservice agricultural education teachers enrolled in the course. Although PCK is discipline-specific, topic-specific, and concept-specific (Carlson et al., 2019), only one topic was studied for this study. There was a limitation to absent participants from class during the days we did the surveys, CoRes, and the animal science dissection lab lesson. Lastly, the location of the study is very specific; therefore, it may not be representative of other teacher preparation courses, units, or programs.

1.9 Definition of Key Terms

Key terms in this study were operationalized as follows:

Pedagogical Content Knowledge (PCK): "For the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word the ways of representing and formulating the subject that make it comprehensible to others.…[and] an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that

students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons" (Shulman, 1986, p. 9).

Professional Knowledge Bases (PKB): "Represents different aspects of a teacher's broader professional knowledge bases including science content knowledge, pedagogical knowledge, knowledge of students, curricular knowledge, and assessment knowledge" (Carlson et al., 2019, p. 91).

Collective Pedagogical Content Knowledge (cPCK): "The knowledge held by a group of people and considered generalizable to some degree, which is why this layer is situated after the learning context layer" (Carlson et al., 2019, p. 91).

Content Representation (CoRe): "A planning tool to conceptualize collective PCK of a group of experienced science teachers around a particular topic" (Hume & Berry, 2011) and contain "the key content ideas, known alternative conceptions, insightful ways of testing for understanding, known areas of confusion, and ways of framing ideas to support student learning" (Loughran et al., 2008, p. 1305).

Preservice Agricultural Education Teachers: Agriculture teachers are typically educated in preservice teacher education programs that not only result in an agriculture teacher certification (Talbert et al., 2022) but prepare teachers to be "competent in a variety of agricultural subject matter areas" and be "effective in the methods and techniques of curriculum planning, instruction, and student and program evaluation" (Barrick & Garton, 2010, p. 32).

Laboratory-Based Instruction: "Activities that involve students in experimentation, manipulation, practice or performance of not only cognitive skills but also psychomotor skills" (Phipps et al., 2008, p. 303).

Agriscience Laboratory Activities: "Learning experiences in which students interact with materials and/or models to observe and understand the nature of agriculture and its underlying biological, physical, and social science components" (Myers, 2005, p. 14).

Laboratory Practices in Agricultural Education course (LPAE): This course introduces preservice agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle and secondary school levels. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources (LaRose, 2021).

CHAPTER 2. LITERATURE REVIEW

2.1 Laboratory Practices in Education

Laboratories bridge the theoretical and practical gap (Cullin et al., 2017). Laboratory practices include experimental, manipulative, or performance activities that involve both cognitive and psychomotor skills (Phipps et al., 2008). The purpose of lab activities in agriculture is to enable students to work with materials and/or models to observe and understand the natural foundations of agriculture (Myers, 2005). In agricultural programs, this type of instruction enables students to apply science concepts through hands-on, interactive experiences (Warner et al., 2006).

There have been many studies on laboratory-based instruction in agriculture. In 2006, Warner et al. examined how lab instruction was used in high school classrooms. Among the challenges with laboratory instruction, a large student enrollment in classes, a lack of funds, and sharing equipment emerged as the top reasons for challenges (Warner et al., 2006). Agricultural education as a profession benefits from laboratory instruction, but limited training and experience may make teaching difficult in the classroom setting (Warner et al., 2006). According to Warner et al. (2006), teaching methods courses for preservice agricultural educators should include laboratory instruction, and preservice teachers should not only learn about laboratory instruction but also have the opportunity to experience it themselves. In creating curriculum, teacher educators should emphasize the value of hands-on laboratory experiences (Warner et al., 2006).

Shoulders and Myers conducted a study on Kolb's Experiential Learning Stages in laboratories in 2013. Agriculture teachers can enhance student learning in laboratory settings using Kolb's Experiential Learning Cycle (1984) as a guide (Shoulders & Myers, 2013). Among the findings of this study, laboratory activities aligned with the concrete experience stage were planned for the most frequently. In contrast, those aligned with the active experimentation stage were planned for the least frequently (Shoulders & Myers, 2013). Only 31% of respondents planned lessons that employed all four stages of experiential learning, with active experimentation missing from most lessons/labs (Shoulders & Myers, 2013). The study recommended that learners must take part in activities at each of the four stages in the experiential learning cycle to fully benefit from laboratory instruction and laboratory experiences.

A recent study focused on agricultural technical skills in laboratory instruction. The researchers examined the subject matter knowledge, specifically the technical skills preservice agricultural teachers need to possess before they begin teaching (Albritton & Roberts, 2020). These included agricultural mechanics, horticulture, animal science, business/program management, natural resources/soil, and food science/safety. According to this study, agri-mechanics requires the most skills, whereas safety requires the least skills (Albritton & Roberts, 2020). Another study by Wells et al. (2018) assessed preservice teachers' perceptions of the lab environment component of the school-based agricultural education (SBAE) model in relation to early field experience coursework. This study found three noteworthy themes: "1) project-based learning is widely used for instructional purposes; 2) laboratory environments are set up and arranged in particular fashions based on needs; and 3) laboratory environments are arranged as settings for effective learning" (Wells et al., 2018 p. 251). The research concluded that laboratories are modeled after industry-based settings, so it is crucial that tasks and work experiences are in line with the real world. Other studies have examined instruction that occurs in different laboratory facilities and lab facility management in agriculture. Shoulders and Myers (2012) surveyed the current availability and use of agricultural laboratories in secondary agricultural education. In terms of available laboratories, respondents identified the following as the top three: mechanics/carpentry/welding, greenhouse, and landscaping areas, whereas the bottom three were meats laboratories, apiaries, and vineyards (Shoulders & Myers, 2012). The research team concluded that experiential learning improves student experiences through the use of applied learning experiences in laboratory settings that mimic industry-based settings.

As in agricultural education, laboratory-based courses are also important in science education. The results of a literature search for previous research on the role of laboratory-based instruction within various branches of science turned up more than 600 articles published between 1970 and 1994 (Hilosky et al., 1998). Similarly, to what Warner et al. (2006) described regarding the value of hands-on experience in the context of laboratory-based instruction in agricultural education, there is also evidence that hands-on experiences can make a meaningful contribution to laboratory-based instruction in science education (Nersessian, 1991; Clough, 2002). Puttick et al. (2015) evaluated the literature on laboratory-based instruction in biology specifically and found that a large number of papers addressed student "content knowledge, reasoning, motivation/engagement" (p. 1). In 2010, authors Aktamış and Acar examined whether the

"Laboratory Practices in Science Teaching" course was helpful to prospective elementary science teachers in terms of self-regulation skills. Through this study, prospective science teachers showed increased self-regulation skills in the course (Aktamış & Acar, 2010), which led them being better at teaching their students scientific knowledge (Aktamış & Acar, 2010).

In a review of research on laboratory practices in agricultural education, one study used the Science Laboratory Environment Index (SLEI). Authors Burleson and Myers (2013) evaluated students' perceptions of the actual and preferred classroom environment at the University of Florida. "The SLEI evaluates the classroom environment based on five scales: Student Cohesiveness, Open-Endedness, Integration, Rule Clarity and Material Environment" (Burleson & Myers, 2013, p. 1). The research found that students valued a greater sense of cohesion and open-endedness in teaching and learning, a better balance between laboratory and lecture, more clarity in the rules, and improved laboratory facilities (Burleson & Myers, 2013).

2.2 Theoretical Framework: Pedagogical Content Knowledge

The theoretical framework utilized in this study was Shulman's (1986; 1987) concept of Pedagogical Content Knowledge (PCK). Shulman (1987) defined PCK as

> "In a word the ways of representing and formulating the subject that make it comprehensible to others.…[and] an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons" (p. 9).

It was Shulman's intention with PCK to illustrate, in a recognizable way, a specialized form of professional knowledge that teachers have and that is individually unique to each teacher. As a result, PCK has been studied widely, across multiple domains, particularly in science and mathematics. In the years following Shulman's PCK work, there have been several interpretations of PCK, but none of the interpretations have provided a clear picture of PCK. PCK experts from around the world met at a PCK summit in 2019 to refine the Conceptual Model of PCK created in 2012 and then formed the Refined Conceptual Model of PCK (Carlson et al., 2019), with the intention of making PCK even more precise (Chan & Hume, 2019).

However, to refine PCK, there were several concerns about the nature of PCK that needed to be addressed. After 20 years of PCK being researched, Abell (2008) led the discussion to clarify and determine if PCK was still useful in science education. Chan and Hume (2018) further

discussed the essential elements of PCK and how it should be studied. One of the topics that needed to be addressed about PCK was if it was a "stand-alone" knowledge possessed by teachers. The question about PCK was whether it was distinct from content knowledge or other knowledge bases (Marks, 1990). Abell (2008) clarified that PCK is indeed its own form of knowledge that has deep connections with other knowledge bases such as content knowledge and pedagogical knowledge. Pedagogical Content Knowledge is also "the transformation of other types of knowledge" (Abell, 2008, p. 1407). Authors Rice and Kitchel (2017a) asserted that "PCK is not just important; it is arguably the most important knowledge base a teacher can possess" (p. 51).

Prior to PCK being established to be its own type of knowledge, many other components of knowledge have been included (apart from content knowledge and pedagogical knowledge) in PCK research, such as curricular knowledge (Grossman, 1990) and assessment knowledge (Tamir, 1988). Professional/teaching knowledge categories has been widely researched in science education (Cochran & Jones, 1998; Edwards & Thompson, 2010; Gess-Newsome, 2015; Grossman, 1990; Halim & Meerah, 2002; Loughran et al., 2012; Okpala & Ellis, 2005; Stodolsky & Grossman, 1995). There have also been studies in agricultural education specifically on content knowledge/content knowledge preparation (Houck & Kitchel, 2010; Rice & Kitchel, 2014, 2016).

In 2015(a), Rice and Kitchel specifically looked at how preservice agriculture teachers acquired and utilized content knowledge. They recommended that more content knowledge be incorporated into pedagogy courses or work alongside the faculty teaching the content to support preservice teachers, so teachers can eventually comfortably teach the content (Rice & Kitchel 2015a). A similar study (Rice and Kitchel, 2015b) described agricultural knowledge bases utilizing the model of Mathematical Knowledge for Teaching (MKT) from Hill et al. (2008). Participants indicated that they had little curricular knowledge and the research team recommended that teacher professional development should include curricular development (Rice & Kitchel, 2015b).

To try and encapsulate all categories of knowledge found in PCK research into a single concept, Chan and Hume (2018) performed an in-depth analysis of science teacher knowledge literature to conceptualize what other knowledge is included with PCK knowledge and research. In their findings, six knowledge categories were defined, and later, five of those six knowledge categories would form the Professional Knowledge Bases (PKB) of the Refined Consensus Model of PCK (Carlson et al., 2019). Abell (2008) also stated, "PCK comprises discrete knowledge components. However, when applied in teaching practice, these knowledge components are

integrated and blended together" (Chan & Hume, 2019, p. 8). These PKBs of the Refined Consensus Model of PCK (Carlson et al., 2019) will be explained further in the conceptual model.

Researchers have also debated whether PCK is individual or collective. Hashweh (2005) discussed PCK's individuality, whereas van Driel, et al. (1998) identified that PCK can be generalized across a group of teachers. Most studies have focused on the individual PCK of teachers because individual PCK is believed to be the greatest contributor to the learning experience of students (Chan & Hume, 2019). Most, if not all research, has been done on individual PCK in agricultural education (Houck & Kitchel, 2010, Rice & Kitchel, 2014, 2015a, 2015b, 2016, 2017a). Carlson et al. (2019) stated that cPCK "encompasses the knowledge that more than one person possesses, meaning knowledge that is not private, but rather the knowledge that is public and held collectively" (p. 90).

Since the Refined Conceptual Model of PCK (Carlson et al., 2019) was published, cPCK has been studied in science education (Boz & Belge-Can, 2020; Ellebæk, 2021). In 2020, Boz and Belge-Can (2020) studied how microteaching enhanced PCK of preservice teachers. In this study, a group of preservice teachers created a lesson plan with goals in mind, then one of the preservice teachers taught the lesson while the other preservice teachers observed, and finally regrouped to reflect and/or revise collectively (Boz & Belge-Can, 2020). Results from this study determined preservice teachers had an uneven PCK development from the microteaching experience but the experience overall did support their cPCK (Boz & Belge-Can, 2020). Cooper et al. (2022) took a new approach in utilizing reading groups to develop Personal Pedagogical Content Knowledge (pPCK) and cPCK highlighting a creative way to develop one's PCK and illustrating that PCK research need not be overly complex.

Pedagogical Content Knowledge is topic-specific and content-driven (Chan & Hume., 2019), and its effectiveness is due to being topic-specific (van Driel et al., 1998). Multiple studies of PCK have been topic-specific in science education across multiple topic areas, while in agricultural education, development of PCK has mainly focused on plant science (Rice & Kitchel, 2017a, 2018). In 2018, Wooditch et al. studied PCK of preservice agriculture teachers focusing on the topic of plant fertilizers in plant science. Despite the intentions of the instructor, results showed a lack of content knowledge after the course, echoing in a lack of PCK development, supporting the results of Rice and Kitchel (2018). Setting goals for pedagogy, content, and PCK development would increase the likelihood that PCK would be developed in preservice agricultural education

teachers in future courses similar to the one in the study or other agriculture courses/topics (Rice & Kitchel, 2018). It is recommended that more PCK research be conducted in other content areas and topics in agricultural education (Rice & Kitchel, 2017b, 2018; Schneider & Plasman, 2011), which could then contribute to future research and inform agriculture teacher preparation programs (Rice and Kitchel, 2018). Studying development of Pedagogical Content Knowledge in animal science dissections will allow us to see if preservice agricultural education teachers are genuinely prepared for this aspect of laboratory instruction in animal science.

2.3 Conceptual Framework: Refined Consensus Model of PCK

The conceptual framework of this study was developed based on preservice agricultural education teachers' PCK on animal science dissection labs after taking a Laboratory Practices in Agricultural Education (LPAE) course. The conceptual framework for PCK was formed from the two categories it originated from: content knowledge (subject matter) and pedagogical knowledge (a broad understanding of teaching techniques) (Shulman, 1986; 1987). Shulman (1986) defines pedagogical knowledge as "knowledge of generic principles of classroom organization and management" (p. 14) and content knowledge as "the amount and organization of knowledge" (p. 9). Many interpretations of PCK have been formed since Shulman first proposed the concept of PCK. Determining which interpretation of PCK to use for this study was determined by the model chosen for the research and the overall goal of the course: preservice teachers feeling prepared to teach agriculture laboratory instruction.

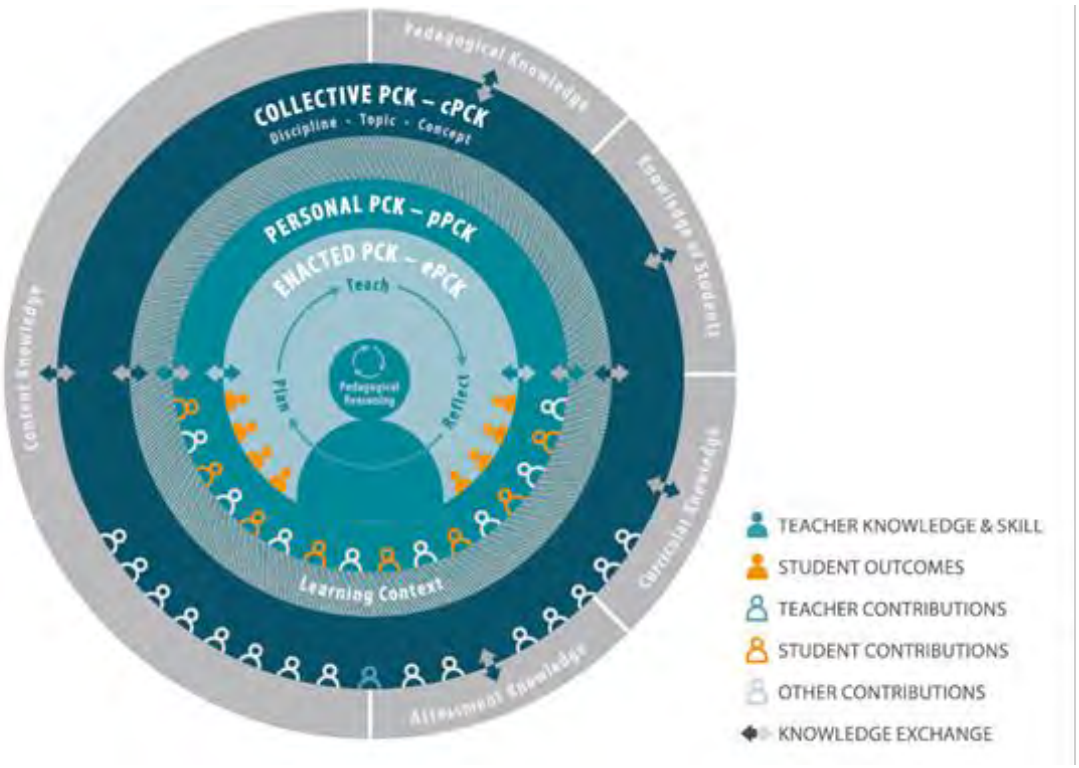


Figure 2.1 Refined Consensus Model of PCK (Carlson et al., 2019)

The Refined Consensus Model (RCM) of PCK in Science Education (Carlson et al., 2019) (Figure 2.1) is centered around the science of content teaching and was the model that was chosen for this study. This model has three realms of PCK: Collective Pedagogical Content Knowledge (cPCK), Personal Pedagogical Content Knowledge (pPCK), and Enacted Pedagogical Content Knowledge (ePCK). The cPCK realm "encompasses the knowledge that more than one person possesses, meaning knowledge that is not private, but rather the knowledge that is public and held collectively" (Carlson et al., 2019, p. 90). pPCK is defined as "a teacher's personal knowledge and unique expertise about teaching a given subject area, resulting from the cumulative experiences with and contributions from students, peers, and others" (Carlson et al., 2019, p. 87). ePCK is "representing the specific knowledge and skills utilized by a teacher in a particular setting to achieve particular student outcomes (Carlson et al., p. 85). This study focused on cPCK and pPCK.

The most outer layer of the RCM of PCK (Carlson et al., 2019) is the other focus of this study. This layer is the Professional Knowledge Basis (PKB) of PCK and "represents different aspects of a teacher's broader professional knowledge bases including science content knowledge,

pedagogical knowledge, knowledge of students, curricular knowledge, and assessment knowledge" (Carlson et al., 2019, p. 91). The RCM of PCK (Carlson et al., 2019) model provides a way to think about how to support teacher development along their entire career path from training leadership to expert leadership by considering the role of experience, students, and colleagues in the development of PCK to science teaching (Carlson et al., 2019), or in particular to this study PCK in teaching agriculture. Each PKB can be defined as follows:

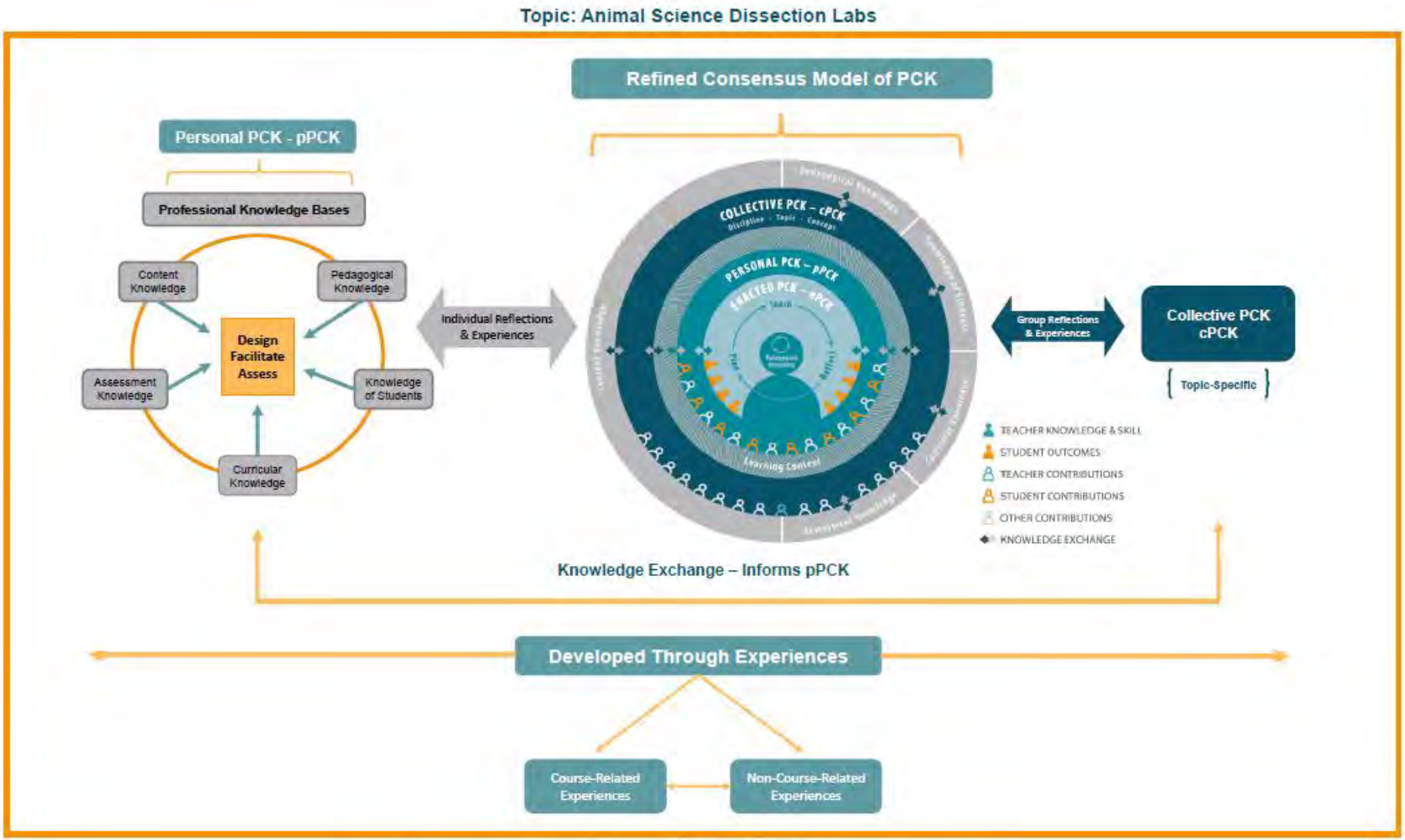
- Content Knowledge: "The part of teachers' subject matter knowledge that is pertinent to the teaching task" (Cochran & Jones, 1998 as cited in Carlson et al., 2019, p. 15).
- Pedagogical Knowledge: "Includes teachers' general, not subject-specific, knowledge and skills related to teaching. It includes, for example, teachers' knowledge and skills about learning theories, instructional principles, and classroom management" (Grossman, 1990 as cited in Carlson et al., 2019, p.15).
- Knowledge of Students: "Entails teachers' knowledge of students' cognitive development and variations in their approaches to learning and general characteristics" (Gess-Newsome, 2015 as cited in Carlson et al., 2019, p.15).
- Curricular Knowledge: Concerns teacher knowledge of the goals of a curriculum, its structures, scope, and sequence (Gess-Newsome, 2015 as cited in Carlson et al., 2019, p.15).
- Assessment Knowledge: "Encompasses teachers' knowledge of how to design formative and summative assessments, and their knowledge of interpretation and action-taking based on assessment data" (Gess-Newsome, 2015 as cited in Carlson et al., 2019, p. 15).

For this study, the conceptual model was adapted from the RCM of PCK (Carlson et al., 2019) to center on the two layers of the RCM of PCK (Carlson et al., 2019) that will be the focus of this study. Figure 2.2 shows the conceptual model for this study. The left side of Fig. 2.2 (left of the RCM) displays the five Professional Knowledge Bases: content knowledge, pedagogical knowledge, knowledge of students, curricular knowledge, and assessment knowledge. More formal experiences through teacher preparation programs further develop these PKBs (Carlson et al., 2019). A wide variety of backgrounds are represented among preservice agricultural education students. Calderhead and Robson (1991) reported that preservice teachers have strong impressions

of teaching from their experience as students. Research question one accounts for this phenomenon so we could describe what previous experiences preservice agricultural education teachers had before taking an LPAE course. This study explores how these PKBs emerge in student planning for instruction through the use of a Content Representation (CoRe) instrument on the topic of animal science dissection labs. CoRes are discussed in detail in section 2.4 of this thesis. In this study, the PKBs were evaluated through individual reflections and experiences of the participants. This is shown through the gray arrow on Fig. 2.2, between the RCM of PCK (Carlson et al., 2019) and the conceptualized portion on the left side of the guiding model.

On the right side of Fig 2.2 (the right of the RCM of PCK (Carlson et al., 2019)), cPCK is pieced out to represent the other focus of this study. Since cPCK embodies the knowledge of more than one individual, cPCK was studied through group reflection and creation of a class-wide CoRe on the topic of animal science dissection labs. This is shown through the dark teal arrow on Fig 2.2 between the original RCM of PCK (Carlson et al., 2019) and the conceptualized portion on the guiding model's right side. Since cPCK can be discipline-specific, topic-specific, and/or concept-specific, this study focused on the topic of animal science dissection, hence the cPCK studied was topic-specific.

In the original RCM of PCK, there is interaction between each ring/realm representing a knowledge exchange (Carlson et al., 2019). This was conceptualized in Fig. 2.2 to note the knowledge exchange occurring between the pPCk and cPCK. cPCK is informed by pPCK from a variety of individuals. In this study, pPCK was primarily by looking at the development of PKBs. The knowledge exchange also conceptualizes how PKB and cPCK can influence one's comfort level in designing, facilitating, and assessing student knowledge. Overall, an individual's PKB and cPCK are developed through experience, which is noted at the bottom of Fig. 2.2. These experiences can occur within a course or outside a course, as well as influence the other, as shown in the triangle below "developed through experience." Participants described these various types of experiences in the study.



Conceptual Framework Model

Note. The conceptual framework of this study was informed by the Refined Consensus Model of PCK (Carlson et al., 2019)

Figure 2.2 Conceptual Model Guiding This Study

2.4 Content Representations (CoRes)

Content Representations (CoRes) and Pedagogical and Professional-experience Repertoires (PaP-eRs) are common tools used to research PCK and were designed by Loghren et al. (2006). Efforts were made by Loughran et al. (2006) to use the CoRes to identify the connections between science content knowledge, instruction, and learning. CoRes (Fig. 2.3) were originally designed to conceptualize cPCK of a group of experienced science teachers around a particular topic (Hume & Berry, 2011) and contain "the key content ideas, known alternative conceptions, insightful ways of testing for understanding, known areas of confusion, and ways of framing ideas to support student learning" (Loughran et al., 2008, p. 1305). Since PCK is topic-specific, CoRes are also topic-specific and aim to display a comprehensive picture of the teachers' PCK. A study conducted by Loughran et al. in 2008 utilized CoRes with preservice teachers in a science education course to help understand what it means to learn to teach a topic in science. Based on the outcomes from the study, it was evident that using CoRes as a tool helped the preservice teachers better understand the nature of science teaching (Loughran et al., 2008).

Hume (2010) used CoRes with science education preservice teachers through discussions, reflections, and workshops in a teacher preparation chemistry course. Every student found the CoRes to be challenging, however, after more guidance with the CoRes, one student mentioned how it influenced their preparation for instruction (Hume, 2010). One of the main outcomes of this study was the value of raising awareness for PCK, which supports the results of Magnusson et al. (1999), and also how PCK involves special thinking, experience, and knowledge (Hume, 2010). Although there has been some research on PCK in agricultural education, not many have implemented the use of CoRes, however the implementation of CoRes is recommended (Rice & Kitchel, 2017b, 2018; Wooditch et al., 2018).

CoRe (Content Representation)

	Big Idea A	Big Idea B	Big Idea C
What I intend the students to learn about the idea.			
Why is it important for the students to know this?			
What else do you know about this idea (that you do not intend the students to know yet)?			
Difficulties/limitations connected with teaching this idea.			
Knowledge about students thinking which influence your teaching of this idea.			
Other factors that influence your teaching of this idea.			
Teaching procedures (and particular reasons for using these to engage with this idea).			
Specific ways of ascertaining students' understanding or confusion around this idea (include likely range of responses)			

Figure 2.3 Content Representation – CoRe (adapted from Loughran et al., 2006)

2.5 Self-Efficacy: Level of Comfort

Self-Efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura 1977, p. 3). Furthermore, teaching efficacy has been defined as "the extent to which the teacher believes he or she has the capacity to affect student performance" (Berman et al., 1977, p. 137). Essentially, it is the acknowledged amount of belief in a teacher's ability to assist students in learning (Gurvitch & Metzler, 2009). Although this framework was not a main focus of this study, since this was the first year the LPAE course was taught, the researchers were curious how participants would describe their level of comfort to design, facilitate, and assess student knowledge animal science dissection labs before and after taking a laboratory practices course.

2.6 Animal Science Dissection

Teaching dissection has played a vital role in medical and science education in preparing students for many careers in the medical field and veterinary/animal science field (De Villiers & Sommerville, 2005; Elizondo-Omaña et al., 2005; Hart et al., 2008; Parker, 2002). In 2002, Parker claimed that the use of dissection in undergraduate classrooms as vital because "each student has the potential to see the body in a different way" (p. 912). However, there is much debate over using dissection in education due to the ethics that surround the conventional hands-on method of dissection (Akpan & Andre, 2000). Animal dissection controversy often stems from the assumption that there are effective alternatives (Hart et al., 2008). There have been suggestions to supplement or replace hands-on dissections with interactive videos or computer simulations (Akpan & Andre, 2000; Bernard, 1972; Bowd, 1993).

According to Orlans (1988), traditional hands-on dissection has a stronger impact on student achievement than less realistic and authentic methods. Akpan and Andre (2000) decided to look into all the claims of how to best teach dissection and studied student achievement based on four different scenarios of teaching dissection: (1) simulation before dissection; (2) dissection before simulation; (3) dissection only; (4) simulation only. Study results support the hypothesis that simulating dissection before dissection boosts learning and that teachers should still consider how to best teach dissection based on each student (Akpan & Andre, 2000).

Although not much research has been done about the use of dissections in agricultural education, studies suggest that using live animals as teaching aids provides memorable learning opportunities (Daly & Suggs, 2010; Fuhrman & Rubenstein, 2017). Despite animal science being the most popular course taught in Indiana (LaRose et al., 2021), most schools do not have the facilities to teach hands-on labs with live animals (LaRose et al., 2021; Shoulders & Myers, 2012). Indiana teachers also often resort to using dissection to complete state standards for animal science, since some of the content lends itself to be taught through dissection (Indiana Department of Education, 2018).

CHAPTER 3. METHODOLOGY

3.1 Overview

This chapter gives an overview of the research methodologies, protocols, and analyses used in this study. A brief description of the purpose and research questions which guided the research design for this study is included, as well as a discussion of the participants, instrumentation, data collection, and data analysis.

3.2 Purpose of Study

There were two purposes of this study. The first purpose was to describe preservice agricultural education teachers' Professional Knowledge Bases, before and after instruction, on the topic of animal science dissection in a Laboratory Practices in Agricultural Education (LPAE) course. The second purpose was to describe preservice agricultural education teachers' cPCK, after instruction, on the topic of animal science dissection in an LPAE course.

3.3 Research Questions

Five research questions guided this study:

1. What were secondary preservice agricultural education teachers' previous experiences before taking a Laboratory Practices in Agricultural Education course?
2. How was secondary preservice agricultural education teachers' Professional Knowledge Bases regarding the topic of animal science dissection lab described before and after participating in a Laboratory Practices in Agricultural Education course in the areas of:

a. Content Knowledge?
b. Pedagogical Knowledge?
c. Knowledge of Students?
d. Curricular Knowledge?
e. Assessment Knowledge?

3. How comfortable do secondary preservice agricultural education teachers feel in their ability to design, facilitate, and assess student knowledge described regarding the topic

of animal science dissection lab before and after participating in a Laboratory Practices in Agricultural Education course?

4. How was secondary preservice agricultural education teachers' Collective Pedagogical Content Knowledge (cPCK) for the topic of animal science dissection described at the end of a Laboratory Practices in Agricultural Education course?
5. How did preservice teachers describe their experiences when comparing Individual CoRe versus Group CoRe discussion?

3.4 Research Design

This non-experimental, descriptive case study focused on developing an in-depth description and analysis of two layers of the Refined Consensus Model (RCM) of PCK (Carlson et al., 2019) of preservice agricultural education teachers in a Laboratory Practices in Agricultural Education (LPAE) course. Case studies describe and analyze a phenomenon in depth (Merriam, 2002). Because they are characterized by the unit of analysis, case studies differ from other types of qualitative research. The unit of analysis can focus on "individual, group, institution, or community" (Merriam, 2002, p. 8). Given the need for more research in Pedagogical Content Knowledge (PCK), the unit of analysis selected for this case study was preservice agricultural education teachers' PCK focused on an animal science dissection. The research team has expertise and an interest in dissection and the specific case chosen was an instrumental case study to understand the experience of preservice agricultural education teachers in an LPAE course at a land-grant university in Indiana. Research using case studies focuses on examining a case within the setting of a personal situation that is current and relevant in society (Creswell & Poth, 2018). Meanwhile, Stake (1995) referred to cases studies as bounded systems. For example, this study examined the LPAE course that took place in Fall of 2021 and the PCK of preservice agricultural education teachers enrolled in the LPAE course. "Instrumental case studies offer value to qualitative researchers who attempt to make their investigations transferable to other circumstances" (Stake, 1995 as cited in Roberts et al., 2016, p. 174).

For this study, animal science dissection was the selected topic. The layers of the RCM of PCK (Carlson et al., 2019) that were studied included (1) the Professional Knowledge Bases (PKB) and (2) the Collective Pedagogical Content Knowledge (cPCK). There are two reasons for only focusing on two layers of the RCM of PCK (Carlson et al., 2019). Firstly, identify preexisting

professional knowledge of preservice agricultural education teachers' when they entered the LPAE course, and to describe if there was any change after the animal science dissection lab experience in the course. Secondly, to describe how preservice agricultural education teachers' cPCK developed after the course's animal science dissection lab experience.

PCK can be investigated using a variety of approaches, and it is recommended that more than one data source is used for an exhaustive analysis (Morrison & Luttenegger, 2015). Even for a topic as particular as animal science dissection, it was necessary to analyze a variety of data sources that could accurately characterize the PCK of preservice agricultural teachers in this study. Qualitative data and some quantitative data were collected to accomplish a well-rounded analysis for this study.

The LPAE course is designed to introduce preservice agricultural education teachers to laboratory instruction on a variety of agriculture topics at the middle and secondary school levels (LaRose, 2021). The course emphasizes laboratory safety, skills acquisition, developing a thorough understanding of laboratory components in agriscience, lab utilization, facilitating student learning in the laboratory setting, and appropriate teaching methods and techniques (LaRose, 2021). The syllabus for the course is located in the appendices (Appendix I).

3.4.1 Laboratory Practice in Agricultural Education Dissection Laboratory Experience

The dissection laboratory experience in the LPAE course was the focus of this study (Appendix G). Prior to the dissection lab, and per the recommendation of Akpan and Andre (2000) to watch videos prior to teaching dissection, participants were instructed to watch reproductive physiology videos made by one of the instructors on male and female anatomy of mammals and chickens. There was also a review of laboratory safety and dissection tool use. In lab, participants were split into pairs in the beginning and dissected a chicken digestive tract as a pair. Participants were given 15 minutes to follow the instructions provided on how to dissect and label the parts of a chicken digestive tract and fill out as much of their handout in the time given while instructors walked around observing and helping when needed. Afterwards, the main instructor lectured from the front of the laboratory classroom and demonstrated with a chicken digestive tract with a camera that projected the teacher's hands and tract on the main projection screen. The teacher-led review of the chicken's digestive tract took 20-30 minutes to check for understanding of parts and functions.

During the second part of the dissection lab, participants sat at lab benches while the main instructor conducted a lecture and demonstration of animal digestive tracts of a sheep and a pig with a camera that projected the teacher's hands and digestive tracts on the screen. This activity took 60 minutes go over the differences and similarities between monogastric and ruminant digestive tracts. The main instructor started with teaching the pig digestive tract first and afterwards, allowed participants to take 5 minutes to discuss the difference between mammalian digestive tracts and chicken digestive tracts. Participants were also instructed to label the pig digestive tract in their handout and then discussed differences as a whole class. Next, the main instructor taught the sheep digestive tract and afterwards allowed participants to take 10 minutes to discuss in their lab groups the difference between a ruminant and nonruminant digestive tract. Students also labeled the sheep digestive tract picture in their handout and then discussed differences with the class.

The third part of the dissection laboratory experience in the LPAE course was group rotations between mammalian reproductive tracts and supply and inventory scenarios for setting up dissection labs (Appendix H). For the scenarios station, participants were given 20 minutes to complete a supply and inventory list based on the scenario they were assigned. Participants were instructed to locate what resources were needed for a lab dissection lab like they experienced and put together a purchase order form for those items. The animal reproductive tracts station had both preserved and fresh animal reproductive tracts, as well as representation of both male and female animal tracts. Participants were given 20 minutes to review what they watched in the videos assigned before class and see if they could identify anything familiar on the reproductive animal tracts.

3.4.2 Quantitative Data Sources

A Pre-Survey (before instruction in the course) was administered the first day of class and included questions that assessed participants' knowledge on animal science dissection (Appendix C). The Pre-Survey was administered at the beginning of the course to assess preservice agricultural education teachers' content knowledge prior to receiving any instruction. The Pre-Survey also included questions that asked participants about their prior experiences with animal science dissections before the LPAE course, as well as their level of comfort to design, facilitate, and complete a Content Knowledge Assessment on animal anatomy. A Post-Survey (after the

animal science-dissection lab) was given one week after the animal science dissection lab during week nine of the course (Appendix D). It included the same Content Knowledge Assessment questions as well as their level of comfort to design, facilitate, to describe any change after the animal science dissection lab experience in the course. Survey questions for the Content Knowledge Assessment were drawn from previous exam questions from a college-level Introduction to Animal Agriculture course. The Pre-Survey and Post-Survey were not graded assignments in the LPAE course.

3.4.3 Qualitative Data Sources

Along with the Pre-Survey, participants individually completed a Content Representation CoRe (Pre-CoRe) before any instruction or experience in the course. The individual Pre-CoRes were used to illuminate preservice agricultural education teachers' PKB by coding for evidence of the five knowledge bases. Data were also collected at the end of the semester, seven weeks after the animal science-dissection lab lesson, using a second round of individually completed CoRes (Post-CoRe), to describe PKBs by coding for evidence of the five knowledge bases and seeing if there was any development of participants' PKBs. A different approach was taken for cPCK. During the last week of the course, preservice agricultural education teachers completed a CoRe as a group (Group CoRe). The Group CoRe was used to measure cPCK, as it was a CoRe collectively created from the knowledge of participants from the entire class.

To reflect and debrief individually on participants' experiences completing the CoRe as a group versus individually, Individual Reflection Questions were implemented following the Group CoRe at the end of the semester. The CoRe tool was used as an instrument in this study because it is the most widely used instrument for assessing PCK (Lehane & Bertram, 2016). "A CoRe sets out the aspects of PCK that are most closely attached to a science topic and that most probably extend across various contexts (e.g., the key content ideas, known alternative conceptions, insightful ways of testing for understanding, known points of confusion, and ways of framing ideas to support student learning)" (Loughran et al., 2008, p. 1305). Individual CoRes were used to describe preservice agricultural education teachers' individual PKB. In contrast, the Group CoRe was used for cPCK since the knowledge in that realm of PCK is held collectively. The Pre-CoRe, Post-CoRe, Group CoRe, or Individual Reflection Questions were not assignments in the course.

Table 3.1 illustrates a timeline of when the quantitative and qualitative data were collected in this study.

Table 3.1 *Study Data Collection Timeline During Fall 2021 Semester.*

<table>
<tr><th>Week 1
(8/26/21)</th><th colspan="2">Week 8
(10/14/21)</th><th>Week 15
(12/8/21 & 12/9/21)</th></tr>
<tr><td>Pre-Survey</td><td rowspan="2">Dissection Lab Experience</td><td>Post-Survey</td><td>Group CoRe</td></tr>
<tr><td>Pre-Individual CoRe</td><td>Post-Individual CoRe</td><td>Individual Reflection Questions</td></tr>
</table>

3.5 Institutional Review Board Committee

To protect the confidentiality of participants involved in this study, the researcher completed the Collaborative Institutional Training Initiative (CITI) in the online training module called The Protection of Human Subjects Research. Additionally, the researcher completed The College of Education-Field Specific Responsible Conduct of Research (RCR) Training. A submission was made to the Institutional Review Board (IRB) and the Committee on the Use of Human Research Subjects at Purdue University after the successful completion of the two online modules (Appendix A). The application entitled "Secondary Preservice Agriculture Teachers' Professional Knowledge Bases and Collective PCK: A Case Study" contained all required information including the Pre-Survey, Post-Survey, Individual Reflection Questions, and an example CoRe. The IRB Review Board found that the study (IRB-2021-825) qualified for exemption status and was approved on August 24, 2021 (Appendix B).

3.6 Participants

Participants in this study included 23 preservice agricultural education teachers enrolled in a Laboratory Practices in Agricultural Education (LPAE) course at a land-grant university. Participants were selected for this study since the LPAE course is a new course and was the course selected for this study. The LPAE course is designed to cultivate PCK related to laboratory teaching. Preservice agricultural education teachers were chosen as the population because the

RCM of PCK (Carlson et al., 2019) had not been used in agricultural education. Lastly, teacher preparation programs work to enhance the PKBs, which are then reinforced through classroom experiences and professional learning activities (Carlson et al., 2019). Further details of the demographics of participants in this study can be found in chapter four.

3.7 Treatment/Intervention

This study describes the natural phenomenon of the current knowledge bases of preservice agricultural education teachers enrolled in an LPAE course and where their knowledge bases originate, specifically examining participants' current knowledge on animal science dissection labs. The intervention in this study is the instruction in the course the preservice teachers enrolled received. Instruction in the LPAE course included how to teach an animal science dissection lab using three different instructional approaches, the content knowledge they need to know for teaching animal science dissection, and comprehensive instruction for multiple agricultural education laboratory topics. Metacognition was developed using the individual and Group CoRes and reflecting through the Individual Reflection Questions.

3.8 Instrumentation and Data Source:

There were six research instruments used in this study. In the beginning, prior to any instruction, participants completed a Pre-Survey (Appendix C) and a Pre-CoRe. After the animal science dissection lab experience in the LPAE course, participants completed a Post-Survey (Appendix D) and a Post-CoRe. At the end of the LPAE course, participants completed a Group CoRe (Table 4.28) as an entire class, followed by Individual Reflection Questions (Appendix E) to reflect on their experience using CoRes in the LPAE course.

3.8.1 Pre-Survey and Post-Survey

The Pre-Survey was completed by participants at the beginning of the LPAE course and comprised of 35 questions, ten of which comprised the content assessment. This survey asked participants to describe their background experience in animal science and dissection, as well as rate their level of comfort to design, facilitate, and assess student knowledge on animal science dissection. The 25 background questions and comfort level questions came from a college-level

Greenhouse and Landscape Fundamentals for Educators course, which originated from Wooditch et al. (2018), and the questions were altered from saying "horticulture" to "animal science". The 10 questions for the content assessment asked participants about their content knowledge on dissection; five questions were on digestive anatomy and five questions were on reproductive anatomy. These questions were reviewed by a panel of experts as well as the research committee prior to distributing to participants. No pilot study was performed for the Pre-Survey. The Post-Survey was given after the animal science dissection lab experience in the LPAE course. The Post-Survey had the same level of comfort questions, and Content Knowledge Assessment questions that were on the Pre-Survey.

3.8.2 Pre-CoRe, Post-CoRe, and Group CoRe

The Pre-CoRe, Post-CoRe, and Group CoRe were all from the same CoRe template designed by Loughran et al. (2006). All three CoRes had the same eight questions:

1. What I intend the students to learn about the idea.
2. Why is it important for the students to know this?
3. What else do you know about this idea (that you do not intend the students to know yet)?
4. Difficulties/limitations connected with teaching this idea.
5. Knowledge about students thinking which influence your teaching of this idea.
6. Other factors that influence your teaching of this idea.
7. Teaching procedures (and particular reasons for using these to engage with this idea).
8. Specific ways of ascertaining students' understanding or confusion around this idea (include likely range of responses).

The Pre-CoRe was administered at the same time as the Pre-Survey, and prior to instruction in the course. Prior to completing the CoRe, an example CoRe was done with the whole class to explain the format, CoRe's question, and why participants were competing the CoRe. After the dissection lab experience in the LPAE course, participants completed a Post-Survey and Post-CoRe. Lastly, at the end of the semester, participants completed a Group CoRe, collectively as a class. Prior to completing the Group CoRe, participants practiced by completing a CoRe in small groups to refresh them on the CoRe's format and questions.

3.8.3 Individual Reflection Questions

The individual questions were completed by participants after they completed the group-CoRe. These questions prompted participants to reflect on their experience completing the CoRe individually versus collectively. There were eight questions:

1. Prior to any instruction in the course, how would you describe your experience while completing the FIRST Content Representation (CoRe) of the semester, individually, for the animal science dissection?
2. After the animal science dissection lab in the course, how would you describe your experience while completing the SECOND Content Representation (CoRe) of the semester, individually for the animal science dissection?
3. How would you describe your experience while completing the LAST Content Representation (CoRe) at the end of the semester, collectively, as a group for the animal science dissection lab compared to completing it individually?
4. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to design effective laboratory instruction for animal science dissection in the future?
5. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to facilitate effective laboratory instruction for animal science dissection in the future?
6. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to assess student learning for teaching animal science dissection in the future?
7. What aspects of completing the CoRe individually vs collectively as a group would you describe that helped you learn to teach animal science dissections? Please describe both completion methods if you can.
8. Reflecting on the process of developing CoRes (individually or as a group), what about this process will you carry forward as you continue to develop your teaching (or pedagogical content knowledge)?

3.9 Validity and Reliability

This section contains a description of the validity and reliability of quantitative and qualitative data for this study.

3.9.1 Quantitative Data (Pre-Survey and Post-Survey)

It is noted that self-reported studies, including questionnaires, lack validity as study participants select a response without interference. However, for this study the online questionnaire utilized a modified version of the background questions (on the Pre-Survey) and the level of comfort questions (Pre- and Post-Survey) from the from a college-level Greenhouse and Landscape Fundamentals for Educators course, which originally came from Wooditch et al. (2018) and was approved by the committee members who have expertise in the content area. Unmodified content level questions (Pre- and Post-Survey) from a college-level Introduction to Animal Agriculture course were also utilized and approved by the committee members who have expertise in the content area. Pre- Post- method has limitations in validity, however. There are a number of validity threats to take into account when using the method, including social desirability bias, effort justification bias, and cognitive dissonance (Hill & Betz, 2005). In addition, Cook and Campbell (1979) raise concerns about the possibility of other events besides the treatment (in this case the dissection experience), especially if the pre-test and post-test intervals are long. In the case of this study, there was an eight-week difference between the Pre-Survey and the Post-Survey.

3.9.2 Qualitative Data (Pre-CoRe, Post-CoRe, Group CoRe, and Individual Reflection Questions)

To maintain validity and reliability, triangulation is often used in qualitative research. Multiple data sources are used in Triangulation in order to obtain a comprehensive understanding of phenomena (Patton, 1999). In order to inform the results of this study from all different angles, Triangulation was accomplished through the use of multiple methods of data collection such as surveys, CoRes, and reflection questions. Another method of trustworthiness was accomplished by having an expert in teacher education and animal science laboratory instruction check the researcher's coding and analysis process and the themes generated. Later, peer debriefing occurred, and results were compared.

3.10 Data Collection

This section contains a description of the methods used to collect quantitative and qualitative data for this study. Data collection for this study consisted of three components: 1) Prior to instruction using the Pre-Survey and Pre-CoRe, 2) after the dissection lab experience using the Post-Survey and Post-CoRe, and 3) the end of the course using the Group CoRe and the Individual Reflection Questions.

3.10.1 Prior to Instruction (Pre-Survey and Pre-CoRe)

At the beginning of the course, a Pre-Survey was distributed and collected using Qualtrics, a licensed web-based survey analysis tool. The researcher was a teaching assistant in the LPAE course participants were enrolled in, and the Pre-Survey was completed in class at the beginning of class (to ensure no prior instruction occurred). Since the Pre-Survey was completed in class, it was not necessary to remind participants to complete it. The Pre-CoRe was distributed following the Pre-Survey and collected through BrightSpace, an online learning platform. Prior to the Pre-CoRe, participants were given a presentation on what PCK is and how CoRes are used to study PCK. Participants also learned the importance of CoRes and how to use a Core by completing a practice CoRe as a class on the topic of animal diseases. Participants were given approximately twenty to twenty-five minutes to complete the Pre-CoRe following the PCK presentation and practice CoRe. All participants completed their Pre-CoRes in class, so there were no completion reminders sent out.

3.10.2 After Dissection Lab Experience (Post-Survey and Post-CoRe)

Following the dissection lab, participants were asked to take a Post-Survey (distributed and collected using Qualtrics) at the end of class. Participants were also asked to complete their Post-CoRes following the Post-Survey. It was not originally planned to have participants complete CoRes outside of class, however, participants asked if they could finish their CoRes after class. Participants were given until the next day to complete their Post-CoRes and reminded to complete and turn in their Post-CoRes through Brightspace (Appendix F).

3.10.3 End of Course (Group CoRe and Individual Reflection Questions)

On the last day of class, participants were asked to work together as a class to complete a Group CoRe. The Group CoRe was already planned to be included in the course and was completed during class time. The Individual Reflection Questions were also planned to be a part of the course, and participants were told to complete them prior to coming to lab. Individual Reflection Questions were submitted through Brightspace. Reminders for both the Group CoRe and Individual Reflection Questions were not sent out.

3.11 Data Management

Both Quantitative data and Qualitative data were collected in this case study. Instruments for the Quantitative data include a Pre-Survey (with a Content Assessment) and a Post-Survey (with a Content Assessment). Instruments for the Qualitative Data include a Pre-CoRe, Post-CoRe, Group CoRe, and Individual Reflection Questions.

3.11.1 Quantitative Data Management

The Pre-Survey and Post-Survey data for this study were collected and stored online through Qualtrics, an online software tool for creating and distributing web-based surveys. Qualtrics utilizes a two-factor authentication that allows only the primary contact to access the study data. After data collection, the questionnaire results were uploaded and stored on Box, allowing only the principal investigator and primary contact on the study to have access to the results.

3.11.2 Qualitative Data Management

The Pre-CoRe, Post-CoRe, and Individual Reflection Questions were submitted to Brightspace, an online learning platform. Brightspace utilizes a two-factor authentication that allows only those involved in the class access. The course instructor was the primary investigator, and the teaching assistant was the primary contact. A teaching lab specialist was involved in the course who assisted in putting the Pre-CoRe, Post-CoRe, and Individual Reflection Questions in a Google folder, all of which had the names of participants removed and replaced with a random number. This allowed the researchers not to be able to identify participants and maintain research

integrity. The Pre-CoRe, post, CoRe, Individual Reflection Questions, and the Group CoRe were all coded on Google sheets. Only the primary investigator and the primary contact had access to the Google folder where the data was located. Google also utilizes two-factor authentication.

3.12 Data Analysis

Both Quantitative data and Qualitative data were collected in this case study. Instruments for the Quantitative data include a Pre-Survey (with a Content Assessment) and a Post-Survey (with a Content Assessment). Instruments for the Qualitative Data include a Pre-CoRe, Post-CoRe, Group CoRe, and Individual Reflection Questions. There was also one question on the Pre-Survey and Post-Survey that was qualitative.

3.12.1 Quantitative Data Analysis

Quantitative data was collected via an online Qualtrics Pre-Survey and Post-Survey and was later entered into a statistical software program, Statistical Package for the Social Sciences (SPSS), version 28.0 ©. SPSS was used for descriptive statistics (frequency and percentages) and R was used to perform Welch's t-tests (Welch-Satterthwaite equation). The Welch's t-test was chosen because it allowed for the possibility that the population variances may differ, allowing for more generalizability. The surveys did not collect any identifiable information from participants, which allowed the researchers to maintain research integrity.

3.12.2 Qualitative Data Analysis

Qualitative data was collected via Pre-CoRes, Post-CoRes, Individual Reflection Questions, and a Group CoRe. The Pre-CoRe and Post-CoRe had two cycles of coding that were done individually and manually. The first cycle was deductive coding using the definitions of PKBs to guide the coding (Content Knowledge, Pedagogical Knowledge, Curricular Knowledge, Knowledge of Students, and Assessment Knowledge). After coding participants' answers for concepts that described a PKB, the second coding cycle occurred to see what participants described for each PKB. Second cycle coding was coded inductively using descriptive and in vivo coding, then categorized to form themes using pattern coding. The Individual Reflection Questions were coded inductively and manually using descriptive and in vivo coding, then categorized to form

themes using pattern coding. The Group CoRe was compared to the Individual CoRes for differences and similarities. A coding checker took notes from all the coding to confirm everything was consistent and coded into appropriate categories.

3.13 Positionality Statement

This study utilized six methodological tools containing open-ended questions that allowed study participants to respond freely. Qualitative analysis was then conducted on those responses. This is why acknowledging the role, and potential influences bias has on those who perform qualitative research is necessary (Bourke, 2014). In the context of this study, sharing a researcher's perspective is essential. Researchers must examine their own opinions by stating the rationale (Throne & Bourke, 2019).

The researcher is a White, heterosexual young adult that identifies as a cisgender female from Greentown, Indiana. For five years, the researcher has assisted in teaching animal science, specifically dissections, and has extensive knowledge of animal science dissection but has not gone through a teacher preparation program. Because of teaching animal science, the researcher is interested in preparing for teaching animal science to future school-based agricultural education (SBAE) agriculture teachers. Having extensive knowledge of animal science dissections could influence the study; however, the study is already designed to be very structured. It is assumed that no influence should be made on the interpretation of the data, although the researcher is very familiar with the topic in the study.

In this study, prolonged engagement was attempted since the researcher was a teaching assistant in the course. This allowed the researcher to build trust with the participants, experience the breadth of variation, and overcome anything that may become misleading due to the researcher's presence on the site. Since the study is very structured and the researcher was a teaching assistant in the course, it can be assumed that the researcher will be empathetic and helpful to the participants taking the course. The type of relationship the researcher had with the participants was both a collaborator and a participant observer.

CHAPTER 4. RESULTS

4.1 Overview

This chapter presents the findings of the five research questions within this study. The subsequent sections are divided based on the research questions and the results. Participants' background experience in animal science and dissections is presented first, followed by how participants described the PKBs of Pedagogical Content Knowledge (PCK) before and after a dissection experience. Lastly, this chapter ends with how participants describe their Collective Pedagogical Content Knowledge (cPCK) and their overall experience with Content Representation CoRes.

4.2 Purpose of the Study

There were two purposes of this study. The first purpose was to describe preservice agricultural education teachers' Professional Knowledge Bases, before and after instruction, on the topic of animal science dissection in a Laboratory Practices in Agricultural Education (LPAE) course. The second purpose was to describe preservice agricultural education teachers' cPCK, after instruction, on the topic of animal science dissection in an LPAE course.

4.3 Research Questions

Five research questions guided this study:

1. What were secondary preservice agricultural education teachers' previous experiences before taking a Laboratory Practices in Agricultural Education course?
2. How was secondary preservice agricultural education teachers' Professional Knowledge Bases regarding the topic of animal science dissection lab described before and after participating in a Laboratory Practices in Agricultural Education course in the areas of:

a. Content Knowledge?
b. Pedagogical Knowledge?
c. Knowledge of Students?
d. Curricular Knowledge?

e. Assessment Knowledge?

3. How comfortable do secondary preservice agricultural education teachers feel in their ability to design, facilitate, and assess student knowledge described regarding the topic of animal science dissection lab before and after participating in a Laboratory Practices in Agricultural Education course?
4. How was secondary preservice agricultural education teachers' Collective Pedagogical Content Knowledge (cPCK) for the topic of animal science dissection described at the end of a Laboratory Practices in Agricultural Education course?
5. How did preservice teachers describe their experiences when comparing Individual CoRe versus Group CoRe discussion?

4.4 Research Question 1:

What were secondary preservice agricultural education teachers' previous experiences before taking a Laboratory Practices in Agricultural Education course?

Research question one explored preservice agricultural education teachers' previous experiences before the LPAE course using a Pre-Survey. There were 23 participants in this study. All participants were Agricultural Education majors in a preservice teacher preparation program, with three participants working on a minor in animal sciences. The college-level classification for participants in this course were juniors 60.9% (14/23), followed by 30.4% (7/23) being seniors and 8.7% (2/23) sophomores. Table 4.1 indicates the number of animal science courses taken prior to the LPAE course at the college- and high school-levels. Participants' highest range of animal science courses was one to two courses for both college- and high school-levels. One to two college-level animal science courses were taken by 50.2% (12/23) of participants, whereas 73.9% (17/23) have taken one to two at the high school-level. For three to four courses, 34.8% (8/23) have taken them at the college-level, and 17.4% (4/23) have taken them at the high school-level. There were 8.7% (2/23) of participants have never taken an animal science course at the college-level or the high school-level, and 4.3% (1/23) participant had taken seven to eight college-level courses.

Table 4.1 *Number of Animal Science Courses Taken by Secondary Preservice Agricultural Education Teachers (N = 23).*

Number of Courses	Level of Course	*f*	%
None			
	College-Level	2	8.7
	High school-Level	2	8.7
1-2			
	College-Level	12	52.2
	High school-Level	17	73.9
3-4			
	College-Level	8	34.8
	High school-Level	4	17.4
5-6			
	College-Level	0	0
	High school-Level	0	0
7-8			
	College-Level	1	4.3
	High school-Level	0	0
9+			
	College-Level	0	0
	High school-Level	0	0

Note. College-Level = number of animal science courses taken in college academic career, High School-Level = number of animal science courses completed (trimester/semester are equivalent for the purposes of this study).

Table 4.2 shows participants' previous experience in animal dissection. There were 65.2 % (15/23) of participants who indicated that they had no work experience in animal science dissections, whereas 13.0% (3/23) have less than six months of experience, and 8.7% (2/23) had anywhere between six months but less than a year. Overall, all the participants in this study had less than four years of work experience in animal science dissection. Several participants (43.5% or 10/23) of participants indicated they participated in animal science activities in both 4-H and school-based agricultural education/Future Farmers of America (SBAE/FFA) programs. There were 30.4% (7/23) of participants have participated in animal science activities only in an SBAE/FFA program, and 13.0% of participants only in a 4-H program. Only 8.7% (2/23) of participants were enrolled in either 4-H or SBAE/FFA but did not participate in animal science activities, and 4.3% (1/23) were not enrolled in either program. Participants were also asked what

experience have they had with learning animal dissection, and 73.8% (18/23) answered from a high school class, 34.8% (8/23) from a college course, and 30.4% (7/23) in an FFA experience outside the classroom. 4-H experience outside the classroom and an experience outside the classroom but not FFA or 4-H was described by 21.7% (5/23) of participants and 17.4% (4/23) of participants that said they had had no prior instruction about animal dissection before the LPAE course.

Table 4.2 *Secondary Preservice Agricultural Education Teachers' Previous Experiences in Animal Dissection (N=23).*

Experience	Amount/Location	*f*	%
Work experience in animal science in animal dissection	No work experience in these areas	15	65.2
	Less than 6 months	3	13.0
	1/2 to less than 1 year	2	8.7
	1 year but less than 2 years	1	4.3
	2 years but less than 3 years	1	4.3
	3 years but less than 4 years	1	4.3
	4 years but less than 5 years	0	0
	5 years or more	0	0
Animal Science program in 4-H, SBAE/FFA*	Not enrolled in either program.	1	4.3
	Did not participate in animal science activities in either program.	2	8.7
	Participated in animal science activities in an SBAE/FFA program.	7	30.4
	Participated in animal science activities in a 4-H program.	3	13.0
	Participated in animal science activities in both programs.	10	43.5
Experience with learning animal dissection**	No prior instruction about animal dissection.	4	17.4
	High school class	18	73.8
	College course	8	34.8
	4-H experience outside a formal classroom.	5	21.7
	Outside of the classroom FFA experience	7	30.4
	Outside of the classroom experience (not 4-H or FFA)	5	21.7

*SBAE/FFA is School-Based Agricultural Education or FFA
Participants could select all that applied

Table 4.3 displays the animal sciences courses previously taken by participants in the LPAE course at the university this course is taught. Introduction to Animal Agriculture had the highest enrollment with 73.9% (17/23) participants, followed by Principles of Animal Nutrition, having 30.4% (7/23) of participants. Applied Animal Management had 8.7% (2/23), and Meat Science had 13.0% (3/23) participants. One participant (4.3%) only recorded animal Growth, Development, & Evaluation, Meat Evaluation, or an Independent Study.

Table 4.3 *Animal Science Courses Taken at Study University Prior to Laboratory Practices in Agricultural Education Course (N=23).*

Course	*f*	%
ANSC 10200: Introduction to Animal Agriculture	17	73.9
ANSC 22100: Principles of Animal Nutrition	7	30.4
ANSC 24500: Applied Animal Management	2	8.7
ANSC 30100: Animal Growth, Development and Evaluation	1	4.3
ANSC 35100: Meat Science	3	13.0
ANSC 49500: Meat Evaluation	1	4.3
ANSC 29300: Independent Study*	1	4.3

Note. Only courses selected by participants are displayed in the table; Participants could select all that applied.
ANSC 29300 is an independent study that a student creates with an individual faculty member.

Participants were also asked if they had taken animal science courses at a different post-secondary institution than this study's university. Table 4.4 shows that 73.9% (17/23) have only taken courses at the same university this LPAE course was taught, and 26.1% (6/23) of participants have taken animal science courses elsewhere.

Table 4.4 *Animal Science Courses Taken at a Different Post-Secondary Institution Prior to Laboratory Practices in Agricultural Education Course (N=23).*

Courses taken at other institutions?	Course Name	*f*	%
No		17	73.9
Yes		6	26.1
	Animal Handling		
	Meat Evaluation		
	Livestock Evaluation		
	Animal Nutrition		
	Animal Breeding		
	Commercial Animal Farming		
	Animal Science		
	Health and Disease		

Note. If participants selected 'yes', they wrote the course they took.

Table 4.5 lists the animal science courses that participants felt helped them prior to the LPAE course. Introduction to Animal Agriculture was the most frequently noted course by 56.6% (13/23) of participants, and 17.3% (4/23) of participants described that no course has best prepared them. One participant did indicate that they hope the LPAE course will best prepare them.

Table 4.5 *Animal Science Courses Described as Helping Prepare Participants Prior to Laboratory Practices in Agricultural Education Course (N=23).*

Course	*f*	%
None	4	17.4
Meat Science	3	13.0
Introduction to Animal Agriculture/Science	13	56.5
Livestock Evaluation	2	8.7
Commercial Farming	1	4.3
Livestock Judging	1	4.3
Livestock Breeding	1	4.3
Animal Nutrition	1	4.3
ANSC 293: Independent Study*	1	4.3

Note. Courses are from multiple post-secondary institutions. Only courses selected by participants are displayed in the table; Participants could select all that applied.
ANSC 29300 is an independent study that a student creates with an individual faculty member.

4.5 Research Question 2:

How was secondary preservice agricultural education teachers' Professional Knowledge Bases regarding the topic of animal science dissection lab described before and after participating in a Laboratory Practices in Agricultural Education course in the areas of: Content Knowledge, Pedagogical Knowledge, Knowledge of Students, Curricular Knowledge, and Assessment Knowledge?

The second research question in this study sought to understand how preservice agricultural education teachers described their Professional Knowledge Bases (PKB) on animal science dissection prior to taking the LPAE course and after the animal science dissection experience in the LPAE course. The PKBs outlined in the Refined Consensus Model (RCM) of PCK (Carlson et al., 2019) include Content Knowledge, Pedagogical Knowledge, Knowledge of Students, Curricular Knowledge, and Assessment Knowledge.

Participants were given CoRes to complete individually (Pre-CoRe and Post-CoRe), which were coded for evidence of the PKBs. Pre-CoRe results and Post-CoRe results for each CoRe question are discussed below. To further flesh out participants' Content Knowledge, an additional Content Knowledge Assessment was administered prior to instruction and following the lab experience. Results of these assessments were analyzed using a t-test and reported in the subsequent sections.

Big Idea Results

A CoRe is developed by asking participants to list the "Big Ideas" associated with a given topic. In a CoRe, the Big Ideas are the horizontal axis, and each of the eight questions is answered for each Big Idea. When it comes to completing a CoRe, big ideas lead the way. This section discusses what Big Ideas participants described on their Pre-CoRe and their Post-CoRe.

Big Idea: Pre-CoRe

In a CoRe, a Big Idea runs through many of the ideas, and relates those ideas to one another, making up the topic of the CoRe. 23 participants completed the Pre-CoRe; only 19 of these participants identified "Big Ideas" related to teaching their future students animal science dissections. There were 17.4% (4/23) participants who did not identify a big idea, and stated "Dissection", so these participants were identified as not having a Big Idea. Participants generated,

on average, 1.0 Big Ideas per participant, resulting in 24 Big Ideas collectively, all relating to animal science dissection. While completing the Pre-CoRe, participants were prompted to identify as many Big Ideas as they could; however, several participants identified subsequent ideas that were the same as their first. In this situation, participants were classified as having only one Big Idea. Similarly, some participants had more than one Big Idea, but would only complete the CoRe for one Big Idea, so like before, this was classified as the participant only having one Big Idea. One specific case of completing the CoRe incorrectly occurred when participants completed the Pre-CoRe. While completing question one of the CoRe, it seemed that where participants were putting their Big Ideas rather than answering question one. Interestingly, one participant described their Big Idea in their Pre-CoRe as a learning outcome rather than an idea, and some participants decided to focus their Big Ideas on specific species. Participants who did not identify a Big Idea were still included in the first and second cycle coding of the PKBs.

Big Idea: Post-CoRe

The Post-CoRe was completed by 18 participants, all of whom identified Big Ideas. Out of the 18 participants who completed the Post-CoRe, 41 Big Ideas were generated. All 41 Big Ideas related to animal science dissection. On average, there were 2.3 Big Ideas per participant for the Post-CoRes. Similar to the Pre-CoRe, one or two participants did not describe in-depth ideas, while others had more than one Big Idea but only completed the CoRe for one Big Idea. Some participants did not complete the Pre-CoRe or repeated the same answer for the Pre-CoRe questions across their Big Ideas or completed the Pre-CoRe incorrectly. These circumstances, however, did not occur on the Post-CoRe.

Pre- and Post-CoRe Big Idea Themes

The Big Ideas for the Pre-CoRe and the Post-CoRe were coded into themes. The most prominent theme that emerged for the Pre-CoRe Big Ideas was *Gross Anatomy*, followed by *Dissection Laboratory Process*, *Implications*, and *Histology*. A sub-theme emerged from *Gross Anatomy*, which was *Compare* (i.e., species, body system, and sex). *Gross Anatomy* was coded from participants describing "parts and functions" or stating a body system or anatomy of a species. Furthermore, *Compare* was a sub-theme from how participants described their Big Ideas as

"comparing and contrasting" or "differentiating" gross anatomy. The theme *Dissection Laboratory Process* is from participants' describing their Big Idea as PPE or Tools, and the theme *Implications* was coded from "having an impact" and "careers," while *Histology* referred to cells. The Post-CoRe Big Ideas had very similar themes emerge: *Compare Species, Compare Sex, Gross Anatomy, Dissection Laboratory Process,* and *Pedagogy* (which was a student project).

CoRe Question 1 Results

CoRe Question 1 prompted participants, "What I Intend Students to Learn About the idea." The CoRe Question 1 asks participants to be specific about what content will be covered based on each of their Big Ideas.

CoRe Question 1: Pre-CoRe

In the first cycle coding of the Pre-CoRe for PKBs, one participant alluded to Curricular knowledge, and most participants describe concepts of Content Knowledge. Evidence of the other three PKBs did not emerge (Pedagogical Knowledge, Knowledge of Students, and Assessment Knowledge). Out of 23 participants, 73.9% (17/23) participants described Content Knowledge, and only one participant's answers alluded to Curricular Knowledge. This particular response was not included in the second cycle coding of CoRe Question 1 since it was the only participant who described Curricular Knowledge in the first round. Prominent themes that emerged from the second cycle of coding Content Knowledge were *Identification* and Vocabulary/Terminology, followed by Process*,* Function*,* and Species Knowledge*,* which were all less prominent. *Identification* had five sub-themes that emerged (*Parts/Organs, Body System, Cells, Tissues, and Tools*), with *Parts/Organs* being the most prominent sub-theme of *Identification. Process* had two sub-themes emerge: *Dissection* (i.e., tools used) and *Body System* (i.e., digestion). *Species Knowledge* alluded to participants talking about how species compared and having individual species knowledge. One participant described a component of Content Knowledge by stating they wanted to teach students the history of tools, which did not code further into a theme.

CoRe Question 1: Post-CoRe

In the first cycle of coding for the Post-CoRe for PKBs, Content Knowledge was the only PKB concept described by all 18 participants. Similar to the Pre-CoRe, *Identification* was again one of the most prominent themes to emerge; however, *Dissection Process* also became a prominent, more specific theme than in the Pre-CoRe since it emerged now as "*Dissection Process*" rather than just *Process*. Other differences emerged between the two CoRes: the theme *Vocabulary/Terminology* was not described as much by participants as it was in the Post-CoRe and *Compare* became a theme rather than a sub-theme because it was described more by participants than previously in the Pre-CoRe. *Function* was also a theme that emerged in the Post-CoRe, the same as in the Pre-CoRe. Sub-themes that emerged from *ID* were interesting for the Post-CoRe. In the Post-CoRe, participants described identifying based on body systems (i.e., Reproductive and Digestive*)* and types of animal digestive tracts (i.e., *Ruminant*, *Monogastric*, *Avian*, or *Unspecified*). Reproduction tracts were not further specified but just stated as reproductive tracts by participants. *Dissection Process* was another theme that had sub-themes emerge differently from the Pre-CoRe. These sub-themes were *How to Dissect* and *Safety*.

Table 4.5 and Table 4.6 show themes that emerged from the second cycle coding of question 1 of the CoRe in both the Pre-CoRe and the Post-CoRe. Content Knowledge was the only PKB that emerged from first cycle coding of both the Pre-CoRe and Post-CoRe, so Table 4.5 and Table 4.6 also shows the progression and change in the themes between the CoRes. The values in Table 4.5 and Table 4.6 are showing how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.5 *CoRe Question 1: "What I Intend Students to Learn About the Idea" Pre-CoRe (N=23)***.*

Content Knowledge (n=17)***		
Theme	Sub-Theme	*f**
Identification	Body System	4
	Parts/Organs	9
	Cells	2
	Tissues	1
	Tools	1
Functions		6
Vocabulary/Terminology		10
Process	Dissection	6
	Body System	3
Species Knowledge		4

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.6 *CoRe Question 1: "What I Intend Students to Learn About the Idea" Post-CoRe (N=18)***.*

Content Knowledge (n=18)***		
Theme	Sub-Theme	*f**
Identification	Ruminant Digestive System	5
	Monogastric Digestive System	4
	Avian Digestive System	4
	Unspecified Body System	9
	Reproductive System	2
Function		5
Vocabulary/Terminology		2
Dissection Process	Safety	7
	How to Dissect	3
Compare		3

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 2 Results

CoRe Question 2 asked participants, "Why is it Important for Students to Know This?", prompting participants to provide a rationale for the importance of the identified Big Idea. While answering this question, participants are making decisions about what to teach, allowing participants to successfully draw on their knowledge of what content is relevant and how the content links with other areas related to the topic and/or Big Idea.

CoRe Question 2: Pre-CoRe

In the first cycle coding of the Pre-CoRe for PKBs, participant responses suggested evidence of three concepts of PKBs: Content Knowledge, Knowledge of Students, and Curricular Knowledge, whereas the other two PKBs were not (Pedagogical Knowledge and Assessment Knowledge). Out of 23 participants, 65.5% (15/23) of participants described Content Knowledge, 17.4% (4/23) described Knowledge of Students, and 47.8% (11/23) described Curricular Knowledge.

Similar to CoRe Question 1 for Content Knowledge, prominent themes that emerged from the second cycle of coding for Content Knowledge for CoRe Question 2 were *Identification* and *Functions and Differences*. *Animal Management, Dissection Process,* and *Anatomical Interactions* were other themes that emerged. *Identification* had two sub-themes that emerged (*Problems* and *Parts/Systems*), with *Problems* being the most prominent sub-theme of *Identification*. *Differences* had two sub-themes emerge (*Species* and *Organs*), where most participants described differences between species as important for their future students. Although *Animal Management* was not a prominent theme, it was interesting for participants to recognize dissection as important for students to know to understand how to care for animals better.

Knowledge of Students was another PKB described by 17.4% (4/23) of participants for CoRe Question 2. The theme that emerged from all participants in the second round of coding was *Future Preparation* (i.e., future classes and future careers of their future students).

Lastly, Curricular Knowledge was another PKB to emerge, and 47.8% (11/23) of participants described this PKB. Like Knowledge of Students, *Preparation* was a theme to emerge and *Relationship of Taught Concepts*, where participants described tying all concepts of dissection together.

CoRe Question 2: Post-CoRe

Concepts of PKBs described from the 18 participants in the Post-CoRe for CoRe Question 2 were 88.9% (16/18) Content Knowledge and 38.9% (7/18) Curricular Knowledge. Unlike in the Pre-CoRe, Knowledge of Students was a PKB that participants did not describe. Five themes emerged for Content Knowledge from second cycle coding: *Animal Management*, *Identification/Function*, *Differences*, *Biology*, and *Safety*. This time *Animal Management* was the most prominent theme for Content Knowledge, where *Identification/Function* was also described by most participants and combined, whereas, in the Pre-CoRe, *Identification* and *Function* were separate themes. Like the Pre-CoRe, for Curricular Knowledge, *Preparation* was the only theme to emerge.

Table 4.7 and Table 4.8 show themes that emerged from the second cycle coding in both the Pre-CoRe and the Post-CoRe for all the PKBs that were described. Table 4.7 and Table 4.8 also show the progression and change in the themes between the CoRes. The values in Table 4.7 and Table 4.8 show how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.7 *CoRe Question 2: "Why is it Important for Students to Know This?" Pre-CoRe (N=23)***.*

Content Knowledge (n=15)***		
Theme	Sub-Theme	*f**
Animal Management		3
Identification	Problems	5
	Parts/Systems	2
Functions	System	5
	Organ	4
Dissection Process		2
Differences	Species	5
	Organ	1
Anatomical Interactions		3

Knowledge of Students (n=4)***		
Theme	Sub-Theme	*f**
Future Preparation		4

Curricular Knowledge (n=11)***		
Theme	Sub-Theme	*f**
Relationship of Taught Concepts		5
Future Preparation		11

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.8 *CoRe Question 2: "Why is it Important for Students to Know This?" Post-CoRe (N=18)***.

Content Knowledge (n=16)***		
Theme	Sub-Theme	*f**
Animal Management		10
Identification/Function	Problems	4
	Parts/Systems	4
Differences		3
Biology		4
Safety		3

Curricular Knowledge (n=7)***		
Theme	Sub-Theme	*f**
Future Preparation		7

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 3 Results

CoRe Question 3 asked participants, "What Else Do You Know About This Idea (That You Do Not Intend Students to Know Yet)?" This question prompts participants to think about what current content knowledge they have on the Big Idea that they do not expect their students to know prior to instruction.

CoRe Question 3: Pre-CoRe

In the first cycle coding of the Pre-CoRe for PKBs, three concepts of PKBs were described: Content Knowledge, Pedagogical Knowledge, and Curricular Knowledge, whereas the other two PKBs were not (Knowledge of Students and Assessment Knowledge). Interestingly, some participants' answers did not fit into a PKB. They discussed concerns they felt they should know before teaching students, such as what if something goes wrong or securing materials for lab. Out of 23 participants, 91.3% (21/23) of participants described Content Knowledge, 17.4% (4/23) described Pedagogical Knowledge, and 0.04% (1/23) described Curricular Knowledge. The

participant that described Curricular Knowledge talked about the anatomical connection across species, however, since only one participant described Curricular Knowledge, it was not included in the second round of coding. For Pedagogical Knowledge, two participants described materials they planned to use, or how they wanted to teach dissection. Again, since there were not many participants describing this PKB, it was not included in the second coding round.

The majority of participants described Content Knowledge. *Identification*, *Dissection Process*, *Species Knowledge*, *Vocabulary and Terminology*, *Function*, *Histology*, and *Diseases* were themes that participants described as the content they knew prior to their student's learning. *Identification* was recognized the most by participants, followed by *Dissection Process*, *Function*, and *Species Knowledge*. The other themes were not described by as many participants. *Identification* did have two sub-themes, *Organs/Parts*, and *Body Systems*, where 13/23 of participants described as having this content knowledge prior to teaching their students. However, participants did not specify what organs/parts or body systems they knew.

CoRe Question 3: Post-CoRe

Content Knowledge and Knowledge of Students were the only two PKB concepts to emerge from cycle one coding for the Post-CoRes for CoRe Question 2. Only 0.05% (1/18) of participants described Knowledge of Students and discussed student disabilities as knowledge to have prior to teaching dissection. Knowledge of Students was not included in cycle two coding since only one participant described the PKB. As for Content Knowledge, all 18 participants described this PKB. Similar themes that emerged as the Pre-CoRe were *Identification*, *Process*, and *Vocabulary/Terminology*. New themes that emerged were *Safety* and *Anatomical Differences*. Like the Pre-CoRe, *Identification* was the most prominent theme, but most participants also described P*rocess*. *Organ/Parts* was a sub-theme for *Identification*, like in the Pre-CoRe. However, a new sub-theme on the Post-CoRe to emerge was *Location*. For *Process*, participants described two sub-themes: Dissection *Process* and *Digestive Process* on the Post-CoRe. However, in the Pre-Core, only *Dissection Process* was a theme and there were no sub-themes.

Results from CoRe Question 3 are illustrated in Table 4.9 and Table 4.10. Themes that emerged from the second cycle coding in both the Pre-CoRe and the Post-CoRe for all the PKBs are listed, respectively. Table 4.9 and table 4.10 also show the progression and change in the

themes between the CoRes. The values in Table 4.9 and Table 4.10 are showing how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.9 *CoRe Question 3: "What Else Do You Know About This Idea (That You Do Not Intend Students to Know Yet)?" Pre-CoRe (N=23)***.*

Content Knowledge (n=21)***		
Theme	Sub-Theme	*f**
Dissection Process		8
Identification Process	Organs/Parts	10
	Body Systems	3
Species Knowledge		7
Vocabulary/Terminology		4
Function		8
Histology		3
Diseases		2

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.10 *CoRe Question 3: "What Else Do You Know About This Idea (That You Do Not Intend Students to Know Yet)?" Post-CoRe (N=18)***.*

Content Knowledge (n=18)***		
Theme	Sub-Theme	*f**
Process	Dissection Process	5
	Digestive Process	7
Identification	Organs/Parts	9
	Location	5
Anatomical Differences		5
Vocabulary/Terminology		5
Safety		4

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 4 Results

CoRe Question 4 prompted participants to consider "Difficulties/Limitations Connected with Teaching This Idea." Considering the difficulties and limitations of a Big Idea is an important aspect of a teacher's PCK which aligns with Shulman's (1986) theory.

CoRe Question 4: Pre-CoRe

Cycle one coding of the Pre-CoRe for PKBs revealed four PKBs were described: Content Knowledge, Pedagogical Knowledge, Knowledge of Students, and Curricular Knowledge. Evidence of Assessment Knowledge was not found. Two participants' responses suggested evidence of Curricular Knowledge through statements that identified preparation as a difficulty when teaching this idea. Curricular Knowledge was not included in cycle two coding since only two participants described this PKB. Content Knowledge was described by 47.8% (11/23) of participants, and *Vocabulary/Terminology*, *Function/Identification*, and *Instructor Content Knowledge* (i.e., specific knowledge) were themes that emerged as participants described that they have limited knowledge of it, or it is complex content, with *Instructor Content Knowledge* being the most prominent theme.

Pedagogical Knowledge had four themes: *Availability of Materials/Resources*, *Timing*, *Funding*, and *Learning Methods*. Pedagogical Knowledge was described by 52.2% (12/23) of participants, and *Availability of Materials/Resources* and *Learning Methods* were described the most by participants. The theme *Learning Methods* was coded from the majority of participants who described a concern of having concern with hands-on labs for dissection.

Evidence for Knowledge of Students was illustrated by 39.1% (9/23) of participants. Two themes emerged: *Active Engagement* and *Relevance*. *Active Engagement* was described as students' lack of interest or simply students objecting to dissection as a difficulty/limitation, whereas *Relevance* was illustrated through discussion of students' personal connection to the material being a difficulty/limitation. A couple of participants also mentioned community perceptions being a difficulty or limitation to teaching dissection.

CoRe Question 4: Post-CoRe

Three PKBs emerged from the Post-CoRe for CoRe Question 4 in cycle one coding: 22.2% (4/18) described Content Knowledge, 72.2% (13/18) described Pedagogical Knowledge, and 66.6% (12/18) described Knowledge of Students. Only one theme emerged for Content Knowledge, and was the same prominent theme in the Pre-CoRe, *Instructor Content Knowledge*. Similarly, these few participants described a difficulty/limitation known to teach their Big Idea even after the dissection experience in the LPAE course. Pedagogical Knowledge had a few new emerging themes compared to the Pre-CoRe, such as *Materials*, *Timing*, *Storage*, and *Lab Space*. *Materials* were the most prominent theme, and like in the Pre-CoRe, participants still mentioned *Available Materials* being a difficulty/limitation, but more specifically, *Acquiring Animal Tracts* and *Animal Tract Quality* as difficulties/limitations. All three of these items are sub-themes of *Materials*. *Active Engagement* and *Understanding Content* were two themes that emerged as difficulties/limitations of Knowledge of Students. Like in the Pre-CoRe, *Active Engagement* was still a major difficulty/limitation described by participants.

Results from CoRe Question 4 are illustrated in Table 4.11 and Table 4.12. Themes that emerged from the second cycle coding in both the Pre-CoRe and the Post-CoRe for all the PKBs are listed, respectively. Table 4.11 and Table 4.12 also show the progression and change in the themes between the CoRes. The values in Table 4.11 and Table 4.12 are showing how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.11 *CoRe Question 4: "Difficulties/Limitations Connected with Teaching this Idea" Pre-CoRe (N=23)***.*

Content Knowledge (n=11)***		
Theme	Sub-Theme	*f**
Vocabulary/Terminology		2
Identification/Function		4
Instructor Content Knowledge		7
Pedagogical Knowledge (n=12)***		
Theme	Sub-Theme	*f**
Available Material/Resources		7
Timing		2
Funding		2
Learning Methods		5
Knowledge of Students (n=9)***		
Theme	Sub-Theme	*f**
Student Participation		5
Relevance		4

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.12 *CoRe Question 4: "Difficulties/Limitations Connected with Teaching this Idea" Post-CoRe (N=18)***.*

Content Knowledge (n=4)***		
Theme	Sub-Theme	*f**
Instructor Content Knowledge		4

Pedagogical Knowledge (n=13)***		
Theme	Sub-Theme	*f**
Materials	Acquiring Animal Tracts	9
	Animal Tract Quality	2
	Available Materials	6
Timing		2
Storage		2
Lab Space		3

Knowledge of Students (n=12)***		
Theme	Sub-Theme	*f**
Student Participation		12
Understanding Content		2

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 5 Results

"Knowledge About Students' Thinking Which Influences Your Teaching of This Idea" was CoRe Question 5. The CoRe question illustrates how students influence teacher decisions regarding the Big Idea.

CoRe Question 5: Pre-CoRe

Pedagogical Knowledge, Knowledge of Students, and Curricular Knowledge were the PKB concepts that emerged from cycle one coding of the Pre-CoRe (Content Knowledge and Assessment Knowledge were not described). Curricular Knowledge was described by 0.04% (1/23) of participants and mentioned how to apply dissection to a real-world setting. Since one participant

only mentioned this PKB, it was not included in cycle two coding. Knowledge of Students was described by 87.0% (20/23), and four themes emerged: *Student Interest*, *Previous Experiences*, *Opinions on Dissection*, and *Student Learning Styles*. When considering what knowledge about students' thinking which influenced their teaching of their selected Big Idea, participants most frequently discussed elements of *Student Interest* and *Experience. Previous Experience* referenced the coursework, background, and life experience of students regarding the participant's Big Idea. Seven participants described concepts related to Pedagogical Knowledge, and the two themes that emerged were *Materials* and *Environment*.

CoRe Question 5: Post-CoRe

Concepts of PKBs described in the Post-CoRe were 83.3% (15/18) Knowledge of Students and 0.05% (1/18) Curricular Knowledge. Like the Pre-CoRe, only one participant described Curricular Knowledge, however, alluded to future classes their future students would be taking. Unlike in the Pre-CoRe, Pedagogical Knowledge was not described by participants in the Post-CoRe. The same four themes in the Pre-CoRe emerged in the Post-CoRe for Knowledge of Students: *Student Interest*, *Previous Experiences* (i.e., the coursework, background, and life experience), *Opinions on Dissection*, and *Student Learning Styles.*

Results from second cycle coding of CoRe Question 5 are found in Table 4.13 and Table 4.14. Table 4.13 and Table 4.14 also show the progression and change in the themes between the CoRes. The values in Table 4.13 and Table 4.14 show how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.13 *CoRe Question 5: "Knowledge About Student's Thinking Which Influences Your Teaching of this Idea" Pre-CoRe (N=23)***.*

Pedagogical Knowledge (n=7)***		
Theme	Sub-Theme	*f**
Materials		4
Environment		2

Knowledge of Students (n=20)***		
Theme	Sub-Theme	*f**
Student Interest		8
Previous Experiences		17
Opinions on Dissection		6
Student Learning Styles		3

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.14 *CoRe Question 5: "Knowledge About Student's Thinking Which Influences Your Teaching of this Idea" Post-CoRe (N=18)***.*

Knowledge of Students (n=15)***		
Theme	Sub-Theme	*f**
Student Interest		6
Previous Experiences		16
Opinions on Dissection		8
Student Learning Styles		2

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 6 Results

CoRe Question 6 was "Other Factors That Influence Your Teaching of This Idea." This CoRe question indicates contextual knowledge about students and general pedagogical knowledge that informs instructional strategy.

CoRe Question 6: Pre-CoRe

0.04% (1/23) Content Knowledge, 60.9% (14/23) Pedagogical Knowledge, 34.8% (8/23) Knowledge of Students, and 13.0% (3/18) Curricular Knowledge were described in cycle one coding of the Pre-CoRes for CoRe Question 6. One participant mentioned that another factor of Content Knowledge to consider is biological knowledge. Like in previous CoRe questions, Content Knowledge was not included in cycle two coding. Pedagogical Knowledge had six themes: *Safety, Lab Space, Availability of Materials, Time of Year, Funding,* and *Number of Students*. Knowledge of Students had two themes: *Previous Experience* and *Opinions on Dissection*. Lastly, Curricular Knowledge only had one theme, which was *Future Preparation* where participants alluded to future careers and classes. Other factors that 8 participants described that did not code into a specific PKB were community resources (local ties with surrounding community and school limitations (school support with dissections).

CoRe Question 6: Post-CoRe

For the Post-CoRe, two of the same PKB concepts were described: Pedagogical Knowledge and Knowledge of Students. Pedagogical Knowledge was described by 77.7% (14/18) of participants, and Knowledge of Students was described by 27.7% (5/18) of participants. The themes that emerged from Pedagogical Knowledge were the same (*Lab Space, Availability of Materials, Time of Year, Funding,* and *Lab Space*), except *Safety* and *Number of Students* were not themes, and instead, *Lab Space* was a new theme for Pedagogical Knowledge in the Post-CoRe. *Student Interest* and *Student Knowledge* were the two themes that emerged from Knowledge of Students. Five participants also mentioned concerns about the school's view of dissection as another influencing factor.

Results from second cycle coding CoRe Question 6 are illustrated in Table 4.15 and Table 4.16. Table 4.15 and Table 4.16 also shows the progression and change in the themes between the CoRes. The values in Table 4.15 and Table 4.16 and Table illustrate how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.15 *CoRe Question 6: "Other Factors that Influence your Teaching of this Idea" Pre-CoRe (N=23)***.*

Pedagogical Knowledge (n=14)***		
Theme	Sub-Theme	*f**
Safety		3
Lab Space		3
Availability of Materials		8
Time of Year		4
Funding		2
Number of Students		2

Knowledge of Students (n=8)***		
Theme	Sub-Theme	*f**
Opinions on Dissection		4
Previous Experience		3

Curricular Knowledge (n=3)***		
Theme	Sub-Theme	*f**
Future Preparation		3

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.16 *CoRe Question 6: "Other Factors that Influence your Teaching of this Idea" Post-CoRe (N=18)***.*

Pedagogical Knowledge (n=14)***		
Theme	Sub-Theme	*f**
Storage		2
Lab Space		3
Availability of Materials		13
Time of Year		4
Funding		3

Knowledge of Students (n=5)***		
Theme	Sub-Theme	*f**
Student Interest		3
Student Knowledge		3

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 7 Results

CoRe Question 7 prompted participants to write their "Teaching Procedures (And Particular Reasons for Using These to Engage with This Idea)." Participants are asked in this CoRe question to consider what methods, materials, planning, and set-up are involved with teaching the Big Idea, and to think through pedagogical decisions regarding teaching it.

CoRe Question 7: Pre-CoRe

Pedagogical Knowledge was described by 73.9% (17/23) of participants, Assessment Knowledge was described by 17.4% (4/23) of participants, and 0.04% (1/23) of participants described Curricular Knowledge for the Pre-CoRe. Two themes emerged for Pedagogical Knowledge: *Visual Teaching Methods* and *Interactive Teaching Methods*. Each theme had sub-themes which illustrated the specific methods described by participants. The most prominent sub-themes for *Visual Teaching Methods* are *Videos* and *Flashcards*, and for *Interactive Teaching Methods*, *Hands-On Lab* was the most emerged sub-theme. Participants did not specify what

"hand-on lab" they were planning for students, only for students to be involved. For Assessment Knowledge, participants primarily discussed *Formative Assessment* as a theme. Lastly, one participant's answer described Curricular Knowledge, and they mentioned sequencing units as a teaching procedure.

CoRe Question 7: Post-CoRe

For the Post-CoRe, the same PKBs (except for Curricular Knowledge) were described, and the same themes emerged for each PKB, respectively. However, the sub-themes changed slightly; fewer interactive teaching methods were described, and participants' focus seemed to be on planning for their students to dissect. Previously, in the Pre-CoRe, participants just said, "hands-on lab."

Table 4.17 and Table 4.18 show themes that emerged from the second cycle coding in both the Pre-CoRe and the Post-CoRe for all the PKBs that were described. Table 4.17 and Table 4.18 also shows the progression and change in the themes between the CoRes. The values in Table 4.17 and Table 4.18 illustrate how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.17 *CoRe Question 7: "Teaching Procedures (and Particular Reasons for Using These to Engage with this Idea) Pre-CoRe (N=23)***.*

Pedagogical Knowledge (n=17)***		
Theme	Sub-Theme	*f**
Visual Teaching Methods	Videos	6
	Flashcards	5
	Lecture	3
	Identification	5
	Models	1
	Images	2
Interactive Teaching Methods	Field Trips	4
	Hands-On Labs	10
	Games/Activities	5
	Discussions	1
	Microscopes	1

Assessment Knowledge (n=4)***		
Theme	Sub-Theme	*f**
Formative Assessment		4

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.18 CoRe Question 7: "Teaching Procedures (and Particular Reasons for Using These to Engage with this Idea) Post-CoRe (N=18)**.

Pedagogical Knowledge (n=16)***		
Theme	Sub-Theme	*f**
Visual Teaching Methods	Videos	4
	Flashcards	2
	Students Observe	3
	Identification	5
	Worksheet	2
Interactive Teaching Methods	Dissections/Hands-On Labs	13
	Discussions	2

Knowledge of Students (n=3)***		
Theme	Sub-Theme	*f**
Formative Assessment		3

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

CoRe Question 8 Results

CoRe Question 8 asked participants to discuss "Specific Ways of Ascertaining students' Understanding or Confusion Around This Idea (Include Likely Range of Responses)." To address this CoRe question, participants should consider specific ways to examine how students grasp or misunderstand the Big Idea. For both the Pre-CoRe and the Post-CoRe, only one PKB concept emerged, Assessment Knowledge. The same themes of *Formative Assessment* and *Summative Assessment* emerged for both the Pre- and Post-CoRe. All participants for both the Pre-CoRe (N=23) and Post-CoRe (N=18) described Assessment Knowledge. Sub-themes emerged based on the type of assessment participants described using on their students. Participants described the use of *Pre-Quizzes/Tests*, *Discussions*, and *Activities* were all sub-themes for the Pre-CoRe and Post-CoRe *Formative Assessments* theme. *Post-Quizzes/Tests*, *Exams/Practicals*, and *Final Presentations* were all sub-themes for *Summative Assessment* for the Pre-CoRe and Post-CoRe.

Table 4.19 and Table 4.20 show themes that emerged from the second cycle coding in both the Pre-CoRe and the Post-CoRe for all the PKBs that were described, respectively. Table 4.19

and Table 4.20 also shows the progression and change in the themes between the CoRes. The values in Table 4.19 and Table 4.20 show how many participants described each theme that emerged in both the Pre-CoRe and the Post-CoRe.

Table 4.19 *CoRe Question 8: "Specific Ways of Ascertaining Students' Understanding or Confusion Around this Idea (Include Likely Range of Responses) Pre-CoRe (N=23)**.*

Assessment Knowledge (n=23)***		
Theme	Sub-Theme	*f**
Formative Assessment	Pre-Quizzes/Tests	22
	Discussions	11
	Activities	2
Summative Assessment	Post-Quizzes/Tests	10
	Exams/Practicals	2
	Final Presentations	2

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Table 4.20 *CoRe Question 8: "Specific Ways of Ascertaining Students' Understanding or Confusion Around this Idea (Include Likely Range of Responses) Post-CoRe (N=18)**.*

Assessment Knowledge (n=18)***		
Theme	Sub-Theme	*f**
Formative Assessment	Pre-Quizzes/Tests	2
	Discussions	5
	Activities	1
Summative Assessment	Post-Quizzes/Tests	8
	Exams/Practicals	5
	Final Presentations	5

Note. Results from second cycle coding of PKBs that prominently emerged from first cycle coding
Total number of participants that described theme/sub-theme
Total number of participants that completed CoRe
*** Total number of participants that described that PKB***

Content Knowledge Analysis

An animal science dissection Content Knowledge Assessment was distributed to participants prior to instruction in the LPAE course and after the dissection experience in the course. Twenty-three participants completed the Pre-test, and 20 participants completed the Post-test. The assessment consisted of 10 questions, with five questions on digestion and five on reproduction. These questions were derived from existing course exam questions from the study university's Introduction to Animal Agriculture course. The mean overall score for the Pre-test was 6.05/10, and for the Post-test, the mean score increased to 7.48/10. For the reproduction questions specifically, the mean score on the Pre-test was 1.55/5 and increased to 3.10/5 on the Post-test. For the nutrition question specifically, the mean score on the Pre-test was 4.41/5 but slightly decreased to 4.33/5 on the Post-test. Table 4.21 displays the t-test results of the animal science dissection content assessment.

Table 4.21 *Animal Science Dissection Content Assessment Before and After Dissection Laboratory Experience in LPAE Course.*

Level	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Overall (Pre-Test)*	6.045	1.29					
			-3.07346	-3.07346	37.0567	0.004	0.941
Overall (Post-Test)*	7.476	1.721					
Digestion (Pre-Test)**	4.409	0.854					
			-0.076	0.290353	40.89643	0.773	-0.089
Digestion (Post-Test)**	4.333	0.856					
Reproduction (Pre-Test)***	1.545	1.184					
			1.55	-4.29886	40.9232	0	1.311
Reproduction (Post-Test)***	3.095	1.179					

Note. Significant at $p < 0.05$

Represents all 10 questions on the content assessment

Represents the 5 questions specifically on digestion from the content assessment

Represents the 5 questions specifically on reproduction from the content assessment

4.6 Research Question 3:

How comfortable do secondary preservice agricultural education teachers feel in their ability to design, facilitate, and assess student knowledge described regarding the topic of animal science dissection lab before and after participating in a Laboratory Practices in Agricultural Education course?

In the Pre- and Post-Survey, participants were asked to gauge their comfort level in their ability to design, facilitate, and assess student knowledge on animal science dissection. Participants were asked prior to any experience in the LPAE course if they would choose to teach animal science in the future. There were 78.3% (18/23) said yes, and 21.7% (5/23) said maybe. After the dissection experience, 65.0% (13/20) of participants still said they would select to teach animal science, and 10.0% (2/20) said maybe. Interestingly, 25% (5/20) said that they would not select to teach animal science if given a choice. Table 4.22 displays the t-test result of participants' choice to teach animal science in the future.

Table 4.22 *Choice to Teach Animal Sciences as an Agriculture Teacher in the Future.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	1.217	0.422					
			0.083	-0.60271	38.5785	0.55	0.185
After ANSC Experience in Course (N=20)	1.3	0.47					
Level			*f*			%	
Before ANSC Experience in Course (N=23)							
Yes			18			78.3	
Maybe			5			21.7	
No			0			0	
After ANSC Experience in Course (N=20)							
Yes			13			65.0	
Maybe			2			10.0	
No			5			25.0	

Note. Scale: "1" = "Yes," "2" = "Maybe," "3" = "No."
Note. Significant at $p < 0.05$

When assessing participants' level of comfort to design effective laboratory instruction for animal science, 43.5% (10/23) expressed that they were mostly comfortable prior to the LPAE course, 26.0% (6/23) said they were somewhat comfortable and 21.7% (5/23) said they were not comfortable. Very comfortable was described by 80.7% (2/23) of participants, and zero participants said they were extremely comfortable designing animal science laboratory instruction before taking the LAPE course. After the dissection experience in the LPAE course, 45.0% (9/20) said they were mostly comfortable, and 25.0% (5/20) of participants that said they were very comfortable designing instruction. There was one participant (5.0%) who expressed they were very comfortable now designing effective laboratory instruction for animal science dissection. There were still 20.0% (4/20) of participants who were somewhat comfortable and one (5.0%) participant who were not comfortable after the dissection lab experience in the LPAE course. Table 4.23

displays the t-test result of participants' level of comfort in participants' ability to design effective laboratory instruction for animal science dissection.

Table 4.23 *Level of Comfort in Ability to DESIGN Effective Laboratory Instruction for Animal Science Dissection.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	2.391	0.941					
			0.659	-2.28499	40.13163	0.028	0.699
After ANSC Experience in Course (N=20)	3.05	0.945					

Level	*f*	%
Before ANSC Experience in Course (N=23)		
Not at all Comfortable	5	21.7
Somewhat Comfortable	6	26.0
Mostly Comfortable	10	43.5
Very Comfortable	2	8.7
Extremely Comfortable	0	0
After ANSC Experience in Course (N=20)		
Not at all Comfortable	1	5.0
Somewhat Comfortable	4	20.0
Mostly Comfortable	9	45.0
Very Comfortable	5	25.0
Extremely Comfortable	1	5.0

Note. Scale: "1" = "Not at all comfortable," "2" = "Somewhat comfortable," "3" = "Mostly comfortable," "4" = "Very comfortable," "5" = "Extremely comfortable."
Note. Significant at $p < 0.05$

Participants' comfort level to facilitate effective laboratory instruction for animal science dissection resulted in 34.8% (8/23) of participants described that they were somewhat comfortable

and 34.8% (8/23) also described that they were mostly comfortable with facilitating prior to instruction in the LPAE course. There were 13% (3/23) of participants that said they were not at all comfortable, and 17.4% (4/23) of participants that said they were very comfortable. However, no participants described being extremely comfortable facilitating animal science dissection labs. After the dissection experience, 50.0% (10/20) of participants that said they were mostly comfortable, and 25.0% (5/20) said they were very comfortable with facilitating animal science dissection labs. There were 10.0% (2/20) that still said they were somewhat comfortable, and one participant said they were still not at all comfortable with facilitating dissection labs. However, 10.0% (2/20) of participants said that they were extremely comfortable with facilitating after the animal science dissection experience. Table 4.24 shows the t-test result of participants' level of comfort in participants' ability to facilitate effective laboratory instruction for animal science dissection.

Table 4.24 *Level of Comfort in Ability to FACILITATE Effective Laboratory Instruction for Animal Science Dissection.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	2.565	0.945					
			0.685	-2.34124	39.9052	0.024	0.716
After ANSC Experience in Course (N=20)	3.25	0.967					
Level			*f*			%	
Before ANSC Experience in Course (N=23)							
Not at all Comfortable			3			13.0	
Somewhat Comfortable			8			34.8	
Mostly Comfortable			8			34.8	
Very Comfortable			4			17.4	
Extremely Comfortable			0			0	
After ANSC Experience in Course (N=20)							
Not at all Comfortable			1			5.0	
Somewhat Comfortable			2			10.0	
Mostly Comfortable			10			50.0	
Very Comfortable			5			25.0	
Extremely Comfortable			2			10.0	

Note. Scale: "1" = "Not at all comfortable," "2" = "Somewhat comfortable," "3" = "Mostly comfortable," "4" = "Very comfortable," "5" = "Extremely comfortable."
Note. Significant at $p < 0.05$

Comfort Levels for assessing student knowledge in laboratory instruction for animal science dissection resulted in 39.1% (9/23) of participants describing that they were mostly comfortable prior to instruction, 26.1% (6/23) of participants being somewhat comfortable, and 17.4% (4/23) being very comfortable. There were 17.4% (4/20) of participants expressed they were not at all comfortable assessing student knowledge in animal science dissection labs, and zero participants described being extremely comfortable. After the dissection experience in the LPAE course, 45.0% (9/20) of participants that said they were mostly comfortable, with 35.0% (7/20) still being somewhat comfortable with assessing student knowledge. Interestingly, zero participants said they were not comfortable at all, and 10% (2/20) described as being very comfortable and 10% (2/20) as extremely comfortable assessing student knowledge after the animal science dissection lab experience. Table 4.25 shows the t-test result of participants' level of comfort in participants' ability to assess student knowledge in laboratory instruction for animal science dissection.

Table 4.25 *Level of Comfort in Ability to ASSESS STUDENT KNOWLEDGE in Laboratory Instruction for Animal Science Dissection.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	2.565	0.992					
			0.407	-1.66371	37.29836	0.105	0.501
After ANSC Experience in Course (N=20)	3.55	0.826					
Level			*f*			%	
Before ANSC Experience in Course (N=23)							
Not at all Comfortable			4			17.4	
Somewhat Comfortable			6			26.1	
Mostly Comfortable			9			39.1	
Very Comfortable			4			17.4	
Extremely Comfortable			0			0	
After ANSC Experience in Course (N=20)							
Not at all Comfortable			0			0	
Somewhat Comfortable			7			35.0	
Mostly Comfortable			9			45.0	
Very Comfortable			2			10.0	
Extremely Comfortable			2			10.0	

Note. Scale: "1" = "Not at all comfortable," "2" = "Somewhat comfortable," "3" = "Mostly comfortable," "4" = "Very comfortable," "5" = "Extremely comfortable."
Note. Significant at $p < 0.05$

Participants were also asked to rate their own effectiveness as a future teachers of animal science laboratory instruction. At the beginning of the LPAE course, 39.1% (9/23) of participants described that they were very comfortable with their own effectiveness as an animal science teacher, and 34.8% (8/23) of participants said that they were mostly comfortable. There were 17.4% (4/20) of participants that said that they were somewhat comfortable. In contrast, 10.0% (2/20) of participants expressed that they were not at all comfortable with their effectiveness as a future teacher of animal science laboratory instruction. No participants described that they were extremely comfortable. After the dissection experience, 60.0% (12/20) of participants described themselves as being mostly comfortable now, and 35.0% (7/20) said they were very comfortable. There was 5.0% (1/20) of participant described being extremely comfortable now with their own effectiveness. There were no participants that described as being somewhat comfortable or not at all comfortable after the dissection lab experience in the LPAE course. Table 4.26 shows the t-test result of participants' level of comfort in participants' own effectiveness as a future teachers of animal science laboratory instruction.

Table 4.26 *Own Effectiveness as a Future Teacher of Animal Science Laboratory Instruction.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	3.043	0.976					
			0.407	-1.66371	37.29863	0.105	0.501
After ANSC Experience in Course (N=20)	3.45	0.605					
Level			*f*			%	
Before ANSC Experience in Course (N=23)							
Not at all Comfortable			2			8.7	
Somewhat Comfortable			4			17.4	
Mostly Comfortable			8			34.8	
Very Comfortable			9			39.1	
Extremely Comfortable			0			0	
After ANSC Experience in Course (N=20)							
Not at all Comfortable			0			0	
Somewhat Comfortable			0			0	
Mostly Comfortable			12			60.0	
Very Comfortable			7			35.0	
Extremely Comfortable			1			5.0	

Note. Scale: "1" = "Not at all comfortable," "2" = "Somewhat comfortable," "3" = "Mostly comfortable," "4" = "Very comfortable," "5" = "Extremely comfortable."
Note. Significant at $p < 0.05$

Lastly, participants were asked to rate their comfort level in currently teaching animal science labs. At the beginning of the LPAE course, 43.5% (10/23) of participants rated that they were somewhat comfortable. There were 21.7% (5/23) of participants that said they were mostly comfortable, and 17.4% said they were very comfortable. There were 17.4% (4/20) of participants that described not being comfortable at all to currently teaching animal science labs. No participants described themselves as being extremely comfortable. However, after the animal science dissection lab experience, there was 5.0% (1/20) of participants described as being extremely comfortable currently teaching, with 50.0% (10/20) of participants saying that they are mostly comfortable and 35.0 % (7/20) of participants saying that they were very comfortable. Only 10.0% (2/20) of participants described themselves as still being somewhat comfortable currently teaching animal science labs. No participants said that they were not comfortable at all. Table 4.27 shows the t-test result of participants' comfort level in currently teaching animal science labs.

Table 4.27 *Level of Comfort to Currently Teach Animal Science Labs.*

Experience	Mean	St. Dev.	Mean Difference	*t*	*df*	*p*	Cohen's d
Before ANSC Experience in Course (N=23)	2.391	0.988					
			0.959	-3.6181	40.2518	0.001	1.096
After ANSC Experience in Course (N=20)	3.35	0.745					
Level			*f*			%	
Before ANSC Experience in Course (N=23)							
Not at all Comfortable			4			17.4	
Somewhat Comfortable			10			43.5	
Mostly Comfortable			5			21.7	
Very Comfortable			4			17.4	
Extremely Comfortable			0			0	
After ANSC Experience in Course (N=20)							
Not at all Comfortable			0			0	
Somewhat Comfortable			2			10.0	
Mostly Comfortable			10			50.0	
Very Comfortable			7			35.0	
Extremely Comfortable			1			5.0	

Note. Scale: "1" = "Not at all comfortable," "2" = "Somewhat comfortable," "3" = "Mostly comfortable," "4" = "Very comfortable," "5" = "Extremely comfortable."
Note. Significant at $p < 0.05$

After rating their comfort level to currently teaching animal science labs, participants were asked to explain why they felt that way. At the beginning of the course, participants explained their comfort level choice. Firstly, when expressing if they were comfortable or not, they expressed that they "know enough" or "could teach." Most participants described that they need more experience and learn more to teach, as well as time. Touching more on experience, participants described having or the lack of having an animal background and lab experience as an explanation for their comfort level. Lastly, participants explained that there are many influences on effective teaching, such as having never taught the subject, having the teaching skills, and the subject being challenging to teach. After the lab experience, participants explained their choice as they did before they had the lab experience, either able to prepare to teach or they are still unsure of themselves teaching. Even though participants said the dissection lab in the course helped, participants felt that there was more to learn, and they needed more experience in general.

4.7 Research Question 4:

How was secondary preservice agricultural education teachers' Collective Pedagogical Content Knowledge (cPCK) for the topic of animal science dissection described at the end of a Laboratory Practices in Agricultural Education course?

By completing a Group CoRe, as an entire class, it was apparent that completing the CoRe collectively elevated all participants in the LPAE course. This is primarily noticeable by acknowledging the Big Ideas generated by the group during completion of the Group CoRe. The four Big Ideas that emerged from the Group CoRe included: Safety Using Lab Equipment and Following Procedures, Terminology, ID differences between various systems within species and between species, and Describe functions and interactions of organ systems. When compared to Big Ideas described individually by participants, the collective Big Ideas are much broader, instead of being specific and repetitive within the same individual CoRe.

CoRe Question 1 of the Group CoRe (what I intend students to learn about the idea) was collectively described by participants as learning objectives covering broad Content Knowledge concepts instead of writing "pieces" of Content Knowledge (i.e., organs or ID) to be learned. CoRe Question 2 (why is it important for the students to know this?) had a common statement that was described across all four Big Ideas. Participants identified that it is important that students learn to be agriculturally literate and prepare their students for the future that each Big Idea facilitates that

importance. This was similar to what participants described individually as well. Like CoRe Question 1, CoRe Question 3 (what else do you know about this idea (that you do not intend the students to know yet)?) was described collectively as broader Content Knowledge concepts. Although still described by participants as having "specific knowledge," individually, participants were creating a list of that specific knowledge and what all they know.

Participants answered CoRe Question 4 (difficulties/limitations connected with teaching this idea) the same as they did individually and described the same concerns: availability of materials, timing, and opinions of dissection. CoRe Question 5 (Knowledge about students' thinking which influences your teaching of this idea) had the same outcome as CoRe Question 4, where student interests and student background were also described, the same as when participants completed the CoRe individually. The group response to CoRe Question 6 was not as deeply described collectively as individually as participants would repeat their answers across their Big Ideas. As for CoRe Question 7 (Teaching procedures (and particular reasons to engage with this idea), although participants had similar ideas on what to do to teach their collective Big Ideas (i.e., Quizlet, videos, etc.), each Big Idea had unique, hands-on teaching procedures to effectively teach each Big Idea. Some were similar to what was mentioned on the individual CoRes, but some teaching procedures were innovative. These teaching procedures were innovative because participants described other teaching procedures besides teacher-led dissections or lectures such as dissecting in groups or projects. Lastly, CoRe Question 8 had the same outcome as CoRe Questions 4 and 5, where it was very similar to what participants answered on their individual CoRes. Table 22 displays the Group CoRe completed collectively in the LPAE course on animal science dissection.

Table 4.28 *Animal Science Dissection Group CoRe*

	Big Idea A: Safety using lab equipment and following procedures	**Big Idea B: Terminology**	**Big Idea C: ID differences between various systems Within species and between species**	**Big Idea D: Describe functions and interactions of organ systems**
What I intend students to learn about the idea	• How to properly use tools. • Biohazard concerns (purpose of safety; how blades are sharp and can inadvertently transmit biohazards). • Safety as a lifelong skill. • Emergency Procedures. • Follow established lab expectations.	• ID the various structures of the organ systems you are dissecting. • Students should have a basic understanding of how to use the vocabulary, so they know how to communicate properly. • Appropriate terminology for SAE's and Job Interviews so that they are Ag literate.	• Functions of each system. • Parts of each system. • What qualifies each species to be classified as their current identification in a system? (i.e., what makes something a ruminant vs. monogastric?). • Diets - specific foods each species can digest and how they accomplish digestion. • Be able to identify parts of systems. • Be able to classify animals into various categories. • Compare and contrast specific organs/organ systems between species.	• How they work. • How they benefit the animal. • How they work together (systems dependency). • What happens if one of the systems fails. • Diseases.

Table 4.28 continued

Why is it important for the students to know this?	• Keeps students safe. • Liability concerns Students can apply safe use of tools to future jobs.	• So that students can be Ag literate; they can talk to someone in the industry/outside the industry and understand what they are talking about. • If they are working in the Ag industry, they will need to know the language to use to communicate on a daily basis. • So they know what is actively happening during the lab lesson and understand your directions.	• Ag literacy! • Help students better understand the importance of nutrition. • That students understand what it is they are dissecting and how it works.	• Ag literacy! • Future career skills/knowledge Understand how to best help a sick animal feel better.
What else do you know about this idea (that you do not intend the students to know yet)?	• OSHA acronyms; laws related to safety. • Specific biohazards. • Safety related to food science and other topics that may be covered in the future. • How to store chemicals.	• Super specific vocab within organ systems. • Consider vocabulary that may be similar to others that students know?	• How to ID differences. • Functions. • How nutrition plays a role. • Microbiota.	• In depth stuff (do not need to know the same stuff as a college course). • Hormones (maybe not at the start, but later one).

Table 4.28 continued

Difficulties/ Limitations connected with teaching this idea.	• Overcoming prior habits that may not be the correct/safe way. • Students with disabilities that affect fine motor control or vision could impact their ability to things safely.	• Go on forever Students could potentially be bored, especially if you are not connecting it to the material. • Similar words; some terms are very similar to each other but mean different things.	• Students might tend to think primarily about the human body. • Can be difficult to illustrate those differences if you do not have an actual tract. • These concepts could be completely new for your students, so you might have to meet students where they are. • Students could be resistant to conducting actual dissection (queasy stomach; moral qualms). • Time and Preparation --> takes a lot of time to find the tract and then to actually conduct the lesson. • Storage of animal tracts. • Funding. • Size of fresh animal tracts (cattle digestive tract is HUGE). • School policies regarding animal dissection/tracts.	• Availability of resources. • Different species can be confusing if taught all at once. • Making sure that myself as an instructor is up to speed on accurate content information.

Table 4.28 continued

Knowledge about students' thinking which influence your teaching of this idea.	• May have prior biology classes that impact their learning. • Prior behaviors of students might impact how you group students.	• Students' interests. • Location of community in which you teach. • Identifying where students are at and then introduce technical terms. • Plan learning activities based on what activities they have had learning success within the past.	• Same as the left.	• Same as the left.
Other factors that influence your teaching of this idea.		• Depends on if your class has a lot of IEP/504 students. • Community Teacher's Prior knowledge.	• Same as the left.	• Same as the left.

Table 4.28 continued

Teaching procedures (and particular reasons to engage with this idea).	• Videos. • Color coding sheet of paper of a map of the lab. • Show them what could happen if they do not follow safety procedures (pictures/videos/ testimonials). • Give them scenarios to ID what is wrong and what to do instead. • Hands on play doh to practice simulating using a scalpel.	• Images, real life examples --> students label these or answer • Multiple Choice. • Flash Cards. • Kahoot. • Quizlet Live. • Quizizz. • Props to represent real-life examples.	• Having real animal tracts (fresh or preserved). • Teacher led (larger animal tract) dissection. • Student led (smaller animal tracts). • Online virtual dissection. • Have students make models of organ systems. • Videos.	• Student presentations at end of unit. • Website simulation. • Skit/Student simulation. • Guest speaker (vet). • Matching organs with function worksheet/online. • Quizizz.
Specific ways of ascertaining students' understanding or confusion around this idea (include likely range of responses)	• Pre-Quiz before doing lab. • Worksheet.	• Pre-Quiz. • Discussion. • Game. • Lab Packet. • Post-Quiz. • Test. • Final Presentation Reflection Paper.	• Same as the left.	• Same as the left.

4.8 Research Question 5:

How did preservice teachers describe their experiences when comparing Individual CoRe versus Group CoRe discussion?

This research question was assessed through Individual Reflection Questions given to participants at the end of the course. There were eight reflection questions, and 22 participants completed them. One participant was removed for lack of responses to the questions.

1. ***Prior to any instruction in the course, how would you describe your experience while completing the <u>FIRST</u> Content Representation (CoRe) of the semester, individually, for the animal science dissection?***

Research question five was analyzed through Individual Reflection Questions that participants completed at the end of the course to reflect upon using CoRes throughout the course. All 22 participants completed the Individual Reflection Questions, and no participant had seen a CoRe before being enrolled in the LPAE course. The first question asked participants to describe their experience when completing the first individual CoRe that was distributed prior to any instruction in the course. There were 86.4% (19/22) of participants described having an unpleasant experience completing the first CoRe individually and described the experience as confusing and difficult. One participant expressed, "This was difficult for me at the beginning because I never thought about animal dissection in this way." However, ten participants described their experience with the first CoRe as easy and enjoyed the CoRe. While completing the first CoRe, 31.8% (7/22) of participants described how having no prior experience or little experience, whether with animals or completing a CoRe before, was not helpful and caused a challenge. Prior to giving participants their first individual CoRe, the course instructors did an example CoRe collectively, and 18.1% (4/22) of participants said that that aided in their experience completing their first CoRe.

2. ***After the animal science dissection lab in the course, how would you describe your experience while completing the <u>SECOND</u> Content Representation (CoRe) of the semester, individually for the animal science dissection?***

The second question asked participants to describe their experience after having a dissection lab experience in the LPAE course and completing their second individual CoRe. There were 95.5% (21/22) of participants said that completing this CoRe was much easier than

completing the CoRe at the beginning of the course. Although participants described that it was easier than before, 22.7% (5/22) of participants still described the CoRe as being difficult to complete or did not have a pleasant experience completing the CoRe. There were 59.0% (13/22) of participants described that the dissection laboratory experience helped them complete the CoRe because they now have the knowledge or examples of how to teach dissection. Participants also described that doing the CoRe again helped them understand the organization more and how they are supposed to complete it. One participant said, "While completing the second Content Representation, I became more familiar with the formatting and content that was being discussed. For me, I am familiar with dissections, but it was in this CoRe that I started to think about it from a teaching perspective rather than a student perspective."

3. ***How would you describe your experience while completing the <u>LAST</u> Content Representation (CoRe) at the end of the semester, collectively, as a group for the animal science dissection lab compared to completing it individually?***

The third question asked participants to describe their experience completing the CoRe as an entire class compared to completing the CoRe individually. There were 81.8% (18/22) of participants described their experience as easier, and 18.1% (4/22) of participants said that this was the easiest CoRe to complete. One student reflected that it was the easiest CoRe because "we had people to check our understanding and bounce ideas off of. Just as when you are teaching, you can always ask your co-teacher or a friend for help or to check out an idea if you are unsure." There were 72.7% (16/22) of participants that also said that group collaboration was helpful to their experience completing the CoRe collectively. One participant said that it was the same experience as completing the CoRe individually and one other participant said it was still difficult and time-consuming. There were 13.6% (3/22) of participants that described the course's dissection lab experience and 18.1% (4/22) participants referenced doing the CoRe again was helpful in their completion of the Group CoRe. Lastly, four participants said they gained more knowledge while collectively completing the Core as a group.

4. ***What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to <u>design</u> effective laboratory instruction for animal science dissection in the future?***

Question four of the reflection questions prompted participants to reflect on takeaways from completing the CoRes individually versus collectively and how that contributed to participants' comfort level to design animal science dissection labs. Individually, participants expressed that they could focus on themselves and how they design animal science dissection labs. One participant reflected, "completing it individually helped me assess the knowledge I had on my own and made me comfortable with my content knowledge and teaching style," while another student reflected, "I do not really think completing it on my own made me feel any more comfortable. I honestly just went with the flow to fill out." The same participant that reflected that individually they just complied with what the CoRe instructed them to do and reflected that the group conversation that occurred in the Group CoRe gave them more ideas and considered the lab more in-depth. They also reflected, "We went into more detail, and this will probably improve my labs in the future." The majority of participants had the same perceptions that collectively, they had more ideas and struggled to complete the CoRe individually. Another student reflected, "The collective CoRe made me feel more comfortable because I feel like it covered more Big Ideas that I would have chosen by myself. It covered more of what lesson plans for a unit would look like rather than specific topics that would be just part of one lesson."

5. ***What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to <u>facilitate</u> effective laboratory instruction for animal science dissection in the future?***

Question five of the reflection questions prompted participants to reflect on takeaways from completing the CoRes individually versus collectively and how that contributed to participants' comfort level facilitating animal science dissection labs. Participants reflected the same thoughts as they did with the CoRes contribution to designing instruction; participants could focus on themselves individually and collectively produce more ideas. However, a couple of participants reflected that the CoRe did not help them with their comfort level in facilitating animal science dissection labs. One student reflected, "I'm not sure that completing the CoRe itself made me more comfortable facilitating effective laboratory instruction in the future. It definitely allowed me to learn how to potentially format a strong lesson flow. However, the facilitation aspect itself

was not really improved because I never actually utilized the CoRe. If designed and completed, I think the CoRe could be incredibly beneficial in a facilitation development tool." While other participants pointed out the "Teaching Procedures" CoRe question (Question 7) was beneficial to their comfort levels with facilitating. One participant reflected, "the planning and what you expect the students to know vs. what you want them to learn is probably the most important for facilitating because it gives you a starting point and an end goal for the lesson."

6. ***What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to <u>assess student learning</u> for teaching animal science dissection in the future?***

Question six of the reflection questions prompted participants to reflect on takeaways from completing the CoRes individually versus collectively and how that contributed to participants' comfort level to assess student knowledge for animal science dissection labs. Similar to designing and facilitating, contributions of the CoRes on participants' comfort levels for assessing student knowledge resulted in participants feeling they could focus on themselves individually and collectively produces more ideas. However, one participant said that although they gained ideas collectively, they are better off doing it individually, saying that "every teacher and facilitator has their own way of grading" and that they would like to continue doing it their own way as they see fit. One other student also expressed similar feelings and described that they liked what they came up with more individually than collectively. A couple of participants referred to CoRe questions that were helpful to them with assessing student knowledge for animal science dissection labs, such as the "ascertaining students question" (Question 8). This CoRe question allowed participants to think of more ways to assess students rather than just a multiple-choice quiz. The "what students should know" (Question 1) CoRe question was described to be "useful to target what to assess the students over." Lastly, some participants expressed that the CoRes did not have a contribution to assessing student knowledge comfort levels. However, one participant expressed that "the CoRe is a great way to design a lesson, but I don't believe that it made me more comfortable assessing students in the future" and "if utilized in a "real-life" scenario, I think that it could be, though."

7. ***What aspects of completing the CoRe individually vs collectively as a group would you describe that helped you learn to teach animal science dissections? Please describe both completion methods if you can.***

Aspects of completing the CoRe individually that participants described as helpful were thinking/planning individually, individually problem solving, and lesson planning. One student described the CoRe as giving them "creative freedom," while on the other hand, it helped student organize their ideas and break down each step. One student described problem-solving where they "broke the lesson topics down in a way that I individually understood it" and "wrote down details of my own previous knowledge and knew then what I needed to research a bit before presentation to students." Other participants reflected that they now understand how the CoRe is a planning tool tied to lesson planning. One participant reflected that they now "realized that there are many things to consider when planning a lab," and one "can't just throw a lab together last minute; it's going to take some time to think about each component" where "this is especially true when you don't have people to bounce ideas off of."

Collectively participants described gaining knowledge or ideas, gaining collaboration skills, and preparing for the future as aspects of completing the CoRe collectively that participants described as helpful. One student described "it gave me others to bounce my ideas off of and help me to work on my collaboration skills which will be beneficial when teaching in the future." Another student noted that animal science dissection labs are intense labs that take a lot of preparation.

8. ***Reflecting on the process of developing CoRes (individually or as a group), what about this process will you carry forward as you continue to develop your teaching (or pedagogical content knowledge)?***

This question prompted participants to reflect on what they would take away from the process of completing CoRes. There were 13.6% (3/22) of participants that expressed that they will not realistically be using any part of the CoRe. The most prominent outcome was participants would use the entire CoRe, or parts of the CoRe. Some participants expressed that they did not like the structure or format of the CoRe. However, participants described that they would take the breakdown the CoRe provides. One student described this as "you have to start slow and break everything down to help keep you from getting overwhelmed." Another reflection participants had about the process is that they would utilize collectively planning in the future and expressed "discussion is a great way to build great lessons." Participants also said they plan to use CoRes for laboratory instruction and lesson planning. Overall, one participant described their CoRe

experience as “The process of the CoRes both individually and as a group taught me a lot. Individually I know I need to have my lab lessons prepped and be looking ahead of time in case I need materials or equipment. As a group I learned how so many variations of a lesson can be done and performed in a lab setting. I believe overall that the CoRe work has really helped me be a better instructor in the laboratory and also on developing fun and interacting labs.” Which made the participant realize the “importance of collaboration skills so that the lab runs smoothly.”

CHAPTER 5. CONCLUSION/RECCOMENDATIONS

5.1 Overview

In this chapter, the results and main findings of this study are presented. Following each conclusion is a discussion on the implications for practice. This chapter concludes with recommendations for future research.

5.2 Purpose of the Study

There were two purposes of this study. The first purpose was to describe preservice agricultural education teachers' Professional Knowledge Bases, before and after instruction, on the topic of animal science dissection in a Laboratory Practices in Agricultural Education (LPAE) course. The second purpose was to describe preservice agricultural education teachers' cPCK, after instruction, on the topic of animal science dissection in an LPAE course.

5.3 Research Questions

Five research questions guided this study:

1. What were secondary preservice agricultural education teachers' previous experiences before taking a Laboratory Practices in Agricultural Education course?
2. How was secondary preservice agricultural education teachers' Professional Knowledge Bases regarding the topic of animal science dissection lab described before and after participating in a Laboratory Practices in Agricultural Education course in the areas of:
    a. Content Knowledge?
    b. Pedagogical Knowledge?
    c. Knowledge of Students?
    d. Curricular Knowledge?
    e. Assessment Knowledge?
3. How comfortable do secondary preservice agricultural education teachers feel in their ability to design, facilitate, and assess student knowledge described regarding the topic of animal science dissection lab before and after participating in a Laboratory Practices in Agricultural Education course?

4. How was secondary preservice agricultural education teachers' Collective Pedagogical Content Knowledge (cPCK) for the topic of animal science dissection described at the end of a Laboratory Practices in Agricultural Education course?
5. How did preservice teachers describe their experiences when comparing Individual CoRe versus Group CoRe discussion?

5.4 Study Context

This study was conducted amidst the global COVID-19 pandemic during the Fall 2021 semester. Throughout the Spring 2020, Fall 2020, and Spring 2021 semesters, participants experienced social distancing and online learning, with accommodations for virtual attendance. The LPAE course took place with limited social distancing and accommodations for virtual learning. Participants in this course are primarily juniors; consequently, the bulk of their undergraduate course experiences have occurred in the context of the pandemic. Teachers and students experienced a disconnect during COVID-19, despite the virtual interactions and learning opportunities provided by instructors (Colao et al., 2020). The adjustment back to a "normal" instructional setting and instruction did present some lingering disconnect and challenges to the study, such as class participation in the LPAE course.

5.5 Conclusions

In this section, the study's conclusions will be presented. There were five findings associated with this study that addressed participants' background knowledge prior to the study, the development of participants' Professional Knowledge Bases (PKB) of Pedagogical Content Knowledge (PCK), comfort levels teaching animal science and animal dissections, participants' cPCK, and lastly participants' perceptions using Content Representations CoRes. The following sections present the five main findings of the study as they relate to their respective research questions.

5.5.1 Research Question 1

Research question one focused on the participants' previous experience in this course prior to any instruction. Apart from a couple of participants, most participants had taken an animal

science course at the college or high school level prior to the course. Introduction to Animal Agriculture was taken by most participants and was described as being the most helpful in participants' preparation. A majority of participants took this course because it is a required course on the plan of study in this teacher preparation program. Overall, a teacher's background and experience influences PCK (Shulman, 1986) and a wide variety of backgrounds are represented among preservice agricultural education participants. It is also known that despite participants' previous experiences or backgrounds, CoRes facilitate the introductory growth of PCK (Hume & Berry, 2011). Based on how participants completed the CoRes, pedagogical decisions changed between the Pre-CoRe and the Post-CoRe on how to teach animal dissection. Before, only a handful of participants described wanting to teach with animal tracts, whereas after the dissection experience with animal tracts, almost every participant described teaching with animal tracts. Calderhead and Robson (1991) found that preservice teachers' ideas about teaching were strongly influenced by their experiences as students. Teacher educators could gain a deeper understanding of why certain decisions are made regarding preservice agricultural education teachers by understanding their students' backgrounds and experiences.

5.5.2 Research Question 2

Overview

In this section, the findings of research question two will be presented. Five findings were associated with this study; Big Ideas Identified on the Pre- and Post-CoRe, concepts of PKBs that emerged from the Pre- and Post-CoRes, and an overall observation of the Pre- and Post-CoRes.

Big Ideas

When completing the Big Ideas for the Pre-CoRes, participants often conceptualized two or more Big Ideas when it was only one Big Idea. Participants appeared to struggle with completing the Pre-CoRe; some filled out the CoRe incorrectly by putting their Big Ideas into CoRe Question 1 rather than answering CoRe Question 1. Based on the Big Ideas and completion of the Pre-CoRe, there were two ways that participants had difficulty: (1) Using the tool itself and following the formatting of the tool, and (2) Generating in-depth Big Ideas. This evidence could mean that preservice agricultural education teachers may already find difficulty using a CoRe due to the

abstract nature of the thinking required to complete it. However, they also have difficulty completing the actual chart, even after doing an example CoRe at the beginning of the course. This is likely due to lack of content knowledge of the participants at the beginning of the course. This evidence is supported by Wooditch et al. (2018) because in their study, the lack of content knowledge of their participants echoed a lack of PCK development.

On the Post-CoRes, no mistakes were made in completing the CoRes, and a majority of participants had more than one Big Idea, whereas, on the Pre-CoRes, most participants had one Big Idea. This could be result from the animal science dissection lab experience in the course, which helped participants populate more ideas and recognize more elevated Big Ideas. This evidence supports Hume et al. (2010), which suggested that having a well-structured learning experience prior to designing the CoRe gives preservice teachers a chance to draw on and analyze the knowledge and skills they have developed throughout their education.

Content Knowledge

Evidence for Content Knowledge concepts emerged through most participant responses to CoRe Questions 1, 2, 3, and 4 in both the Pre-CoRes and Post-CoRes. Between the two CoRes, participants went from listing everything they knew in one word on the Pre-CoRes, to describing concepts they knew and wanted to teach for their Big Ideas, illustrating greater evidence of higher-order thinking, on the Post-CoRe. An example of this growth was seen on CoRe Question 3, where participants described on the Pre-CoRes that they wanted to teach a "process" but did not specify what process. Then on the Post-CoRe described that they wanted to teach the process of dissection (i.e., how to dissect) and the process of digestion. The same phenomenon happened on CoRe Question 1, where participants described on the Pre-CoRe they wanted to teach "Identification of Parts" but not what specific parts or system they wanted participants to identify. However, on the Post-CoRe, they stated what type of body system or animal tract they wanted to identify.

Participants showed an increase in their overall Content Knowledge of animal science dissection on the Content Knowledge Assessment. Participants showed growth in the reproduction part of the content assessment, whereas the digestion part showed a slight decrease. This was an interesting result because the LPAE animal dissection lab experience had multiple types of animal digestive tracts and did not watch animal digestive anatomy videos prior. Whereas for the reproduction portion participants did watched videos prior, which incidentally supports Akpan and

Andre (2000). This could be also be due to three fewer participants taking the post-assessment. However, the laboratory dissection experience in the LPAE course focused on poultry digestion for the student-led dissection, but none of the Content Knowledge Assessment questions were about avian digestive anatomy.

Pedagogical Knowledge

Pedagogical Knowledge concepts were described in CoRe Questions 4, 5, and 6 of the Pre-Core and Post-CoRe. Overall, this Pedagogical Knowledge Base (PKB) developed because participants recognized difficulties/limitations, preparation considerations, and teaching procedures. For example, on CoRe Question 4, participants initially recognized that availability or acquisition of materials could be difficult, but participants did not identify what would be difficult. Then on the Post-CoRes, participants described that locating animal tracts and tract qualities (i.e., is the tract complete) would hinder dissection labs. Another example of this is on CoRe Question 6 where participants considered storage after the laboratory experience as a factor of influence, whereas before the experience, they did not. Lastly, for teaching procedures, participants mentioned that they wanted to do "hands-on labs" but did not indicate what they were going to do that was hands-on when answering the Pre-CoRe. On the Post-CoRe, participants then indicated that they wanted their future students to do dissections to teach their Big Idea.

Curricular Knowledge, Knowledge of Students, and Assessment Knowledge

Lastly, PKB concepts for Curricular Knowledge, Knowledge of Students, and Assessment Knowledge were described the least by participants. Given the nature of CoRe Question 8 (Specific Ways of Ascertaining Students' Understanding or Confusion Around this Idea), it makes sense that Assessment Knowledge was the only PKB described and the only time it was described mainly by the majority of participants. CoRe Question 5 was a question on the CoRe that could allow participants to describe concepts of Knowledge of Students, given the nature of the question (Knowledge about Student's Thinking Which Influences Your Teaching of this Idea). Moreover, most participants did describe this PKB. However, there was no change in participants' answers prior to and after the dissection experience. Curricular Knowledge was the PKB that was mentioned the least by participants. This could be because most participants have not yet had a

curricular methods course, which, in the plan of study for these participants, is usually taken after taking the LPAE course.

Overall Research Question 2 Conclusion

Overall, participants began to understand the formatting and the questions that the CoRe was asking, which resulted in concepts of PKBs being described appropriately according to questions on the CoRe. An example of this is CoRe Question 5 asks (Knowledge about Students' Thinking Which Influences Your Teaching of this Idea). On the Pre-CoRe, concepts of Pedagogical Knowledge and Knowledge of Students are described, whereas, on the Post-CoRe, only Knowledge of Students is described. Given the nature of the question, Pedagogical Knowledge concepts do not necessarily make sense to answer the question. More guidance and exposure to CoRes influenced participants preparation for instruction which supports Hume (2010) findings. Overall, it is possible that participants began to become familiar with the complexity of teaching while utilizing the CoRe. By understanding the complexity of teaching dissection, they began to understand their own learning and progression (i.e., metacognition) (Bowling et al., 2022). The conceptual model in this study (Figure 2.2) reflects how Personal Pedagogical Content Knowledge (pPCK) is influenced by this phenomenon.

5.5.3 Research Question 3

Research question three asked participants to rate their comfort level in designing, facilitating, and assessing student knowledge. Overall, there was an increase in participants' comfort in designing, facilitating, and assessing student knowledge, and after the LPAE dissection experience, most participants were still most comfortable with all three concepts. At the beginning of the course, participants rated their effectiveness as a future teacher of animal science and their level of comfort in currently teaching animal science. Most participants were in the middle of mainly feeling comfortable/very comfortable. After the experience, few to no participants rated themselves as somewhat comfortable/not at all comfortable, and most participants were still mostly comfortable/very comfortable. When given a choice to select if they would choose to teach animal science, all participants said yes or maybe at the beginning of the course. However, after the course, most participants still said yes/maybe. Five participants said they would not choose to teach animal

science. This could have occurred for multiple reasons, the first being that they possibly did not realize until after the dissection experience what they did not know in order to teach. It is also possible that participants realized that they did not like the environment (i.e., managing/handling animal tracts, students with sharp objects, etc.). Another reason could be is that the participants simply do not like animal science, and they do not find the content interesting, even if they feel comfortable designing, facilitating, and assessing student knowledge.

The conceptual model (Figure 2.2) used in this study showed that pPCK influences a teacher's comfort with designing, facilitating, and assessing student knowledge. As Bandura's theory (1977) indicated, greater knowledge of PCK should result in a more self-efficacious attitude within the classroom. After the dissection experience in the course, participants became more comfortable with designing, facilitating, and assessing student knowledge in animal science dissection labs, alluding to the experience increasing participants' PCK.

5.5.4 Research Question 4

Research question four examined how participants described collective pedagogical knowledge at the end of the LPAE course. Observations from the Group CoRe showed that the LPAE dissection experience pushed the depth of thinking and implication. An example of this is when we look at the Big Ideas and CoRe Question 1 (what I intend students to learn about the idea), where the Big Ideas cover more concepts and content of dissection, and the content knowledge described more like learning outcomes. Like in research question two, collectively participants displayed some examples of higher-level metacognition than when completing a CoRe individually (Bowling et al., 2022). However, repeating answers for the CoRe questions across the Big Ideas were not examples of higher-level metacognition (Bowling et al., 2022).

5.5.5 Research Question 5

This research question sought to see how participants described their experience completing the CoRe individually versus collectively. When participants were first introduced to the CoRe, they described that it was challenging to complete the CoRe, even after going through an example CoRe at the beginning of the course. This evidence could mean that preservice agricultural education teachers may already find difficulty using a CoRe to begin with due to the

abstract nature of the thinking required to complete it. Participants found doing the CoRe a second time individually was easier, meaning that doing CoRe more than once aids in the understanding of what the CoRe is and how it is a beneficial planning tool. Lastly, most participants described completing the CoRe collectively as their preferred method instead of completing it individually. However, one aspect of completing the CoRe individually that participants preferred over collective aspects was assessing participants. Participants mentioned that they gained new ideas from completing the CoRe collectively as well as collaboration skills to use in the future as a teacher. Since PCK is both individual and collective (Carlson et al., 2019), CoRes can help guide both of these concepts of PCK development.

5.6 Implications for Research

To the researcher's knowledge, the conceptual model that guided this study has not been implemented in published SBAE research, as it is a relatively new model for PCK research. It is recommended to use the Refined Consensus Model of PCK (Carlson et al., 2019) in future research of PCK and future research PCK in agricultural education. This model could be used to study the PCK of both inservice and preservice agricultural education teachers, however PCK has been studied more on inservice agricultural education teachers (Rice & Kitchel, 2016, 2017a, 2017b, 2018). There are many recommendations of studying PCK in agricultural education, however based on this study, each realm of PCK (cPCK, pPCK, and ePCK) could be areas of research in ether professional development or teacher preparation programs.

PKBs have been studied to an extent in agricultural education, but not all collectively as shown in the Refined Consensus Model of PCK (Carlson et al., 2019). Also, Curricular Knowledge was a PKB that was not described as much as the other PKBs (i.e., Content Knowledge, Pedagogical Knowledge, Knowledge of Students, and Assessment Knowledge). Therefore, it is recommended PKB research within PCK be performed in a curricular development class to study how that PKB is described by students who have had experiences with curriculum knowledge. It is also recommended to study PKB of inservice teachers to see if there is a need for professional development within PKB.

To the researcher's knowledge, this is the first time CoRes have been used to study PCK in all agricultural education research, so it is recommended that future PCK research with CoRes be performed on both preservice and inservice teachers. The scope of this study was limited to one

topic within one course in a teacher preparation program. Because only one agricultural topic of the LPAE course was covered, the results may not apply to other agricultural topics, which is also stated by Wooditch et al. (2018) in their studied who studied plant fertilizers. In their study, PCK in plant fertilizers was found to not developed in-depth due to the lack of content knowledge (Wooditch et al., 2018). However, in this study, PCK of animal dissection was found to have further developed.

5.7 Implications for Practice

Shneider and Plasman (2011) expressed a need for more opportunities for teachers to think about, experience, and reflect on preservice teachers' PCK. For preservice teachers to successfully develop their Pedagogical Content Knowledge, they should be encouraged to understand how the process is carried out (Kind, 2009). To facilitate PCK development, it is strongly encouraged that educators across teacher education programs use the CoRe rubrics to facilitate the development of preservice teachers' PCK across the entire program. "Teacher preparation programs need to consider issues of connected knowledge at the level of individual course design and at the level of the design of entire programs of study (including integration between college courses and classroom-based experiences)" (Bransford et al., 2005, p. 86).

If CoRes are utilized to achieve PCK development across a teacher education program, it is recommended that preservice teachers be exposed to a CoRe more than once in order to gain a deeper understanding of the CoRe (Hume, 2010; Loghren et al., 2008). CoRes facilitate and helps teachers understand what it means to teach a topic (Loghren et al., 2008) and "…teachers need to do more than simply implement particular techniques; they need to be able to think pedagogically, reason through dilemmas, investigate problems, and analyze student learning to develop appropriate curriculum for a diverse group of learners" (Darling-Hammond et al., 2005, p. 392).

In addition to exposing students to more CoRes, it is recommended to complete CoRes collectively or alongside an inservice teacher first before completing them individually since group collaboration elevated preservice teachers' confidence in using CoRes. Another recommendation is for preservice teachers to complete CoRes and implement the CoRes that they design that way students can learn to structure a lab they are not only interested in, but that they can teach in the future, which is also recommended by Rice and Kitchel (2018).

Another recommendation for CoRes is to use them as professional development for inservice agricultural education teachers. This could be implemented through the use of Group CoRes to not only develop an inservice teachers' cPCK, but also their pPCK since there is a knowledge exchange between those two realms of PCK (Carlson et al., 2019). Initially the professional development could start with a topic that most inservice agricultural teachers are familiar with to allow for understanding and practice with a CoRe. Then the professional development could progress to utilizing CoRes to assist inservice teachers with topics they are not as familiar with.

Lastly, a recommendation to further develop PCK in animal science is to collaborate with the Introduction to Animal Agriculture course to see if a change in the course can be made to learn the content and learn how to teach the content. This recommendation is based off Rice and Kitchel's (2015a) recommendation to incorporate more content knowledge in pedagogy courses or work with professors that teach the content knowledge courses. This will allow preservice teachers to be more comfortable teaching the content. This could be implemented through alternate assignments in the course design for agricultural educators in the course.

5.8 Overall Takeaway

The goal of laboratory instruction in agricultural programs is to allow students to apply science concepts through hands-on, interactive experiences (Warner et al., 2006). In order to achieve this goal, better laboratory experiences must be offered to preservice agricultural education teachers to experience themselves (Warner et al., 2006). Providing better laboratory experiences allows for better learning experiences for preservice agricultural education teachers' future students. Mimicking industry setting in laboratories improves student experiences (Prosser and Allen, 1925), however, not all SBAE laboratory facilities are alike (LaRose et al., 2021) and teachers have to adapt. Adapting how to teach based off the learning context is PCK (Carlson et al., 2019; Chan & Hume, 2019). PCK develops over a career (Chan & Hume, 2019), and offering opportunities for PCK development in preservice agricultural education teachers allows for the start for their PCK to continuously blossom (Rice & Kitchel, 2017b, 2018; Schneider & Plasman, 2011).

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APPENDIX A. INSTITUTIONAL REVIEW BOARD (IRB)

Date: 4-25-2022

IRB #: IRB-2021-825
Title: Secondary Preservice Agriculture Teachers' Professional Knowledge Bases & Collective PCK: A Case Study
Creation Date: 5-19-2021
End Date:
Status: Approved
Principal Investigator: Sarah LaRose
Review Board: Exempt Reviewer and Admin Office Actions FY2022
Sponsor:

Study History

Submission Type Initial	Review Type Exempt	Decision Exempt
Submission Type Modification	Review Type Exempt	Decision Exempt

Key Study Contacts

Member Sarah LaRose	Role Principal Investigator	Contact slarose@purdue.edu
Member Miranda McGuire	Role Primary Contact	Contact mcguir18@purdue.edu

Appendix A Continued

Initial Submission

Study Personnel

*required

Study Personnel

In this section you will name all staff who will participate in the study.

*required

A Principal Investigator (PI) is responsible for all aspects of a research study.
STUDENTS ARE NOT AUTHORIZED TO BE PRINCIPAL INVESTIGATORS

Provide the name of the Principal Investigator of this study.
All faculty (tenured, tenure-track, research and clinical) are eligible to be Principal Investigators. Others requesting to submit proposals as the Principal Investigator for the first time must obtain special approval.

Once the name is selected, training courses from the CITI system should appear when you click "View". If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Name: Sarah LaRose
Organization: PWL Ag Sciences Edu & Comm
Address:
Phone:
Email: slarose@purdue.edu

If you cannot find the name of the Purdue University personnel that you are looking for using the "Find People" button above, please list them here. We will need to verify their information and load into the system.

✓ Faculty (tenured, tenure-track, research and clinical)

Student

Purdue non-faculty staff member granted special PI status.

Appendix A Continued

*required

Primary Contact

Provide the name of the Primary Contact of this study. The Primary Contact will be copied on all correspondence regarding the IRB review. Note that the Primary Contact and the Principal Investigator may be the same. The Primary Contact must be a current Purdue University faculty, staff, postdoc, or student and must have a role as Key Personnel on the study.

Once the name is selected, training courses from the CITI system should appear. If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Name: Miranda McGuire
Organization: PWL Ag Sciences Edu & Comm
Address:
Phone:
Email: mcguir18@purdue.edu

If you cannot find the name of the Purdue University personnel that you are looking for using the "Find People" button above, please list them here. We will need to verify their information and load into the system.

(First Name: Last Name: Purdue e-mail address)

If you wish to provide a campus phone number for the Primary Contact, you may list it here.

This field is optional. Most correspondences from the IRB will arrive via the Cayuse system.

Appendix A Continued

*required

Key Personnel

Below is a definition of Key Personnel. Please read the definition and decide who will need to be listed as Key Personnel on the study. The PI defines the roles of each staff member based on the definition below.

Key personnel: The Principal Investigator and any project staff, students, postdoctoral staff, internal or external to Purdue University who contribute in a substantive way to the scientific development or execution of a project (including, but not limited to, consent, data collection or analysis).

*required

Does your study have additional Key Personnel besides the PI and Point of Contact?

Once the name is selected, training courses from the CITI system should appear. If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Yes

✓ No, the only personnel on the project are the PI and Point of Contact.

*required

Provide a brief description of each person's position at Purdue (e.g. student, staff, faculty) and their role in the study.

Examples:
Prof. Principal (faculty) will oversee all aspects of the study design and conduct
John Researcher (graduate student) will recruit and consent participants and collect data
Purdue Pete (staff) will analyze collected study data.

Dr. Sarah LaRose (faculty) will oversee all aspects of the study design and conducting the study, oversee graduate students to assist in data collection, and be the primary instructor for the course.
Miranda McGuire (graduate student) will recruit participants, and collect and analyze data.

Appendix A Continued

Research Sites

*required

Where will the study take place?

✓ Purdue University

*required

Please check the following locations.

✓ West Lafayette

Regional Campus (PFW, PNW, IUPUI)

Polytechnic Institute Statewide Sites

Extension Sites

*required

Please provide a brief description of the Purdue University location(s).

Provide building names, course titles, event names as applicable.

LILY, CRTN, ASREC, other general parts of campus

External Site (non Purdue University)

Appendix A Continued

Getting started with your submission

*required

Welcome to the submission system for the Purdue HRPP/IRB. Before you begin, you should be familiar with the framework of human research protections and how they relate to your proposed study. The materials to help you appear on our website.

Be certain that all personnel have completed online training prior to submitting the protocol.

Helpful Tip: Use the Create PDF button at the top of the page if you need to share a PDF version of this protocol for discussion with a reviewer outside of the Cayuse system.

The choices you make on the first two sections will help populate the required sections for your submission. Please look through the options and make the choice closest to your research. You can always seek assistance by scheduling an appointment with the HRPP Office or reviewing the materials at www.irb.purdue.edu.

Exempt study

Please look at the list of studies below. Determine if your proposed study design might fit into one of these descriptions.

Exempt research still requires review by the Human Research Protection Program. Choose this option if you believe your study is:

- ✓ Research in a common educational setting (e.g. school, daycare) about normal educational practices.
- Educational Test, Survey, Interview, or Observation of Public Behavior
- A benign intervention involving short puzzles, games and their outcomes on human behavior conducted during a single day.
- Secondary Analysis of data, documents, records, pathological or diagnostic specimens that are publicly available or properly deidentified.
- Taste and Food Quality Evaluation or Consumer Acceptance Studies.

*required

Please choose a category. The proper sections will populate based on your selection.

Category 1 Research conducted in established educational settings with normal education practices like:

✓ 1. *Research on regular and special education instructional strategies*
2. *Research on the effectiveness of, or the comparison, among instructional techniques, curricula, or classroom management methods*

Category 2 Research that ONLY includes interactions through:

- *Surveys with adults*
- *Interviews with adults*
- *Focus Groups with adults*
- *Educational Tests (cognitive, diagnostic, aptitude, achievement)*
- *Observation of public behavior*

Category 3 Benign Behavioral Interventions.

Interventions that are brief in duration, harmless, painless, not physically invasive, not likely to have a significant adverse lasting impact on the subjects, and the investigator has no reason to think the subjects will find the interventions offensive or embarrassing.

Examples of Benign Behavior Interventions can include having participants:

- play an online game,
- solve puzzles under various noise conditions
- decide how to allocate a nominal amount of received cash between themselves and someone else

Category 4 Secondary analysis of samples or data.

NOTE: Before you will be able to submit this protocol, you will need to know the terms and conditions associated with receiving the existing data or specimens. You might also need to know the original intended use from the study's consent form. Contact the provider of the data or specimens to obtain this information before proceeding. You may also contact the Purdue IRB (irb@purdue.edu) for guidance.

Category 6 Food and Taste Acceptance

The research is only a taste and food acceptance quality evaluation or food consumer acceptance study

Appendix A Continued

Non-exempt study

Research that does not fit into an exempt category typically involves the collection of new data from a participant.

Just-in-time

I have been contacted by a sponsor (often NSF or NIFA/USDA) to provide documentation of IRB approval, (such as Just-in-Time or JIT) but my application to the IRB is dependent on other factors such as:

- *completion of instruments*
- *prior animal studies*
- *purification of compounds*

Note: This category should be utilized ONLY if the above criteria apply. If study procedures are discernible at the time of the sponsor request, please do not select this option. The research team should affirm that their sponsor will accept documentation for a development protocol.

If you request this study type, the title of the IRB protocol must exactly match the title of the grant proposal. Most funding agencies will not accept protocols with different titles.

Quality Improvement

My research involves activities without a plan to conduct research (Case Report or Quality Improvement project)

I need to know if my project is considered "Human Subjects Research"

I would like to request that another IRB Review this study. (Request for Purdue IRB to defer to another site).

When Purdue University will be engaged in human subject research with one or more institutions, investigators may submit a Request for Deferral asking that the review be deferred to one institution's Institutional Review Board (IRB).

Appendix A Continued

Category One Exemption Research in a common educational setting about normal educational

*required

Is the research conducted in an established or commonly accepted educational setting?

In addition to schools and colleges, an educational setting could be any place where educational activities regularly take place, including an after-school program, work place, library, or a museum.

✓ Yes

No

*required

Identify the educational setting(s).

Please be specific, name all sites, school corporations, and list their locations.

Purdue University in the Lilly Hall of Life Sciences building.

*required

Does the research involve normal educational practices ONLY?

Examples of normal educational practices include:

- *Research on regular and special educational instruction strategies*
- *Research on the effectiveness of or the comparison among accepted instructional techniques, curricula, or classroom management methods*
- *May include the use of technology, such as an online course or use of computer software*

The research must focus ONLY on educational practices.
Researchers intending to collect information about (Such as personal characteristics, beyond basic demographics, of students, families or teachers, mental health, personal beliefs or

opinions beyond those associated with the curriculum or learning, should select "NO" in the box below.

✓ Yes, my research is intended to study only regular and special educational instruction strategies and/or the effectiveness of or the comparison among accepted instructional techniques, curricula, or classroom management methods.

No, my research study is intended to study more than the educational practices.
(Such as personal characteristics, beyond basic demographics, of students, families or teachers, mental health, personal beliefs or opinions beyond those associated with the curriculum or learning.)

*required

Is the research likely to adversely affect students' opportunity to learn required educational content?

The research should not take time or attention away from normal instruction in a way that might negatively impact student achievement (e.g. negative impact on student standardized test scores or time away from required curriculum)

Researchers are reminded that while the submission of an informed consent/assent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate

Yes

✓ No

*required

Is the research likely to adversely affect the assessment of educators who provide instruction?

Research designed to evaluate the practice of individual teachers or that takes time away from normal instruction (as described above) could adversely impact the assessment of educators.

Researchers are reminded that while the submission of an informed consent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate

Yes

✓ No

*required

Does the research require access to student education or health records?

Education records include any records held by the educational institution that contain personally identifiable information about students, including records related to an individual student's performance, such as written or electronic records typically found in transcripts (grades/courses/GPA/test scores), student work products such as tests, homework assignments and interactions with online student learning systems. Education records of students in most K-12 and colleges/universities are subject to regulations under the Family Educational Rights and Privacy Act (FERPA).

Protected Health Information (PHI) is covered under the HIPAA Privacy Rule which provides federal protections for personal health information held by covered entities and gives patients an array of rights with respect to that information.

Check all boxes that apply.

Yes, Student education records covered under FERPA.

Yes, Protected Health Information (PHI).

✓ No, Neither student educational records nor Protected Health Information are involved.

*required

How will schools, teachers and/or students be identified for recruitment?

Students who are taking the course will be recruited by the instructors to have the option to be a part of the research.

*required

Will subjects (either teachers or students) receive payment, extra credit, or other incentives for their participation in the study?

✓ Yes

No

*required

Describe the payment or incentive.

- *Estimate the maximum total payment. Please indicate what information you will be collecting from subjects who will be paid for their participation.*
- *If extra credit is a consideration, note that extra credit must not exceed 3% of the overall grade. Provide a description of the alternate, equivalent option to the extra credit.*

Post-Individual CoRe will be worth 5 points and the Individual Reflections Questions will also be worth 5 points. The course grade will be calculated out of 1,130 points, valuing the total extra credit points (10) at less than 1% of the overall course grade.

Students who choose to opt out of completing the CoRe and Individual Reflection Questions will be provided an opportunity to earn equivalent extra credit points (10 points) by completing a written 1 page reflection on any class learning activity of their choice. This alternate option to earn extra credit is equivalent in length and rigor to the CoRe and Individual Reflection Questions.

*required

Include a description, if relevant for your project, to describe how the research contributes to the required curriculum.

Include in this description whether or not the activity would occur in the educational setting regardless of the research taking place.

The surveys, CoRes, and reflection questions will be given as a regular component of learning activities in the class regardless of the research being conducted.

This is the first year that this course is being taught, as a newly required course in the Agricultural Education major's curriculum. Understanding how planned learning activities impact development of preservice teacher knowledge and skills is essential for both the instructor developing the course, and for the students who are developing those skills. The research conducted through this course will assess already planned learning activities.

*required

Please describe the reasons that you believe adverse effects on the students and educators are minimized.

If students do not participate in the learning activities that we are researching, their grades will not be adversely affected.

Since the learning activities assessed in this research do not actively contribute to the planned graded assignments in the course, student engagement in these activities do not negatively impact their overall course performance. Offering alternative extra credit assignments provides students equal opportunities to gain extra credit, regardless of participation in the research activities.

*required

Do you have permission by the educational site to conduct research (e.g. access data from the student record or be onsite) at the location?

Note that researchers should first contact the FERPA Office (for education records) or HIPAA Privacy Officer at the study site to find out the procedures that the study site requires to obtain restricted information. The IRB may need to see the permission letter or data use

agreement signed by the site to affirm that access is properly granted. Even if the investigator is using data from his/her own class, permission must be obtained from the Office of the Registrar (for Purdue University data) or appropriate FERPA official for the study site before using data for research purposes.

Yes, we have obtained permission from all sites.

External collaborators (such as site principals or directors) may utilize the IRB-provided template. See the "?" button in the right hand corner of this section for the template link. The HRPP expects all of these elements to be addressed in a permission letter, so using the template is recommended.

✓ No, we have not yet secured the permission of all sites and/or the site prefers evidence of an IRB approval before granting permission.

*required

Please confirm that you will seek permission to conduct research at all study sites.

External collaborators (such as site principals or directors) may utilize the IRB-provided template. See the "?" button in the right hand corner of this section for the template link. The HRPP expects all of these elements to be addressed in a permission letter, so using the template is recommended.

✓ I certify that I will obtain permission required by the site. The researchers will not begin a study until permission by a senior official has been obtained.

*required

Do you have a copy of the syllabus or activity schedule for the educational activity?

Activities considered exempt under Category 1 should be curricular in nature.

✓ Yes

*required

Please attach the syllabus or activity schedule.

Appendix A Continued

ASEC 340 Syllabus 2021_FINAL (Repaired).docx

No, but I affirm that the activity being studied is a part of the normal curriculum or schedule and I will upload a copy of the syllabus or activity schedule when it is available.

No

*required

Do the researchers hold any authority over the targeted population?
Examples:
Teacher/student
Supervisor/Employee
Club Leader/Club Member

Please keep in mind the researcher that conducts recruitment, collects, and analyzes identifiable data cannot have authority over the potential participant due to the potential for undue influence.
If necessary, a third party (listed as key personnel) who does not have authority over the targeted population must conduct recruitment and strip all identifiers prior to researchers/authority figures have access to the data.

✓ Yes

*required

Please detail how the study will prevent against undue influence or coercion to participate.

If necessary, a third party (listed as key personnel) who does not have authority over the targeted population must conduct recruitment and strip all identifiers prior to researchers/authority figures have access to the data.
At the beginning of the course, students will be invited to participate, but it will be strongly emphasized that participation in the study does not affect their grade. Alternate equivalent opportunities for extra credit will be offered at the same time as the invitation to participate.

No

Appendix A Continued

Exempt - Your research appears to be eligible for exemption under Category 1. You will be guided to answer just a few more items before submitting your protocol.

Researchers are reminded that while the submission of an informed consent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate.

This exemption determination is subject to review by the HRPP Office. Please do not begin your research until you receive the final determination letter. All personnel listed in the application must complete training prior to conducting research.

Please click continue to move on to the next required sections.

Funding Source(s)

*required

CURRENT Funding Source(s)

To review your protocol appropriately with differing sponsor standards, the HRPP must have the accurate funding source. It is a PI's responsibility to update funding sources as a modification to the protocol and associated forms (such as the consent form) when funding changes.

Please list any sources of funding that are **confirmed** by contract, agreement, or other support of a sponsor.
You will list any pending sources in the next question.

If the research is funded by a subcontract, please add both the subcontract source and the prime sponsor.

Externally sponsored (federal, state, corporate, foundations, industry, donor)

✓ Internal Purdue University Funds (Includes departmental funds, start-up funds.) *(Note, this does not include Purdue Research Foundation or Purdue Research Park companies-please list as external sponsor above).*

None - There are no confirmed funding sources at this time.

Appendix A Continued

ANTICIPATED Funding Source(s) - Required

To review your protocol appropriately with differing sponsor standards, the HRPP must have the accurate funding source. It is a PI responsibility to update funding sources as a modification to the protocol and associated forms when funding changes.

If you are a student or staff member filling this out on behalf of a Principal Investigator (PI), please be certain to affirm with the PI that this information is accurate.

Please list any sources of funding where sponsorship is **anticipated** or pending a final decision.

Externally sponsored (federal, state, corporate, foundations, industry, donor)

✓ There are no pending funding sources at this time.

If the protocol does not have a sponsor, please detail how the study will be conducted without funding.

Study will be conducted using the PI's start-up funds.

Appendix A Continued

Conflict of Interest and/or Outside Activities Disclosure

Conflicts of Interest or outside activities must be disclosed and managed prior to IRB approval. For more information about these policies, please consult the resources listed in the question marks in each section.

The IRB may request confirmation of proper disclosures.

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*required

Does this IRB protocol involve any work, advice, or service for an entity other than Purdue University?

For example, if this activity is done as an outside consulting activity, or employee's start-up company, this activity will not qualify for review by the Purdue IRB and an outside IRB or service must be sought.

✓ I attest that I understand the outside activities policy and Individual Financial Conflict of Interest policies and that all members of the research team are conducting this project on behalf of Purdue University.

*required

Do you or any investigator(s) participating in this study have a significant financial interest (SFI) related to this research project?

Receiving more than $5,000 in compensation from, or having ownership interests in, outside entities, constitute Significant Financial Interests that need to be disclosed. Definitions of SFI, Investigator and Institutional Responsibilities, can be found at https://www.purdue.edu/policies/ethics/iiib2.html#definitions.

Yes

✓ No

Appendix A Continued

*required

Do you or any person affiliated with the protocol have or know of any arrangement or understanding, tentative or final, relating to any future financial interest, financial relationship, future grant, position, or advisory role either related to the protocol, or dependent on the outcome of the research under the protocol?

Yes

✓ No

*required

Is there anything not disclosed above which you believe might constitute a conflict of interest or an appearance of a conflict of interest in connection with the protocol?

Yes

✓ No

Appendix A Continued

Other attachments

*required

Do you have any other supporting documents to attach?

You may attach COVID-19 Research Space Standard Operating Procedures here if this is a new protocol submitted during the COVID-19 pandemic.

Investigators are invited to submit reference lists, study instruments, supporting information, training data, device pictures, or other relevant items for their study that were not addressed in the application.

✓ Yes

Attach any other documents. Please use a file name that describes the document.

You may attach multiple files to this entry.

PLEASE DO NOT UPLOAD PARTICIPANT DATA OR IDENTIFIABLE RESEARCH DATA.

Blank CoRe.jpg

Completed CoRe.PNG

Individual Reflection Questions.docx

Final Post-Assessment.pdf

Final Pre-Assessment.pdf

No

Appendix A Continued

Modification Submission

Modification/Amendment to a Protocol

Changes to a study must be approved by the HRPP/IRB.

Examples include (but are not limited to) changes in:

- Recruitment methods
- Screening materials
- Intended study population
- Inclusion/Exclusion criteria

For a list of minor changes that do not require IRB review, please see Purdue HRPP Standard Operating Procedure 305. (Link appears in the "?" button above.) Also, see www.irb.purdue.edu for additional changes not requiring modification during the COVID-19 pandemic.

*required

What type of change(s) would you like to make?

IMPORTANT:

All revisions to the protocol must be made to the relevant sections of your study in the sidebar. Please note, that more than one section may require change. For non-exempt protocols, please review your current consent form and edit language as needed.

Remember to review any advertisements, scripts, information sheets and consent forms. Attach them to the relevant sections of your protocol. Please title any attachments with dates or version control numbering in the file name to assist with review.

Personnel

Study Procedures

Appendix A Continued

Change to the recruitment and/or data collection status.
(For example, click here if you are finished with data collection and would like to notify the IRB that the study will only analyze the collected data.)

✓ Something else (e.g. participant compensation amounts)

(For resuming on-campus in-person research)- COVID-19 Research Space Standard Operating Procedure approval.

(For resuming off-campus in-person research)- COVID-19 off-campus research certification of practices outlined in the EVPRP Guidance for Off-Campus Research Activities

*required

Study Change Justification

Please provide a brief summary of the requested modification(s). Please include a summary of any changes to the risk/benefit ratio that may result from the modification.
Update to Individual Reflection questions. They are located in the "Final Individual Reflection Questions" doc under "other attachments".

Study Personnel

*required

Study Personnel

In this section you will name all staff who will participate in the study.

*required

A Principal Investigator (PI) is responsible for all aspects of a research study.
STUDENTS ARE NOT AUTHORIZED TO BE PRINCIPAL INVESTIGATORS

Provide the name of the Principal Investigator of this study.
All faculty (tenured, tenure-track, research and clinical) are eligible to be Principal Investigators. Others requesting to submit proposals as the Principal Investigator for the first time must obtain special approval.

Once the name is selected, training courses from the CITI system should appear when you click "View". If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Name: Sarah LaRose
Organization: PWL Ag Sciences Edu & Comm
Address:
Phone:
Email: slarose@purdue.edu

If you cannot find the name of the Purdue University personnel that you are looking for using the "Find People" button above, please list them here. We will need to verify their information and load into the system.

(First Name: Last Name: Purdue e-mail address)

*required

Please check your Purdue University PI classification.

✓ Faculty (tenured, tenure-track, research and clinical)

Student

Purdue non-faculty staff member granted special PI status.

Appendix A Continued

*required

Primary Contact

Provide the name of the Primary Contact of this study. The Primary Contact will be copied on all correspondence regarding the IRB review. Note that the Primary Contact and the Principal Investigator may be the same. The Primary Contact must be a current Purdue University faculty, staff, postdoc, or student and must have a role as Key Personnel on the study.

Once the name is selected, training courses from the CITI system should appear. If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Name: Miranda McGuire
Organization: PWL Ag Sciences Edu & Comm
Address:
Phone:
Email: mcguir18@purdue.edu

If you cannot find the name of the Purdue University personnel that you are looking for using the "Find People" button above, please list them here. We will need to verify their information and load into the system.

(First Name: Last Name: Purdue e-mail address)

If you wish to provide a campus phone number for the Primary Contact, you may list it here.

This field is optional. Most correspondences from the IRB will arrive via the Cayuse system.

*required

Key Personnel

Appendix A Continued

Below is a definition of Key Personnel. Please read the definition and decide who will need to be listed as Key Personnel on the study. The PI defines the roles of each staff member based on the definition below.

Key personnel: The Principal Investigator and any project staff, students, postdoctoral staff, internal or external to Purdue University who contribute in a substantive way to the scientific development or execution of a project (including, but not limited to, consent, data collection or analysis).

*required

Does your study have additional Key Personnel besides the PI and Point of Contact?

Once the name is selected, training courses from the CITI system should appear. If the courses are not appearing. Click the "?" on the top of this question to find out how to sync your accounts.

Yes

✓ No, the only personnel on the project are the PI and Point of Contact.

*required

Provide a brief description of each person's position at Purdue (e.g. student, staff, faculty) and their role in the study.

Examples:
Prof. Principal (faculty) will oversee all aspects of the study design and conduct
John Researcher (graduate student) will recruit and consent participants and collect data
Purdue Pete (staff) will analyze collected study data.

Dr. Sarah LaRose (faculty) will oversee all aspects of the study design and conducting the study, oversee graduate students to assist in data collection, and be the primary instructor for the course.
Miranda McGuire (graduate student) will recruit participants, and collect and analyze data.

Appendix A Continued

Research Sites

*required

Where will the study take place?

✓ Purdue University

*required

Please check the following locations.

✓ West Lafayette

Regional Campus (PFW, PNW, IUPUI)

Polytechnic Institute Statewide Sites

Extension Sites

*required

Please provide a brief description of the Purdue University location(s).

Provide building names, course titles, event names as applicable.
LILY, CRTN, ASREC, other general parts of campus

External Site (non Purdue University)

Appendix A Continued

Getting started with your submission

*required

Welcome to the submission system for the Purdue HRPP/IRB. Before you begin, you should be familiar with the framework of human research protections and how they relate to your proposed study. The materials to help you appear on our website.

Be certain that all personnel have completed online training prior to submitting the protocol.

Helpful Tip: Use the Create PDF button at the top of the page if you need to share a PDF version of this protocol for discussion with a reviewer outside of the Cayuse system.

The choices you make on the first two sections will help populate the required sections for your submission. Please look through the options and make the choice closest to your research. You can always seek assistance by scheduling an appointment with the HRPP Office or reviewing the materials at www.irb.purdue.edu.

Exempt study

Please look at the list of studies below. Determine if your proposed study design might fit into one of these descriptions.

Exempt research still requires review by the Human Research Protection Program. Choose this option if you believe your study is:

✓
- Research in a common educational setting (e.g. school, daycare) about normal educational practices.
- Educational Test, Survey, Interview, or Observation of Public Behavior
- A benign intervention involving short puzzles, games and their outcomes on human behavior conducted during a single day.
- Secondary Analysis of data, documents, records, pathological or diagnostic specimens that are publicly available or properly deidentified.
- Taste and Food Quality Evaluation or Consumer Acceptance Studies.

*required

Please choose a category. The proper sections will populate based on your selection.

Category 1 Research conducted in established educational settings with normal education practices like:

✓ 1. *Research on regular and special education instructional strategies*
2. *Research on the effectiveness of, or the comparison, among instructional techniques, curricula, or classroom management methods*

Category 2 Research that ONLY includes interactions through:

- *Surveys with adults*
- *Interviews with adults*
- *Focus Groups with adults*
- *Educational Tests (cognitive, diagnostic, aptitude, achievement)*
- *Observation of public behavior*

Category 3 Benign Behavioral Interventions.

Interventions that are brief in duration, harmless, painless, not physically invasive, not likely to have a significant adverse lasting impact on the subjects, and the investigator has no reason to think the subjects will find the interventions offensive or embarrassing.

Examples of Benign Behavior Interventions can include having participants:

- play an online game,
- solve puzzles under various noise conditions
- decide how to allocate a nominal amount of received cash between themselves and someone else

Category 4 Secondary analysis of samples or data.

NOTE: Before you will be able to submit this protocol, you will need to know the terms and conditions associated with receiving the existing data or specimens. You might also need to know the original intended use from the study's consent form. Contact the provider of the data or specimens to obtain this information before proceeding. You may also contact the Purdue IRB (irb@purdue.edu) for guidance.

Category 6 Food and Taste Acceptance

The research is only a taste and food acceptance quality evaluation or food consumer acceptance study

Appendix A Continued

Non-exempt study

Research that does not fit into an exempt category typically involves the collection of new data from a participant.

Just-in-time

I have been contacted by a sponsor (often NSF or NIFA/USDA) to provide documentation of IRB approval, (such as Just-in-Time or JIT) but my application to the IRB is dependent on other factors such as:

- *completion of instruments*
- *prior animal studies*
- *purification of compounds*

Note: This category should be utilized ONLY if the above criteria apply. If study procedures are discernible at the time of the sponsor request, please do not select this option. The research team should affirm that their sponsor will accept documentation for a development protocol.

If you request this study type, the title of the IRB protocol must exactly match the title of the grant proposal. Most funding agencies will not accept protocols with different titles.

Quality Improvement

My research involves activities without a plan to conduct research (Case Report or Quality Improvement project)

I need to know if my project is considered "Human Subjects Research"

I would like to request that another IRB Review this study. (Request for Purdue IRB to defer to another site).

When Purdue University will be engaged in human subject research with one or more institutions, investigators may submit a Request for Deferral asking that the review be deferred to one institution's Institutional Review Board (IRB).

Appendix A Continued

Category One Exemption Research in a common educational setting about normal educational

*required

Is the research conducted in an established or commonly accepted educational setting?

In addition to schools and colleges, an educational setting could be any place where educational activities regularly take place, including an after-school program, work place, library, or a museum.

✓ Yes

No

*required

Identify the educational setting(s).

Please be specific, name all sites, school corporations, and list their locations.

Purdue University in the Lilly Hall of Life Sciences building.

*required

Does the research involve normal educational practices ONLY?

Examples of normal educational practices include:

- *Research on regular and special educational instruction strategies*
- *Research on the effectiveness of or the comparison among accepted instructional techniques, curricula, or classroom management methods*
- *May include the use of technology, such as an online course or use of computer software*

The research must focus ONLY on educational practices.
Researchers intending to collect information about (Such as personal characteristics, beyond basic demographics, of students, families or teachers, mental health, personal beliefs or

opinions beyond those associated with the curriculum or learning, should select "NO" in the box below.

✓ Yes, my research is intended to study only regular and special educational instruction strategies and/or the effectiveness of or the comparison among accepted instructional techniques, curricula, or classroom management methods.

No, my research study is intended to study more than the educational practices.
(Such as personal characteristics, beyond basic demographics, of students, families or teachers, mental health, personal beliefs or opinions beyond those associated with the curriculum or learning.)

*required

Is the research likely to adversely affect students' opportunity to learn required educational content?

The research should not take time or attention away from normal instruction in a way that might negatively impact student achievement (e.g. negative impact on student standardized test scores or time away from required curriculum)

Researchers are reminded that while the submission of an informed consent/assent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate

Yes

✓ No

*required

Is the research likely to adversely affect students' opportunity to learn required educational content?

The research should not take time or attention away from normal instruction in a way that might negatively impact student achievement (e.g. negative impact on student standardized test scores or time away from required curriculum)

Appendix A Continued

Researchers are reminded that while the submission of an informed consent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate

Yes

✓ No

*required

Does the research require access to student education or health records?

Education records include any records held by the educational institution that contain personally identifiable information about students, including records related to an individual student's performance, such as written or electronic records typically found in transcripts (grades/courses/GPA/test scores), student work products such as tests, homework assignments and interactions with online student learning systems. Education records of students in most K-12 and colleges/universities are subject to regulations under the Family Educational Rights and Privacy Act (FERPA).

Protected Health Information (PHI) is covered under the HIPAA Privacy Rule which provides federal protections for personal health information held by covered entities and gives patients an array of rights with respect to that information.

Check all boxes that apply.

Yes, Student education records covered under FERPA.

Yes, Protected Health Information (PHI).

✓ No, Neither student educational records nor Protected Health Information are involved.

*required

How will schools, teachers and/or students be identified for recruitment?

Students who are taking the course will be recruited by the instructors to have the option to be a part of the research.

*required

Will subjects (either teachers or students) receive payment, extra credit, or other incentives for their participation in the study?

✓ Yes

No

*required

Describe the payment or incentive.

- *Estimate the maximum total payment. Please indicate what information you will be collecting from subjects who will be paid for their participation.*
- *If extra credit is a consideration, note that extra credit must not exceed 3% of the overall grade. Provide a description of the alternate, equivalent option to the extra credit.*

Post-Individual CoRe will be worth 5 points and the Individual Reflections Questions will also be worth 5 points. The course grade will be calculated out of 1,130 points, valuing the total extra credit points (10) at less than 1% of the overall course grade.

Students who choose to opt out of completing the CoRe and Individual Reflection Questions will be provided an opportunity to earn equivalent extra credit points (10 points) by completing a written 1 page reflection on any class learning activity of their choice. This alternate option to earn extra credit is equivalent in length and rigor to the CoRe and Individual Reflection Questions.

*required

Include a description, if relevant for your project, to describe how the research contributes to the required curriculum.

Include in this description whether or not the activity would occur in the educational setting regardless of the research taking place.

The surveys, CoRes, and reflection questions will be given as a regular component of learning activities in the class regardless of the research being conducted.

This is the first year that this course is being taught, as a newly required course in the Agricultural Education major's curriculum. Understanding how planned learning activities impact development of preservice teacher knowledge and skills is essential for both the instructor developing the course, and for the students who are developing those skills. The research conducted through this course will assess already planned learning activities.

*required

Please describe the reasons that you believe adverse effects on the students and educators are minimized.

If students do not participate in the learning activities that we are researching, their grades will not be adversely affected.

Since the learning activities assessed in this research do not actively contribute to the planned graded assignments in the course, student engagement in these activities do not negatively impact their overall course performance. Offering alternative extra credit assignments provides students equal opportunities to gain extra credit, regardless of participation in the research activities.

*required

Do you have permission by the educational site to conduct research (e.g. access data from the student record or be onsite) at the location?

Note that researchers should first contact the FERPA Office (for education records) or HIPAA Privacy Officer at the study site to find out the procedures that the study site requires to obtain restricted information. The IRB may need to see the permission letter or data use

agreement signed by the site to affirm that access is properly granted. Even if the investigator is using data from his/her own class, permission must be obtained from the Office of the Registrar (for Purdue University data) or appropriate FERPA official for the study site before using data for research purposes.

Yes, we have obtained permission from all sites.

External collaborators (such as site principals or directors) may utilize the IRB-provided template. See the "?" button in the right hand corner of this section for the template link. The HRPP expects all of these elements to be addressed in a permission letter, so using the template is recommended.

✓ No, we have not yet secured the permission of all sites and/or the site prefers evidence of an IRB approval before granting permission.

*required

Please confirm that you will seek permission to conduct research at all study sites.

External collaborators (such as site principals or directors) may utilize the IRB-provided template. See the "?" button in the right hand corner of this section for the template link. The HRPP expects all of these elements to be addressed in a permission letter, so using the template is recommended.

✓ I certify that I will obtain permission required by the site. The researchers will not begin a study until permission by a senior official has been obtained.

*required

Do you have a copy of the syllabus or activity schedule for the educational activity?

Activities considered exempt under Category 1 should be curricular in nature.

✓ Yes

*required

Please attach the syllabus or activity schedule.

Appendix A Continued

ASEC 340 Syllabus 2021_FINAL (Repaired).docx

No, but I affirm that the activity being studied is a part of the normal curriculum or schedule and I will upload a copy of the syllabus or activity schedule when it is available.

No

*required

Do the researchers hold any authority over the targeted population?
Examples:
Teacher/student
Supervisor/Employee
Club Leader/Club Member

Please keep in mind the researcher that conducts recruitment, collects, and analyzes identifiable data cannot have authority over the potential participant due to the potential for undue influence.
If necessary, a third party (listed as key personnel) who does not have authority over the targeted population must conduct recruitment and strip all identifiers prior to researchers/authority figures have access to the data.

Appendix A Continued

✓ Yes

*required

Please detail how the study will prevent against undue influence or coercion to participate.

If necessary, a third party (listed as key personnel) who does not have authority over the targeted population must conduct recruitment and strip all identifiers prior to researchers/authority figures have access to the data.

At the beginning of the course, students will be invited to participate, but it will be strongly emphasized that participation in the study does not affect their grade. Alternate equivalent opportunities for extra credit will be offered at the same time as the invitation to participate.

No

Exempt - Your research appears to be eligible for exemption under Category 1. You will be guided to answer just a few more items before submitting your protocol.

Researchers are reminded that while the submission of an informed consent document is not reviewed as part of an exempt application, researchers still have an ethical obligation to ensure that participants are fully informed about the nature of a research project so that they can make an informed decision to participate.

This exemption determination is subject to review by the HRPP Office. Please do not begin your research until you receive the final determination letter. All personnel listed in the application must complete training prior to conducting research.

Please click continue to move on to the next required sections.

Appendix A Continued

Funding Source(s)

*required

CURRENT Funding Source(s)

To review your protocol appropriately with differing sponsor standards, the HRPP must have the accurate funding source. It is a PI's responsibility to update funding sources as a modification to the protocol and associated forms (such as the consent form) when funding changes.

Please list any sources of funding that are **confirmed** by contract, agreement, or other support of a sponsor.
You will list any pending sources in the next question.

If the research is funded by a subcontract, please add both the subcontract source and the prime sponsor.

Externally sponsored (federal, state, corporate, foundations, industry, donor)

✓ Internal Purdue University Funds (Includes departmental funds, start-up funds.) *(Note, this does not include Purdue Research Foundation or Purdue Research Park companies-please list as external sponsor above).*

None - There are no confirmed funding sources at this time.

ANTICIPATED Funding Source(s) - Required

To review your protocol appropriately with differing sponsor standards, the HRPP must have the accurate funding source. It is a PI responsibility to update funding sources as a modification to the protocol and associated forms when funding changes.

If you are a student or staff member filling this out on behalf of a Principal Investigator (PI), please be certain to affirm with the PI that this information is accurate.

Please list any sources of funding where sponsorship is **anticipated** or pending a final decision.

Appendix A Continued

Externally sponsored (federal, state, corporate, foundations, industry, donor)

✓ There are no pending funding sources at this time.

If the protocol does not have a sponsor, please detail how the study will be conducted without funding.

Study will be conducted using the PI's start-up funds.

Conflict of Interest and/or Outside Activities Disclosure

Conflicts of Interest or outside activities must be disclosed and managed prior to IRB approval. For more information about these policies, please consult the resources listed in the question marks in each section.

The IRB may request confirmation of proper disclosures.

*required

Does this IRB protocol involve any work, advice, or service for an entity other than Purdue University?

For example, if this activity is done as an outside consulting activity, or employee's start-up company, this activity will not qualify for review by the Purdue IRB and an outside IRB or service must be sought.

✓ I attest that I understand the outside activities policy and Individual Financial Conflict of Interest policies and that all members of the research team are conducting this project on behalf of Purdue University.

Appendix A Continued

*required

Do you or any investigator(s) participating in this study have a significant financial interest (SFI) related to this research project?

Receiving more than $5,000 in compensation from, or having ownership interests in, outside entities, constitute Significant Financial Interests that need to be disclosed. Definitions of SFI, Investigator and Institutional Responsibilities, can be found at https://www.purdue.edu/policies/ethics/iiib2.html#definitions.

Yes

✓ No

*required

Do you or any person affiliated with the protocol have or know of any arrangement or understanding, tentative or final, relating to any future financial interest, financial relationship, future grant, position, or advisory role either related to the protocol, or dependent on the outcome of the research under the protocol?

Yes

✓ No

*required

Is there anything not disclosed above which you believe might constitute a conflict of interest or an appearance of a conflict of interest in connection with the protocol?

Yes

✓ No

Appendix A Continued

Other attachments

*required

Do you have any other supporting documents to attach?

You may attach COVID-19 Research Space Standard Operating Procedures here if this is a new protocol submitted during the COVID-19 pandemic.

Investigators are invited to submit reference lists, study instruments, supporting information, training data, device pictures, or other relevant items for their study that were not addressed in the application.

✓ Yes

Attach any other documents. Please use a file name that describes the document.

You may attach multiple files to this entry.

PLEASE DO NOT UPLOAD PARTICIPANT DATA OR IDENTIFIABLE RESEARCH DATA.

Blank CoRe.jpg

Completed CoRe.PNG

Final Post-Assessment.pdf

Final Pre-Assessment.pdf

Final Individual Reflection Questions.docx

No

APPENDIX B. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL LETTER

PURDUE
UNIVERSITY

This Memo is Generated From the Purdue University Human Research Protection Program System, Cayuse IRB.

Date: November 17, 2021
PI: Sarah LaRose
Re: Modification - IRB-2021-825
Secondary Preservice Agriculture Teachers' Professional Knowledge Bases & Collective PCK: A Case Study

The Purdue University Institutional Review Board has approved the modification for your study "*Secondary Preservice Agriculture Teachers' Professional Knowledge Bases & Collective PCK: A Case Study.* " The Category for this Exemption is listed below. This study maintains a status of exempt and an administrative check-in date of August 23, 2024. The IRB must be notified when this study is closed. If a study closure request has not been initiated by this date, the HRPP will request study status update for the record.

Specific details about your modification approval appear below.
Decision: Exempt

What are your responsibilities now, as you move forward with your research?

Document Retention: The PI is responsible for keeping all regulated documents, including IRB correspondence such as this letter, approved study documents, and signed consent forms for at least three (3) years following protocol closure for audit purposes. Documents regulated by HIPAA, such as Release Authorizations, must be maintained for six (6) years.

Site Permission: If your research is conducted at locations outside of Purdue University (such as schools, hospitals, or businesses), you must obtain written permission from all sites to recruit, consent, study, or observe participants. Generally, such permission comes in the form of a letter from the school superintendent, director, or manager. You must maintain a copy of this permission with study records.

Training: All researchers collecting or analyzing data from this study must renew training in human subjects research via the CITI Program (www.citiprogram.org) every 4 years. New personnel must complete training and be added to the protocol before beginning research with human participants or their data.

Modifications: Change to any aspect of this protocol or research personnel must be approved by the IRB before implementation, except when necessary to eliminate apparent immediate hazards to subjects or others. In such situations, the IRB should still be notified immediately.

Unanticipated Problems/Adverse Events: Unanticipated problems involving risks to subjects or others, serious

adverse events, and
noncompliance with the approved protocol must be reported to the IRB immediately through an incident report. When in doubt, consult with the HRPP/IRB.

Monitoring: The HRPP reminds researchers that this study is subject to monitoring at any time by Purdue's HRPP staff, Institutional Review Board, Post Approval Monitoring team, or authorized external entities. Timely cooperation with monitoring procedures is an expectation of IRB approval.

Change of Institutions: If the PI leaves Purdue, the study must be closed or the PI must be replaced on the study or transferred to a new IRB. Studies without a Purdue University PI will be closed.

Other Approvals: This Purdue IRB approval covers only regulations related to human subjects research protections (e.g. 45 CFR 46). This determination does not constitute approval from any other Purdue campus departments, research sites, or outside agencies. The Principal Investigator and all researchers are required to affirm that the research meets all applicable local/state/ federal laws and university policies that may apply.

If you have questions about this determination or your responsibilities when conducting human subjects research on this project or any other, please do not hesitate to contact Purdue's HRPP at irb@purdue.edu or 765-494-5942. We are here to help!

Sincerely,

Purdue University Human Research Protection Program/ Institutional Review Board
Login to Cayuse IRB

See Purdue HRPP/IRB Measures in Response to COVID-19 at www.irb.purdue.edu

APPENDIX C. PRE-SURVEY

PURDUE UNIVERSITY

A Survey Instrument for Secondary Preservice Agriculture Teachers' Professional Knowledge Bases & Collective PCK: A Case Study

The purpose of this study was to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course.

Dr. Sarah LaRose (Principal Investigator)
Miranda McGuire (Primary Contact)
Department of Agricultural Sciences Education & Communication
Purdue University
915 W. State St.
West Lafayette, IN 47907
IRB- 2021-825

Appendix C Continued

RESEARCH PARTICIPANT CONSENT FORM

A study to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course.

Principal Investigator: Dr. Sarah E. LaRose
Department of Agricultural Sciences, Education, and Communication
Purdue University

Navigate through the *Participant IRB Consent Form* below to learn more detailed information pertaining to this study:

Key Information

Please take time to review this information carefully. This is a research study. Your participation in this study is voluntary, which means that you may choose not to participate at any time without penalty or loss of benefits to which you are otherwise entitled. You may ask questions to the researchers about the study whenever you would like. If you decide to take part in the study, you will be asked to sign this form, be sure you understand what you will do and any possible risks or benefits. This research aims to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course. There is a need for focusing on pedagogical content knowledge explicitly with clear opportunities for teachers to think about, experience, and reflect on how to think about each aspect of PCK

(Schneider & Plasman, 2011). To allow for data collection, the duration of this study is approximately the entire semester of ASEC 340.

What is the purpose of this study?

Participants who are currently enrolled in ASEC 340 of the 2021 fall semester are being asked to participate in describing preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course. We would like all individuals in the course to particpate in this study.

What will I do if I choose to be in this study?

Participants who are currently enrolled in ASEC 340 of the 2021 fall semester will be contacted via email or in class throughout the duration of this study. If participants are willing to be involved, the active link for the Qualtrics survey instrument will be available for them to complete. Within Qualtrics and prior to the survey instrument itself, the research participant will be prompted to review the informed consent form and agree to participate in the study before they can proceed through the survey instrument. Both qualitative and quantitative data will be collected from the Qualtrics survey instrument and then analyzed.

How long will I be in the study?

Your participation in this study entails completing 2 online Qualtrics surveys that has an estimated time for completion of 15 minutes. And completing 2 individual CoRes and a class Group CoRe. To allow for data collection the duration of this study is approximately the entire Fall 2021 semester.

What are the possible risks or discomforts?

The standard for minimal risk is that which is found in everyday life or during the performance of routine physical or physiological exams or tests. There is little risk of discomfort caused by providing personal opinions and unfavorable responses. Breach of confidentiality is always a risk with data, but we will take precautions to minimize this risk as described in the confidentiality section.

Are there any potential benefits?

There are no anticipated direct benefits to participants.

Will I receive payment or other incentive?

Participants who complete the who complete the Qualtrics post survey and post-individual CoRe will be offered extra credit. However for those that do not participate in the Qualtrics post survey and post-individual CoRe will have another opportunity for extra credit.

Are there costs to me for participation?

There are no anticipated costs to participate in this research.

Will information about me and my participation be kept confidential?

Your identity will be kept confidential to the extent provided by law throughout the duration of this study. References to names or personal subject information will not be included in the research output nor connected to any reports or comments. Only the research team associated with this study will have access to your survey responses for data analysis purposes. Participant response records from the Qualtrics survey instrument will be analyzed and stored within Purdue Box and will be destroyed after data analysis. The study's research records may be

reviewed by the US DHHS Office for Human Research Protections and by departments at Purdue University responsible for regulatory and research oversight.

What are my rights if I take part in this study?

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Who can I contact if I have questions about this study?

If you have questions, comments, or concerns about this research project, you can talk to one of the researchers. Principal Investigator, Dr. Sarah LaRose, Department of Agricultural Sciences, Education, and Communication, Purdue University, 915 W. State St., West Lafayette, IN 47907, (e) slarose@purdue.edu (p) (765) 494-8430. Primary Contact, Miranda Mcguire, Department of Agricultural Sciences, Education, and Communication, Purdue University, 915 W. State St., West Lafayette, IN 47907, (e) mcguir18@purdue.edu (p) (765) 494-8430.

To report anonymously via Purdue's Hotline, see www.purdue.edu/hotline

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Human Research Protection Program - Purdue University

Appendix C Continued

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Human Research Protection Program - Purdue University
Ernest C. Young Hall, Room 1032
155 S. Grant St.
West Lafayette, IN 47907-2114

Documentation of Informed Consent

I have had the opportunity to read the consent form above and have the research study explained. I have had the opportunity to ask questions about the research study, and my questions have been answered. I am prepared to participate in the research study described above.

- ◯ I consent and agree to participate in this study
- ◯ I do not consent; I do not wish to participate in this study

Appendix C Continued

What is your college-level classification for Fall 2021 (by the number of credit hours, as Purdue defines)?

- ○ Freshman
- ○ Sophomore
- ○ Junior
- ○ Senior

What is your major(s)?

Are you working on a minor in animal science?

- ○ No
- ○ Yes

What are your career objectives or dream job?

Appendix C Continued

Why are you taking this course?

What do you hope to gain from this course?

Number of animal science courses taken in your college academic career.

- ○ None
- ○ 1-2
- ○ 3-4
- ○ 5-6
- ○ 7-8
- ○ 9 or more

How many high school-level animal science courses have you completed? (trimester/semester are equivalent for the purposes of this study)

- ○ None
- ○ 1-2
- ○ 3-4
- ○ 5-6
- ○ 7-8
- ○ 9 or more

Appendix C Continued

How many years of work experience do you have in Animal Science specifically in the area of Animal Dissection?

- ○ No work experience in these areas
- ○ Less than 6 months
- ○ 1/2 to less than 1 year
- ○ 1 year but less than 2 years
- ○ 2 years but less than 3 years
- ○ 3 years but less than 4 years
- ○ 4 years but less than 5 years
- ○ 5 years or more

Please indicate if you have participated in an Animal Science program in 4-H or high school agricultural education (Ag Ed) or FFA?

- ○ No, I was not enrolled in either program.
- ○ No, I did not participate in Animal Science activities in either program.
- ○ Yes, I participated in Animal Science activities in an Ag Ed/FFA program.
- ○ Yes, I participated in Animal Science activities in a 4-H program.
- ○ Yes, I participated in Animal Science activities in both programs.
- ○ Other, please specify

Appendix C Continued

What experience have you had with learning Animal Dissection? Please select all that apply.

- ☐ Have not had any prior instruction about Animal Dissection.
- ☐ Had it in a high school class.
- ☐ Had it in a college course.
- ☐ Had it in a 4-H experience outside a formal classroom.
- ☐ Had it in an outside of the classroom FFA experience.
- ☐ Had it in an outside of the classroom experience (not 4-H or FFA).

What animal science classes have you taken at Purdue University? Please select all that apply.

- ☐ ANSC 102 Introduction to Animal Agriculture
- ☐ ANSC 106 Biology of Companion Animals
- ☐ ANSC 221 Principles of Animal Nutrition
- ☐ ANSC 230 Physiology of Domestic Animals
- ☐ ANSC 245 Applied Animal Management
- ☐ ANSC 295 Introduction to Animal Products
- ☐ ANSC 301 Animal Growth, Development and Evaluation
- ☐ ANSC 303 Animal Behavior
- ☐ ANSC 311 Animal Breeding
- ☐ ANSC 324 Applied Animal Nutrition
- ☐ ANSC 331 Horses in Human History and Culture
- ☐ ANSC 332 Environmental Physiology of Domestic Animals

Appendix C Continued

- [ ] ANSC 333 Physiology of Reproduction
- [ ] ANSC 345 Animal Health Management
- [ ] ANSC 351 Meat Science
- [ ] ANSC 370 Livestock Evaluation
- [ ] ANSC 371 Dairy Evaluation
- [ ] ANSC 390 Animal Sciences Internship
- [ ] ANSC 404 Animal Welfare
- [ ] ANSC 435 Reproductive Management of Farm Animals
- [ ] ANSC 440 Horse Management
- [ ] ANSC 441 Beef Management
- [ ] ANSC 442 Sheep Management
- [ ] ANSC 443 Swine Management
- [ ] ANSC 444 Dairy Management
- [ ] ANSC 445 Commercial Poultry Management
- [ ] ANSC 446 Companion Animal Management
- [ ] ANSC 470 Livestock Judging
- [ ] ANSC 471 Dairy Judging
- [ ] ANSC 485 Dairy Farm Evaluation
- [ ] ANSC 495 Cracking the Poultry Industry
- [ ] ANSC 495 Meat Evaluation
- [ ] Please list other classes you have taken at Purdue (Free Response)

Have you taken any other animal science courses at a different post-secondary college?

- ◯ Yes
- ◯ No

Assume that in the future you become an agriculture teacher. If you have your choice, will you choose to be the one to teach animal science to your students?

- ◯ Yes
- ◯ Maybe
- ◯ No
- ◯ I don't know

Of the animal science courses you have taken at Purdue University, do you feel like you can teach Animal Sciences at the secondary level based on your current content knowledge?

- ◯ Yes
- ◯ Maybe
- ◯ No
- ◯ I don't know
- ◯ Other

Appendix C Continued

Of the animal science courses you have taken at Purdue University, do you feel like they have prepared you to teach hands-on animal science labs at the post-secondary level?

- ◯ Yes
- ◯ Maybe
- ◯ No
- ◯ I don't know
- ◯ Other

Which course(s) do you feel has best prepared you? Please list all the courses.

Please rate your level of comfort in your own ability to ***DESIGN*** effective laboratory instruction for Animal Science Dissection?

- ◯ Not at all comfortable
- ◯ Slightly comfortable
- ◯ Moderately comfortable
- ◯ Very comfortable
- ◯ Extremely comfortable

Appendix C Continued

Please rate your level of comfort in your own ability to ***FACILITATE*** effective laboratory instruction for Animal Science Dissection?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Please rate your level of comfort in your own ability to ***ASSESS STUDENT LEARNING*** in laboratory instruction for Animal Science Dissection?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Please rate how you think you will view your own effectiveness as a future teacher of Animal Science laboratory instruction:

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Please rate your level of comfort in your own ability to currently teach animal science labs?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Please explain your answer to the previous question. Give an example or two on your feelings about the level of comfort in your ability to currently teach animal science labs.

Do you have any additional thoughts or feelings on teaching animal science you would be willing to share? (For example: Do you dread it? Look forward to it? Want to emulate a teacher? Want to avoid making the mistakes of a teacher?)

This survey is anonymous, however, we would like to match your pre and post-tests. Please write in the space a number you can use as an identifier on the pre and post-test. Hint - I suggest the last four digits of your phone number or your house number. Please do not write your name or Purdue ID! Please record this number where you can find it at the end of the semester as you will use the same number on the post-test.

Appendix C Continued

PURDUE UNIVERSITY

Which of the following is NOT a chamber of the ruminant stomach?

- ◯ Rumen
- ◯ Omasum
- ◯ Abomaum
- ◯ Duodenum

Ruminant stomachs are separated into _____ compartments?

- ◯ One
- ◯ Two
- ◯ Three
- ◯ Four

Do pigs have a four-chambered stomach?

- ◯ Yes
- ◯ No

Appendix C Continued

Which of the following is not a ruminant?

- ◯ Cow
- ◯ Sheep
- ◯ Horse
- ◯ Goat

Which type of digestive system do pigs have?

- ◯ Ruminant
- ◯ Multigastric
- ◯ Monogastric
- ◯ Unigastric

This thick, muscular structure serves as a barrier between the uterus and the external environment.

- ◯ Vulva
- ◯ Oviduct
- ◯ Cervix
- ◯ Fornix

This ovarian structure, also referred to as the "yellow body," secretes hormones to maintain pregnancy.

- ◯ Corpus hemorrhagicum
- ◯ Corpus luteum
- ◯ Corpus albicans
- ◯ Ovary

Where does sperm formation occur?

- ◯ Vas deferens
- ◯ Epididymis
- ◯ Urethra
- ◯ Seminiferous tubules

The seminiferous tubules are located in the _____.

- ◯ Testes
- ◯ Epididymis
- ◯ Vas deferens
- ◯ Seminal vesicles

A fully mature follicle ready for ovulation is referred to as a _____.

- ◯ Primary follicle
- ◯ Primordial follicle
- ◯ Secondary follicle
- ◯ Graafian follicle

Appendix C Continued

We thank you for your time spent taking this survey.
Your response has been recorded.

APPENDIX D. POST- SURVEY

PURDUE UNIVERSITY

A Survey Instrument for Secondary Preservice Agriculture Teachers' Professional Knowledge Bases & Collective PCK: A Case Study

The purpose of this study was to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course.

Dr. Sarah LaRose (Principal Investigator)
Miranda McGuire (Primary Contact)
Department of Agricultural Sciences Education & Communication
Purdue University
915 W. State St.
West Lafayette, IN 47907
IRB- 2021-825

Appendix D Continued

RESEARCH PARTICIPANT CONSENT FORM

A study to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course.

Principal Investigator: Dr. Sarah E. LaRose
Department of Agricultural Sciences, Education, and Communication
Purdue University

Navigate through the *Participant IRB Consent Form* below to learn more detailed information pertaining to this study:

Key Information

Please take time to review this information carefully. This is a research study. Your participation in this study is voluntary, which means that you may choose not to participate at any time without penalty or loss of benefits to which you are otherwise entitled. You may ask questions to the researchers about the study whenever you would like. If you decide to take part in the study, you will be asked to sign this form, be sure you understand what you will do and any possible risks or benefits. This research aims to describe preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course. There is a need for focusing on pedagogical content knowledge explicitly with clear opportunities for teachers to think about, experience, and reflect on how to think about each aspect of PCK

(Schneider & Plasman, 2011). To allow for data collection, the duration of this study is approximately the entire semester of ASEC 340.

What is the purpose of this study?

Participants who are currently enrolled in ASEC 340 of the 2021 fall semester are being asked to participate in describing preservice agriculture teachers' Professional Knowledge Bases, before and after instruction, & describe their Collective PCK, after instruction, on the topic of animal science-dissection in a Laboratory Practice in Agricultural Education course. We would like all individuals in the course to particpate in this study.

What will I do if I choose to be in this study?

Participants who are currently enrolled in ASEC 340 of the 2021 fall semester will be contacted via email or in class throughout the duration of this study. If participants are willing to be involved, the active link for the Qualtrics survey instrument will be available for them to complete. Within Qualtrics and prior to the survey instrument itself, the research participant will be prompted to review the informed consent form and agree to participate in the study before they can proceed through the survey instrument. Both qualitative and quantitative data will be collected from the Qualtrics survey instrument and then analyzed.

How long will I be in the study?

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What are the possible risks or discomforts?

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Are there any potential benefits?

There are no anticipated direct benefits to participants.

Will I receive payment or other incentive?

Participants who complete the who complete the Qualtrics post survey and post-individual CoRe will be offered extra credit. However for those that do not participate in the Qualtrics post survey and post-individual CoRe will have another opportunity for extra credit.

Are there costs to me for participation?

There are no anticipated costs to participate in this research.

Will information about me and my participation be kept confidential?

Your identity will be kept confidential to the extent provided by law throughout the duration of this study. References to names or personal subject information will not be included in the research output nor connected to any reports or comments. Only the research team associated with this study will have access to your survey responses for data analysis purposes. Participant response records from the Qualtrics survey instrument will be analyzed and stored within Purdue Box and will be destroyed after data analysis. The study's research records may be

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Appendix D Continued

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Documentation of Informed Consent

I have had the opportunity to read the consent form above and have the research study explained. I have had the opportunity to ask questions about the research study, and my questions have been answered. I am prepared to participate in the research study described above.

- ○ I consent and agree to participate in this study
- ○ I do not consent; I do not wish to participate in this study

Appendix D Continued

After taking this course and if you have your choice, will you choose to be the one to teach animal science to your students?

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ I Don't Know

Of the animal science courses you have taken in your college career, do you feel like you can teach Animal Sciences at the secondary level based on your current content knowledge?

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ I don't know
- ◯ Other

Appendix D Continued

Of the animal science courses you have taken at in your college career, do you feel like they have prepared you to teach hands-on animal science labs at the post-secondary level?

- ○ Yes
- ○ No
- ○ Maybe
- ○ I don't know
- ○ Other

Please rate your level of comfort in your own ability to ***DESIGN*** effective laboratory instruction for Animal Science Dissection?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Appendix D Continued

Please rate your level of comfort in your own ability to ***FACILITATE*** effective laboratory instruction for Animal Science Dissection?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

Please rate your level of comfort in your own ability to ***ASSESS STUDENT LEARNING*** in laboratory instruction for Animal Science Dissection?

- ○ Not at all comfortable
- ○ Slightly comfortable
- ○ Moderately comfortable
- ○ Very comfortable
- ○ Extremely comfortable

What worked/what didn't work for you to learn how to teach Animal Science Dissections?

Appendix D Continued

If you were to teach a lesson or unit on Animal Science Dissections, what teaching methods and resources would you use?

After taking this course, please rate how you think you will view your own effectiveness as a future teacher of Animal Science laboratory instruction:

- ◯ Not at all comfortable
- ◯ Slightly comfortable
- ◯ Moderately comfortable
- ◯ Very comfortable
- ◯ Extremely comfortable

After taking this course, please rate your level of comfort in your own ability to currently teach animal science labs?

- ◯ Not at all comfortable
- ◯ Slightly comfortable
- ◯ Moderately comfortable
- ◯ Very comfortable
- ◯ Extremely comfortable

Following up to the previous question, why do you feel this way? Give an example or two.

Do you have any additional thoughts or feelings on teaching animal science after taking this course you would be willing to share? (For example: Do you dread it? Look forward to it? Want to emulate a teacher? Want to avoid making the mistakes of a teacher?)

This survey is anonymous, however, we would like to match your pre and post-tests. **Please write in the space a number you can use as an identifier on the pre-test.**

The next page will take you to the Content Assessment.

Appendix D Continued

Which of the following is NOT a chamber of the ruminant stomach?

- ◯ Rumen
- ◯ Omasum
- ◯ Abomaum
- ◯ Duodenum

Ruminant stomachs are separated into _____ compartments?

- ◯ One
- ◯ Two
- ◯ Three
- ◯ Four

Do pigs have a four-chambered stomach?

- ◯ Yes
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Appendix D Continued

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- ◯ Goat

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- ◯ Unigastric

This thick, muscular structure serves as a barrier between the uterus and the external environment.

- ◯ Vulva
- ◯ Oviduct
- ◯ Cervix
- ◯ Fornix

This ovarian structure, also referred to as the "yellow body," secretes hormones to maintain pregnancy.

- ◯ Corpus hemorrhagicum
- ◯ Corpus luteum
- ◯ Corpus albicans
- ◯ Ovary

Where does sperm formation occur?

- ◯ Vas deferens
- ◯ Epididymis
- ◯ Urethra
- ◯ Seminiferous tubules

The seminiferous tubules are located in the _____.

- ◯ Testes
- ◯ Epididymis
- ◯ Vas deferens
- ◯ Seminal vesicles

A fully mature follicle ready for ovulation is referred to as a _____.

- ◯ Primary follicle
- ◯ Primordial follicle
- ◯ Secondary follicle
- ◯ Graafian follicle

We thank you for your time spent taking this survey.
Your response has been recorded.

APPENDIX E. INDIVIDUAL REFLECTION QUESTIONS

1. Prior to any instruction in the course, how would you describe your experience while completing the **FIRST** Content Representation (CoRe) of the semester, individually, for the Animal Science--Dissection? Was it difficult, easy? Please explain.

2. After the Animal Science--Dissection lab in the course, how would you describe your experience while completing the **SECOND** Content Representation (CoRe) of the semester, individually for the Animal Science--Dissection lab? Was it more difficult, easier? Please explain.

3. How would you describe your experience while completing the **LAST** Content Representation (CoRe) at the end of the semester, collectively, as a group for the Animal Science--Dissection lab compared to completing it individually? Was it more difficult, easier? Please explain.

4. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to **design effective laboratory instruction** for **Animal Science--Dissection** in the future?

5. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to **facilitate effective laboratory instruction** for **Animal Science--Dissection** in the future?

6. What aspects of completing the CoRe individually vs collectively as a group would you describe contributed to how comfortable you feel to **assess student learning** for teaching **Animal Science--Dissection** in the future?

Appendix E Continued

7. What aspects of completing the CoRe individually vs collectively as a group would you describe that **helped you learn to teach** Animal Science--Dissections? Please describe both completion methods if you can.

	Individual CoRe	Group CoRe
How completing the CoRe in this format helped you learn to teach?		

8. Regarding the process of developing CoRes individually or as a group: What about this process (if any) will you carry forward as you continue to develop your ability to design, facilitate, and assess laboratory-based instruction?

APPENDIX F. REMINDER FOR POST-SURVEY & POST CORE

Reminders on Reflection 8 & CoRe 2 — Oct 16, 2021 10:03 AM

Hi all!

It was brought to my attention some of you thought the CoRe from the dissection lab Thursday was due at the same time as the reflection. So, I have extended the deadline for that! All 23 of you submitted a CoRe at the beginning of the semester, and since I am studying how each of your individual thought processes has changed before and after the dissection lab, everyone submitting a CoRe would benefit me a lot. So far, 18 of you have turned it in (THANK YOU!). It would be excellent if those that haven't turned it in yet could submit one too! :)

Also, not very many of you have turned in this week's reflection yet, so I wanted to remind everyone that it is due **tonight at 11:59 PM!**

Have a great weekend! Let me know of any questions or concerns!

Miranda

Survey — Oct 14, 2021 5:56 PM

Hi All,

I hope you enjoyed lab today! Just wanted to add a note about the survey that was forgotten in lab today.

In the first survey at the beginning of the semester, we asked you to put a 4 digit number identifier at the end of the survey and write it down somewhere so you wouldn't forget. You will need this 4 digit number again for this survey.

Also, just a reminder that if you didn't complete the CoRe in class today, you have until midnight tonight!

Please let me know of any concerns or questions!

Miranda

APPENDIX G. LABORATORY PRACTICES IN AGRICULTURAL EDUCATION FALL 2021 DISSECTION LAB LESSON PLAN

ASEC 340 Animal Dissection Lab Lesson Plan

Learning Objectives:

1. Explore the organs in a system and identify key structures and functions of the ruminant, nonruminant, and poultry digestive tracts.
2. List main differences between ruminant, nonruminant, and poultry digestion.
3. Identify basic anatomy for mammalian male and mammalian female systems.
4. Describe functions of anatomical structures within processes of reproduction.
5. Visualize how organ systems look in reality compared to diagrams, pictures, or videos.
6. Develop phyco-motor skills for using dissection tools

Appendix G Continued

Time	Activity	Instructions & Learning Activity (Outline of Content)	Materials & Resources
Before Lab	**Female & Male Reproduction**		
Before Lab	**YouTube/EdPuzzel Repro Anatomy Videos**	• Students are instructed to watch videos before coming to the lab. • Some content about female repro anatomy that will be covered in this activity include: o **Vulva:** Most exterior portion of the female tract; has mucus and excrete pheromones o **Vagina:** Helps in the protection of the uterus from bacteria. o **Cervix:** Lowest region of the uterus; it attaches the uterus to the vagina and provides a passage between the vaginal cavity and the uterine cavity. o **Uterine Body:** Where the Uterine horns connect. o **Uterine Horns:** Houses the fetus (in some species). o **Utero-tubal Junction:** Sperm reservoir (sorts out the good and bad sperm). o **Isthmus of Oviduct**: Tube sperm travels through. o **Ampulla of Oviduct:** Tube the oocyte (ovulated egg) travels through. o **Ampullary Isthmus Junction**: Site of fertilization. o **Infundibulum of Oviduct:** The "catcher's mitt" in the female. It is shaped around the	• Repro Dissection Handout • Female functional anatomy video: https://youtu.be/jA5Nd-4cV8M • Ovulation and Follicles video: https://youtu.be/vJZ8UmhDQJU • Male functional anatomy video: https://youtu.be/kwriWRCDN4g • Testicular anatomy and function video: https://youtu.be/uYOckWZGsMo

		ovary to catch the oocyte when it releases from the ovary. o **Ovary:** The most interior portion of the tract. It is the "Egg House". Releases the oocyte. A female is born with as many eggs that she will use in her lifetime. (In people and animals!) o **Corpus Hemorrhagicum, Corpus Luteum, Corpus Albicans:** ▪ **CH:** ruptured blood vessels (red body) ▪ **CL:** depending on species (yellow-body) ▪ **CA:** (White Body) Scar tissue o **Graafian Follicle**: A Follicle ready for ovulation or "to pop". • Some content about male repro anatomy that will be covered in this activity include: o **Spermatic cord:** Connects testes to the body o **Scrotum:** The scrotum is a muscular sac containing the testes. It supports and protects the testes and also plays a major role in temperature regulation. The reason the testes are located in the scrotum is to maintain the testicular temperature at several degrees below core body temperature, a necessity for normal spermatogenesis. o **Testes:** Serve as the manufacturing and assembly of sperm and secrete the male sex hormone, testosterone. (**Testosterone:** is essential for the development of male characteristics, maintaining normal sexual behavior, and sperm production). o **Seminiferous tubules:** Tubular loops with both ends emptying into the rete testis within the testes. Function: Site of spermatogenesis (sperm production). o **Rete testes:** Collects spermatozoa from the seminiferous tubules within the testes. Facilitates sperm transport to the epididymis. o **Epididymis:** Maturation and storage of sperm. o **Caput Epididymis (Head):** Matures sperm and makes sperm more fertile.	

Appendix G Continued

		○ Cauda Epididymis (Tail): Where most mature sperm is located (for boars) and stored before ejaculation. ○ **Vas Deferens or Ductus Deferens (carrying away duct):** The duct that rises from the tail of the epididymis into the abdomen, where it joins the urethra for ejaculation. Removal of a section of the vas deferens in each testis is known as a vasectomy, preventing the passage of sperm from the epididymis. ○ **Urethra:** The two vas deferens eventually unite into a single tube, the urethra, which is the channel passing through the penis. The urethra in the male serves as a common passageway for semen from the reproductive tract and urine from the urinary tract. ○ **Accessory Sex Glands:** Make sure sperm gets to the female and survive. Production of seminal fluid, improving sperm viability, flushes the reproduction tract, adjusts pH. • **Sigmoid Flexure/Retractor Penis Muscle:** Sigmoid flexure is maintained by the Retractor Penis Muscle, which holds the penis inside the sheath when contracted. When relaxed, the penis protrudes and becomes erect. • **Penis:** The organ of insemination. Spongy-type material within the penis is filled with blood during sexual arousal, resulting in an erection of the organ. ○ **Glans Penis:** The end of the penis is the glans penis and is richly supplied nerves, which are stimulated to induce ejaculation. ○ **Urethral Process:** In male goats and sheep. It helps spread the semen during ejaculation.	
2:30 PM - 2:35 PM (5 min)	**Review & Safety**		
2:30 PM - 2:35 PM (5 min)	**PPE, Safety, Tools Review**	• Take 5 minutes to check everyone has proper PPE and understands the safety protocols for handing animal dissection tracts. • Review how to handle dissection tools.	• Gloves • Goggles • Aprons (optional) • Cleaning Supplies • Sharps Container
2:35 PM - 3:25 PM (50 min total)	**Avian Digestion**		

Appendix G Continued

Part 1: **2:35 PM - 2:55 PM** (20 min) **Part 2:** **2:55 PM - 3:15 PM** (20 minutes) **Part 3:** **3:15 - 3:25 PM** (10 min)	**Chicken Digestive Tract Dissection**	• The chicken digestive tract, Avian Digestion Handout, Chicken Digestion Handouts, dissection pins, and dissection tool kits are already set up at lab stations when students arrive. o Students went over safety procedures and handling in the lecture class the day before. • Students are split into pairs and will share a chicken digestive tract and dissection tools. 1. Students will be given 20 minutes to follow the instructions and fill out as much of their handout in the time given while instructors walk around observing and helping when needed. 2. After the 20 minutes is up, the main instructor is at the front of the room lecturing and demonstrating with a chicken digestive tract with a camera that projects the teacher's hands and tract on the screen and will take the next 20-25 minutes to go over the chicken digestive tract to check for understanding and review. 3. Students will return their dissection tools to the front of the lab. And instructors and students will do a little clean up before the next activity. • Some of the content that will be covered in this activity will include: o **Mouth:** Where digestion begins through salivary secretions (chemical digestion). No mastication or mechanical digestion takes place in the mouth since poultry don't have teeth! Mechanical digestion takes place in the Gizzard! o **Esophagus:** Passage of food to the stomach—through a wave of contractions called "Peristaltic Action". o **Crop:** The crop holds food before it goes further down its digestive tract. Chickens basically store food in their crops; it is like a chicken lunchbox. Then it moves into the stomach or proventriculus. This used to be used for regurgitation to young. Wild birds still use their crop for this action. ▪ Ducks have a pseudocrop which is even smallGizzard**ventriculus:** The true stomach of a bird. Mixes and stores	• Avian Digestion Handout • Mammalian Ruminant vs Nonruminant Digestion Handout • Chicken Digestive System Photo • Chicken Part Pieces • Dissection tool Kit • Chicken Digestive Tract Supplemental Material Available to Students Outside of Class: • Chicken Digestive Tract Video: https://youtu.be/FXKTum7P-FA

		ingested food. Initiates protein and fat digestion, i.e., chemical digestion (HCl is secreted). It also controls the release of food into the small intestine. o **Gizzard:** The gizzard is a muscular part of the digestive system that "chews" food by using small stones, or grit, to grind the food up. Chickens need grit because they don't have teeth. o **Small Intestine:** Where the majority of digestion and absorption of nutrients takes place. ▪ **Duodenum:** mixing gastric digesta (going to be more acidic coming from the stomach. Pancreatic secretions take place here to increase the pH of the digesta since it was so acidic coming from the stomach. This protects the rest of the small intestine. ▪ **Jejunum:** where the majority of digestion and absorption takes place. ▪ **Ileum**: has some digestion and absorption take place. Used for nutrition research to see what the animal has absorbed and not absorbed. o **Large Intestine:** Consists of the cecum and colon. The main function is the absorption of water. Cecal fermentation does take place. o **Ceca:** TWO blind pouches located where the small and large intestines join. Some of the water remaining in the digested material is reabsorbed here. o **Cloaca:** Excrete waste.	
3:25 PM - 4:15 PM (50 min total)	**Ruminant vs. Nonruminant Digestion**		
Part 1: 3:25 PM - 3:40 PM (15 mins) **Part 2: 3:40 PM - 3:50 PM** (10 min) **Part 3:**	**Ruminant vs. Nonruminant Digestive Tracts**	• Students will sit and lab benches while the main instructor conducts a lecture and demonstration of digestive tracts of a sheep and a pig with a camera that projects the teacher's hands and tract on the screen and will take the next 60 minutes to go over the sheep and pig digestive tract.	• Mammalian Ruminant vs Nonruminant Digestion Handout Supplemental Material Available to Students Outside of Class: • Pig Digestive Tract Video: https://youtu.be/fNlfqe_vOLk

Appendix G Continued

3:50 PM - 4:05 PM (15 min) **Part 4:** **4:05 PM - 4:15 PM** (10 min)		**1.** The main instructor will start with the pig'sdigestive tract. o Students will take notes while the instructor goes over the pig digestive tract. **2.** Allow students to take 5 minutes to discuss the difference between a mammalian digestive tract and chicken digestive tract. Also, label the pig digestion tract. o The instructor will take 5 minutes to discuss with the class. **3.** The main instructor will then teach about the sheep digestive tract. **4.** Allow students to take 10 minutes to discuss in their lab groups the difference between a ruminant and nonruminant digestive tract and also label the sheep tract picture. Then discuss with the class. • Some of the pig digestive tract content that will be covered in this activity include: o **Mouth:** Where digestion begins through mastication (mechanical digestion) and salivary secretions (chemical digestion). o **Esophagus:** Passage of food to the stomach—through wa ave of contractions called "Peristaltic Action". o **Stomach:** Mixes and stores ingested food. Initiates protein and fat digestion, i.e., chemical digestion. It also controls the release of food into the small intestine. There are four regions of a monogastric stomach, not 4 compartments. o **Small Intestine:** Where the majority of digestion and absorption of nutrients takes place. ▪ **Duodenum:** mixing gastricdigesta (going to be more acidic coming from the stomach. Pancreatic secretions take place here to increase the pH of the digesta since it was so acidic coming from the stomach,. TThis protectsthe rest of the small intestine. ▪ **Jejunum:** where the majority of digestion and absorption takes place ▪ **Ileum:** has some digestion and absorption take place. Used for nutrition research to see what the animal has absorbed and not absorbed.	• Ruminant Digestive Tract Videos: https://youtu.be/8OmXFSOxl_Q https://youtu.be/3LMnuOpnmyk

		○ **Large Intestine:** Consists of the cecum and colon. Main function is the absorption of water. Cecal fermentation does take place. • Some of the sheep digestive tract content that will be covered in this activity include: ○ **Mouth:** Where digestion begins through mastication (mechanical digestion) and salivary secretions (chemical digestion). ○ **Esophagus:** Passage of food to the stomach—through a wave of contractions called "Peristaltic Action". ○ **Rumen:** Located on the left side of the abdomen. Has papillae lining. Its function is to operate like a big fermentation vat. A thing to note is the rumen is NOT functional at birth. Physical mixing and breakdown take place. There is a symbiotic relationship with microorganisms to break down cellulose. Ruminants do not break down cellulose by remastication. That is simply for particle size—for better absorption. The cellulose breakdown produces VFA's, AA, and proteins. ○ **Reticulum:** Has a honeycomb appearance, facilitates bigger particles from smaller particles—forming a bolus. This bolus is what will be regurgitated them remasticated. This is where hardware disease can occur. ○ **Omasum:** Has many piles (to increase surface area!)—allowing for water absorption. Removes bicarbonate to make digesta more acidic to adjust to the pH of the abomasum before entering the abomasum. ○ **Abomasum:** True stomach of the ruminant. Mixes and stores ingested food. Initiates protein and fat digestion, i.e., chemical digestion (HCl is secreted). It also controls the release of food into the small intestine. ○ **Small intestine:** Where the majority of digestion and absorption of nutrients takes place. ▪ **Duodenum:** mixing gastric digesta (going to be more acidic coming from the stomach. Pancreatic secretions take place	

Appendix G Continued

		here to increase the pH of the digesta since it was so acidic coming from the stomach. This protects the rest of the small intestine. ▪ **Jejunum:** where the majority of digestion and absorption takes place ▪ **Ileum:** has some digestion and absorption take place. Used for nutrition research to see what the animal has absorbed and not absorbed. o **Large intestine:** Consists of the cecum and colon. The main function is the absorption of water.	
4:15 PM - 4:30 PM (15 min)	**Post CoRe**	• Students will complete a post-CoRe with a content assessment. • Instructors will clean up and set up for the next stations.	• Post CoRe via BrightSpace.
4:30 PM - 5:00 PM (30 min total)	**Group Rotation Activities**		
Group 1: 4:30 PM- 4:45 PM (15 min) **Group 2: 4:45 PM- 5:00 PM** (15 min)	**Order Form Activity**	• Students will utilize the next 20 minutes to complete a supply & inventory list based on their assigned scenario. • Students will locate what resources for 5 items are available to gather the items they need for a lab like this. • They will also put together an order form.	• Supply & Inventory Scenario A • Supply & Inventory Scenario B • Supply & Inventory Scenario C • Supply & Inventory Sheet Activity Sheets
Group 1: 4:30 PM- 4:45 PM (15 min) **Group 2: 4:45 PM- 5:00 PM** (15 min)	**Preserved Animal Repro Tracts Activity**	• Students will take the next 15 minutes to review what they watched in the animal repro videos before class and see if they can identify anything familiar on the preserved tract. • An instructor will guide the group with probing questions to compare what students observe between a preserved tract and a fresh tract.	• Preserved vs Fresh Tracts Handout • Preserved tract • Fresh tract
5:00 PM - 5:20 PM (20 min total)	**Discussion**		
5:00 PM - 5:20 PM (20 min total)	**Final Discussion**	• Some probing discussion questions could be: o What learning activities did you complete in advance of today's lesson? How did they help you prepare for the dissections? o How were the two dissections conducted today structured? How/why might you modify them in a future class?	

		o What supplies did we use today that would be useful for your assigned scenario? o Where else can you conduct a lab like today if you didn't have access to a science lab classroom? o What misconceptions or misunderstandings would you anticipate your students having when moving through a dissection lab? How can you uncover and respond to these?	

APPENDIX H. DISSECTION LAB ORDER FORM ACTIVITY SCENARIOS

Scenario A

As you are drawing near to your Animal Nutrition Unit within your Animal Science course, you look ahead to ensure you've got the appropriate supplies to conduct a dissection. You plan on addressing the following state standards with your dissection lab:

Core Standard 3: Students analyze the nutritional needs of animals and evaluate feed rations for effectiveness.

AS-3.1 Differentiate between nutritional requirements of animals in different growth stages and production systems (e.g., growth, maintenance, gestation, natural, organic, etc.).

AS-3.2 Correlate a species' nutritional needs to feedstuffs that could meet those needs.

Core Standard 7: Apply principles of comparative anatomy and physiology to uses within various animal systems.

AS-7.3 Compare and contrast animal cells, tissues, organs, body systems types and functions among animal species

You teach 2 classes of Animal Science. There are 22 students in one class, and 15 in the other. Class periods last 55 minutes, and you have budgeted up to 3 days in your curriculum scope and sequence to be able to conduct a dissection lab. You have a classroom with large tables that you plan on using to conduct the dissections upon. You've tried to obtain fresh tracts previously, but don't have a way to freeze them. Most of the processing facilities in your area have closed down recently anyway, as the area becomes increasingly suburbanized. You have $500 that you can spend on supplies for this lab. ***How can you provide a dissection experience for your students?***

Preserved tracts are likely your main option. Common sources of preserved tracts and dissection supplies include: Ward's Science, Carolina Biological, NASCO, and Fisher Scientific.

1. How might you structure your dissection? Will students be working in pairs, groups, or will you be leading a demonstration?

2. Based on the lesson format, how many tracts will you need to order?

3. How will you store your supplies leading up to the lab?

4. What safety considerations do you need to prepare for?

5. What tools/equipment will you need to conduct your dissection?

6. What PPE will be necessary for students and yourself to conduct these dissections? From whom will you purchase this PPE?

7. Using the supplied Purchase Order form, compose a set of Purchase Orders that will be used to obtain the supplies need for your dissection lab. Remember that each PO form is for only one company, so if you order from multiple companies, you will need to create a separate PO for each one. A sample PO is posted on Brightspace as an example, in addition to a copy of a blank PO.

Scenario B

As you are drawing near to your Animal Reproduction Unit within your ALS Animals course, you look ahead to ensure you've got the appropriate supplies to conduct a dissection. You plan on addressing the following state standards with your dissection lab:

Core Standard 5: Students evaluate animals for breeding readiness and soundness, and apply scientific principles to select and care for breeding animals.

ALSA-5.8 Compare and contrast the reproductive organs for male and female domesticated animal species.

ALSA-5.12 Describe spermatogenesis and sperm motility. List and explain factors that affect both.

ALSA-5.26 Evaluate the implementation and effectiveness of artificial insemination techniques.

Core Standard 8: Students apply principles of comparative anatomy and physiology to uses within various animal systems.

ALSA-8.1 Correlate the functions of animal cell structures to animal growth, development, health and reproduction.

ALSA-8.5 Identify and explain the major organ systems found in vertebrae systems (Muscular, Skeletal, Circulatory, Respiratory, Digestive, Nervous, Endocrine, Integumentary, Excretory, Urinary, Immune).

You teach 1 class of ALS Animals. There are 31 students in the class. Class periods last 55 minutes, and you have budgeted up to 3 days in your curriculum scope and sequence to be able to conduct a dissection lab. Fortunately, a member of your chapter's FFA Alumni & Supporters works at a processing plant and can provide you fresh tracts whenever you need them, as long as you give them a week's notice. Unfortunately, your classroom is cramped and has limited space, as students are seated at individual desks instead of workbenches, and there are no counters available. The only place you can safely conduct a dissection is in your Ag Mechanics Shop. You have $500 that you can spend on supplies for this lab. ***How can you provide a dissection experience for your students?***

Preserved tracts are likely your main option. Common sources of preserved tracts and dissection supplies include: Ward's Science, Carolina Biological, NASCO, and Fisher Scientific.

1. How might you structure your dissection? Will students be working in pairs, groups, or will you be leading a demonstration?

2. Based on the lesson format, how many tracts will you need to order?

3. How will you store your supplies leading up to the lab?

4. What safety considerations do you need to prepare for?

5. What tools/equipment will you need to conduct your dissection?

6. What PPE will be necessary for students and yourself to conduct these dissections? From whom will you purchase this PPE?

7. Using the supplied Purchase Order form, compose a set of Purchase Orders that will be used to obtain the supplies need for your dissection lab. Remember that each PO form is for only one company, so if you order from multiple companies, you will need to create a separate PO for each one. A sample PO is posted on Brightspace as an example, in addition to a copy of a blank PO.

Scenario C

Congratulations! You've made it to the end of the school year in your ALS Animals courses. This year you have 2 sections consisting of 16 and 29 students. At the end of the year, you plan to conduct a fetal pig dissection to allow students to see how all of the organ systems work together to maintain homeostasis (systems dependency). You have previously conducted dissections as a whole class on various organ systems, but it has primarily been teacher-led, due to budget constraints.

Your fetal pig dissection occurs over the course of 3 days. Students utilize the following manual that guides them through dissecting the specimen, working in pairs or trios: https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1014&context=qc_oers

Students are assessed on their responses to the questions at the conclusion of each of the 3 major sections of the dissection:

Fetal Pig Anatomy I: External Features, Oral Cavity, Pharynx, and Digestive System

Fetal Pig Anatomy II: The Respiratory System & Cardiovascular System

Fetal Pig Anatomy III: The Urogential System

This lab sums up the learning occurring across multiple units during your course this year, so multiple state standards for ALS Animals are met through these lab activities. The state standards for ALS Animals can be found here: https://www.doe.in.gov/sites/default/files/standards/als-animals-framework.pdf

As you approach the final weeks of the course, you receive an email from a parent expressing concern for the upcoming fetal pig dissection. The parent saw the that the lab would be coming up soon based on what had been posted to your Learning Management System and the course syllabus. Their child is a student in your smaller section of 16 students, and has thoroughly enjoyed learning about animals across the school year. Although they were ok with watching you conduct dissections in front of the whole class the rest of the year, the student feels extremely uncomfortable conducting a dissection themselves (even with a partner), expressing a moral objection to conducting dissection. They have also opted out of dissections in their biology classes in previous years.

After talking with your principal about the student's objection to the planned dissection activity, your principal suggests coming up with an alternative activity for the student. While there is no law currently on the books in Indiana that allows students to opt-out of dissections, neighboring states like Illinois do have one, and lawmakers in Indiana have tried to pass laws as recently as 2019 to allow students this choice (https://www.wfyi.org/news/articles/lawmaker-wants-even-more-choice-in-hoosier-schools-for-dissecting-animals). Your principal thinks that this could potentially spin out of control, and advises that you allow the student to complete an alternative assignment.

1. How will you assess student learning? How will you ensure that the alternative assignment is aligned with the assessment that students who are conducting the actual dissection are completing?

2. What options do you think you might be able to use? Will you need to order/pay for anything? How will this compare in terms of time to prepare, and time to complete?

3. How would you approach having a conversation with the student and their parent?

APPENDIX I. LABORATORY PRACTICES IN AGRICULTURAL EDUCATION FALL 2021 SYLLABUS

PURDUE UNIVERSITY
College of Agriculture

ASEC 34000
Laboratory Practices in Agricultural Education
Fall 2021

INSTRUCTORS

Dr. Sarah E. LaRose
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F2F Meetings in Lilly 3-214 or 3-215
Zoom: https://bit.ly/McGuireStudentHours

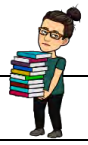
COURSE INFORMATION

Time and Location (August 23rd – December 10th)
Lecture: Wednesdays 3:30 – 4:20 pm
Lab: Thursdays 2:30 – 5:30 pm
Lilly Hall of Life Sciences 3-102 and 3-119; off-site locations

Course Description (2 Credit Hours)
This course is designed to introduce pre-service agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle school and secondary school level. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources. Travel to on and off-campus sites will be required.

Course Essential Questions and Learning Objectives
EQ1. What is the role of the laboratory in school-based agricultural education?
Objective 1: Assess the role of laboratory integration in agricultural education.
Objective 2: Identify types of laboratory teaching spaces utilized in agricultural education.
EQ2. How do I design, manage, and evaluate Agriscience laboratory instruction?
Objective 3: Design student Agriscience projects to promote student skill development.
Objective 4: Create an organizational system to manage laboratory supplies and spaces.
Objective 5: Develop a system by which to evaluate Agriscience laboratory activities and projects.
EQ3. What safety concerns should I be aware of during laboratory instruction?
Objective 6: Develop and implement an Agriscience laboratory safety instructional program.
Objective 7: Analyze teaching spaces and laboratory activities for potential safety concerns.

Required Text:



Author(s)	Publication Year	Title	ISBN
Talbert, B.A., Vaughn, R., Croom, B.D., & Lee, J.S.	2014	Foundations of Agricultural Education (3rd edition)	ISBN-10: 0132859602 ISBN-13: 978-0132859608

Optional Text:

Froschauer, L., & Bigelow, M. L. (2012). *Rise and Shine: A practical guide for the beginning science teacher.* Arlington, VA: National Science Teachers Association Press.

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

Supplemental Resources:

Additional course readings and handouts may be drawn from other sources such as the ones below:

- National Council for Agricultural Education (2015). *National AFNR Content Standards, Revised 2015.* Retrieved from https://thecouncil.ffa.org/afnr/
- National Council for Agricultural Education (2016). *National Quality Program Standards for Agriculture, Food, and Natural Resources Education.* Retrieved from: https://thecouncil.ffa.org/program-standards-tool/
- National FFA Organization. (1998). *Agriculture teacher's manual*. Indianapolis, IN: Author. Retrieved from https://archives.iupui.edu/bitstream/handle/2450/3042/Agricultural%20Teachers%20Manual%2C%201998.pdf?sequence=1
- National FFA Organization. (2019). *National FFA Website* (www.ffa.org).

Other Required Resources:

You will need to arrive to class with appropriate attire for the lab of the day. This will typically include the following:

- Sturdy, closed-toe shoes (work boots are ideal)
- Clothing that covers your midriff, legs, arms, and back so that you are protected from potential chemicals or other supplies which might injure your skin. This clothing may get dirty.
- No loose, dangling jewelry, hoodie strings, or long hair. Bring something to tie your hair back with if you have long hair
- On days where we head outside, it would be useful to bring sunglasses, a hat to shade your face, and a bottle of water
- Clipboards are handy for taking notes in a setting where we might not have a writing surface.

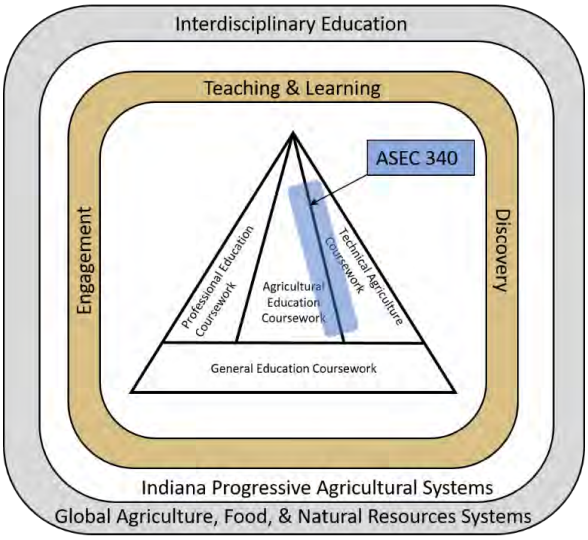
Important Websites:

www.doe.in.gov/licensing/lvis - How to secure an initial Indiana teaching license.

www.ffa.org – Resources for teachers/FFA Advisors
Username: _____

WHERE THIS COURSE FITS IN YOUR PROGRAM OF STUDY

Purdue Ag Education Program Model



EXPECTATIONS FOR SUCCESS

What can you expect from us as your instructors?

- Instruction in up-to-date course content, delivered in a variety of ways, drawing from research-based best practices and personal experiences as agricultural educators
- Constructive feedback on course assignments to encourage your growth and success
- Timely and clear communication through Brightspace and Purdue email channels
- Individualized support as needed – we love to help!
- Thought-provoking questions and challenging assignments to push your growth as a professional educator
- Believing that you are capable to demonstrate a high standard of performance – you will one day be influencing the minds and hearts of students!

What do we expect from you as students?

- Putting your best effort into your work but not at the expense of your physical and mental well-being
- To believe in your own ability to grow as an educator
- To arrive prepared to engage in course material and learning activities; this is a course heavily based on laboratory experiences and participation. Please capitalize on the opportunity to learn!
- Timely completion of course readings and assignments
- To ask questions which help clarify your understanding or deepen discussion
- To be your own best advocate – if you need help, be sure to ask!
- To practice the skills and dispositions necessary to be an inclusive educator.

What do you expect from your peers in our learning community?

- Be a kind person; Treat others the way they want to be treated.
- Be willing to have your thinking challenged.
- Actively participate in class activities.
- Arrive to class ready to start on time.
- Be supportive and willing to assist each other outside of class.
- Don't be afraid to ask questions and help others when they have questions.

ATTENDANCE & ACTIVE ENGAGEMENT

Attendance and active engagement in this class is an essential component of this course. Consequently, active engagement in class sessions is required and is factored into the grade for each student. As such, students are expected to attend each class session. Furthermore, material covered in this course is absorbed through discussion, small group participation, and hands-on classroom activities. Therefore, your presence and active participation are vital to the learning experience in this class. Your active engagement will be assessed using the Active Engagement rubric posted on Brightspace, during 4 randomly chosen lab classes.

Note: Each assignment will have a due date and no late work will be accepted for full credit unless you have a verified excused* absence. Any assignments/quizzes/exams or other graded items will have a 5% grade reduction for each day they are late, up to 7 days, at which time late items will no longer be accepted and a 0 will be assigned.

*An excused absence is defined as an absence in which the student advises the instructor before the class takes place and the student provides written verification for the excuse. Verification means that a written explanation of the absence signed by the appropriate authority (e.g., physician, coach, advisor). However, regardless of the reason for your absence, you are responsible for material covered in class, any changes in assignments, and for adequate preparation for the day you return.

PROTECT PURDUE ADHERENCE

The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask in classrooms and campus building, at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

IF YOU NEED TO QUARANTINE OR ISOLATE

If you become quarantined or isolated at any point in time during the semester, please contact me as soon as possible to let me know so we can develop a plan to continue to support you from a distance. If you experience any symptoms of COVID-19 or suspect you may have been exposed to someone with COVID-19 stay home and call the Protect Purdue Health Center at (765)496-INFO. In addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

NAME AND PRONOUN USAGE

We will honor the names and pronouns you provide, and your request at any point to address you by your correct name and/or gender pronoun. Please advise us of how you would like to be referred to in class. We also expect class members to honor the names and pronouns peers provide. If you would like more information about gender- and sexual-identity, gender-neutral and inclusive language, or the role gender plays in our culture, please visit these resources:
Gender Spectrum – Understanding Gender
The Genderbread Person infographic that distinguishes among gender identity, gender expression, biological sex, and sexual orientation
Purdue LGBTQ Center - https://www.purdue.edu/lgbtq/

GRIEF ABSENCE POLICY FOR STUDENTS

Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the death of a member of the student's family.

MODE OF COMMUNICATION

The most common form of communication will occur face-to-face in class. However, there are times when updates must be sent regarding changes in course assignments, class meeting times and guest speakers, etc. Students should check their Purdue email and Brightspace periodically throughout the week in order to stay up-to-date with the latest information. Please allow 24 hours (1 working day) for a response. Emails sent over the weekend will be answered by noon on the first Monday.

PROFESSIONALISM IN THE CLASSROOM

In order to maintain a quality learning environment that encourages respect for the instructor, guest speakers and your classmates, please arrive on time, disengage from electronics (unless otherwise instructed) and contribute to the class.

COURSE ASSIGNMENTS

We will primarily assess your learning through performance-based assessments where you have an opportunity to apply the skills developed in this course. Additionally, written reflections on your learning will be used as a means to assess your growth as a learner. Unless otherwise indicated, all assignments are to be submitted on Brightspace by 11:59 pm on the due date.

Appendix I Continued

Assignment Criteria

Proofread and edit all assignments prior to submission.

1. Please type all assignments.
2. Spelling and grammar always matter and are graded.
3. Contact the instructor with questions about any assignments well in advance of the due date.
4. Please submit all assignments as an MS Word or PDF document via Brightspace unless indicated otherwise by the instructor.
5. Format references and citations in APA format.
6. If applicable, use the supplied template for appropriate assignments posted on Brightspace.
7. Save assignment documents with clear titles such as:
    - "LastName_LaboratoryProposalNarrative.docx"
8. Please place in a header or at the top of the first page of all assignments the following information:
    - Title of Assignment, Your Name, ASEC 340, Instructor's Name, Date

Late Work

As this course emphasizes development of instructional design, delivery, and assessment skills, the content explored occurs in a sequential manner, in which you will build foundational knowledge and skills that will help you with subsequent assignments. Therefore, it is imperative that assignments are completed in a sequential order. The posted assignment due dates are listed to help you stay on track and prioritize completion of course material. No late work will be accepted for full credit unless you have a verified excused absence. If you are unable to complete the assignment by the due date, you may contact me (slarose@purdue.edu) and I will do my best to negotiate a revised due date at my discretion.

Excused absence: an absence in which the student advises the instructor before the class takes place and the student provides written verification for the excuse.

Verification: means that a written explanation of the absence signed by the appropriate authority (e.g., physician, coach, or advisor).

Regardless of the reason for your absence, you are responsible for material covered in class, any changes in assignments, and for adequate preparation for the day you return. Any work submitted more than a week after the due date will automatically result in a zero.

Assignment Descriptions

Below are brief descriptions of the major course assignments. Please see assignment descriptions on Brightspace for more detailed information.

Lab Use Infographic 1

At the beginning of this course, reflect on the following questions:

- *Why* do agriculture teachers use laboratory settings?
- *How* do agriculture teachers use laboratory settings?
- *How do YOU* plan to use laboratory settings?
- What key aspects regarding laboratory setting use do you have *questions* about?

Using technology such as www.canva.com, create an infographic that illustrates your thoughts on the above questions.

Lab Use Infographic 2

After your experiences in this class, your beliefs about how and why agriculture teachers utilize laboratory settings may have changed. Update your original infographic to reflect how your views may have changed, and why you now may think differently.

Teaching Laboratory Facility Proposal, Design, and Narrative

You will design a teaching laboratory facility of your choice to be utilized by a secondary school agriculture program. This design is for a single facility, such as a greenhouse, head house, large animal facility, Ag mechanics lab, food science lab, etc. You may choose to develop a proposal for either modifications to an existing facility, or to design a brand new facility.

There are two components to this project:

1) Teaching laboratory proposal
2) Teaching laboratory final design and narrative

The following elements should be included in your teaching facility proposal:

- Type of facility, what classes it is designed for
- Number of students designed to accommodate
- Justification for how this facility will support/improve the educational value of the SBAE program
- Type of equipment necessary
- A brief sketch or sample photos of the type of facility you would like to design

The following elements should be included in your teaching facility final design and narrative:

- All of the elements included in your proposal, with adjustments made based on feedback
- An explanation for why each component was chosen
- An explanation for how each component will be used in the facility
- An explanation of how this facility will improve the educational value of the SBAE program
- A description of why you designed the facility in the manner you did
- All of the above should be written in a manner which explains your proposal as a sales pitch to your school administration in an effort to fund construction of the project.

Laboratory Manager Portfolio

You will develop a portfolio of equipment and resources which can be used to teach within agricultural laboratory settings. This portfolio should aid you in preparing to teach a variety of laboratory topics within SBAE as an agriculture teacher. Each week, you should add to this portfolio as we move throughout the various laboratory settings this semester. An example will be provided as a guide. For each topic we cover you should add the following elements to your portfolio:

1) Tools and instructional equipment needed to teach that lab topic
    a. Include potential supplier source, price, and picture of tool
    b. SDS for any chemicals needed
2) One article which you could use to supplement your students' knowledge regarding that lab topic. This should be accessible for learners at middle and high school reading levels.

Skills Assessment Tool

You and a partner will be responsible for developing a skills assessment which assesses students' skills during one of the class laboratory trips. You will be assigned one laboratory experience to assess. You should develop this tool in advance of the laboratory in which you are to use the assessment, and submit a final copy of the tool after using it to assess your peers. Your final copy of the skills assessment tool is due within 1 week of the laboratory in which you used it.

Safety Quiz

You will design a safety quiz for the laboratory of your choice. The safety quiz should be set up to be taken by students before they are permitted to work in the laboratory. The quiz should be of appropriate length to adequately assess necessary safety aspects, and should include a variety of question formats. You are responsible for meeting with Dr. LaRose 1 week prior to your laboratory site visit to ensure you've considered various aspects of safety specific to that lab. You should have a working draft of your safety quiz constructed prior to your meeting with Dr. LaRose. Your final copy of the safety quiz is due within 1 week of the laboratory in which you used it.

Weekly Questions for Laboratory Site Visits

You will be responsible for creating a minimum of 2 unique questions for each weekly on-site laboratory visit. You will post your unique questions on Brightspace by Tuesday at 5:00 pm prior to each laboratory site visit on Thursday. You should not post a similar question that has been previously posted.

Weekly Laboratory Reflections

Following each laboratory site visit, you will be required to complete a one-page (double spaced) reflection which is due within 48 hours following the laboratory experience. Your reflection should specifically discuss the following:

- What agricultural skills were learned/taught during the lab?
- How did the instructor guide your skill development as a learner?
- How would you plan on using the agricultural skills and teaching techniques you learned today within your own future classroom instruction, SAE, and FFA delivery?

GUEST LECTURERS & FIELD TRIPS

Through the semester guest lecturers will be invited to give special presentations to the class covering a range of topics. As such, it is extremely important to come prepared to ask the guest lecturer questions and be prepared to engage in the learning activities led by the guest lecturer. This class also involves travel to on and off-campus locations to situate ourselves within agricultural teaching lab settings. Advance notice will be given to allow for travel arrangements to be made.

ACCOMODATIONS

Students with disabilities must be registered with Adaptive Programs in the Office of the Dean of Students before classroom accommodations can be provided. If you are eligible for academic accommodations because you have a documented disability that will impact your work in this class, please schedule an appointment with me as soon as possible to discuss your needs.

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

COURSE EVALUATION

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. We strongly urge you to participate in the evaluation system.

UNIVERSITY INFORMATION

Nondiscrimination Policy

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue's nondiscrimination policy can be found at: http://www.purdue.edu/purdue/ea_eou_statement.html

Report Hate and Bias

Purdue University is a community where diversity is valued and incidents of hate and bias are not tolerated. Students, faculty, staff, and campus visitors who feel that they have been the victim of a bias related incident (or who have witnessed a bias related incident) are encouraged to report it online using the following link or to contact the Office of Student Rights and Responsibilities at (756)494-1250.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern. Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

Mental Health Resources – CAPS

- **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try** WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.
- **If you need support and information about options and resources**, please contact or see the Office of the Dean of Students. Call (765)494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester.

- Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.
- **If you're struggling and need mental health services**: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Course Changes

The instructor reserves the right to modify and adapt the course syllabus throughout the semester as needed. All changes will be posted to BrightSpace.

COURSE SCHEDULE

A Note on Flexibility

This is the first semester this course has been taught at Purdue. While I have the absolute best intentions to adhere to the proposed schedule, it is likely that things will change as we go along. I hope you are willing to engage in this exciting process of course creation and knowledge development!

Week	Date	Topics	Readings Due	Assignment Due
1	W: 8/25 Lecture	Course introductions, expectations How do agriculture teachers use lab settings?	1. Utilizing School Laboratories Ag Ed Mag 2. Talbert Ch. 10 Classroom and Laboratory Facilities 3. 2. Talbert Ch. 21 Using Laboratories	
	TH: 8/26 Lab Lilly 3-119	Class Expectations Scientific method, inquiry, and instructional methods in lab settings	1. Experiential Learning in the 21st Century Ag Ed Mag 2. A Study on Teaching Critical Thinking in Science 4. "What is Inquiry Based Instruction?" 4."Implementing Inquiry Based Teaching Methods" 5. "Bringing Inquiry-Based Learning into your Class" MacKenzie (2016) 6. "Rethinking Laboratories: Tools for converting cookbook labs into inquiry" Volkmann & Abell (2003) 7. "How to Teach with Classroom Experiments"	Weekly Lab Reflection

Appendix I Continued

2	W: 9/1 Lecture	Designing in-class labs for learning engagement and safety	1. OSHA Brief: Hazard Communication Standard – Safety Data Sheets	**Lab Use Infographic 1**
	TH: 9/2 Lab Lilly 3-119	Ensuring safety in lab settings	1. Safety in Ag Ed Laboratories Ag Ed Mag 2. Safer STEM and CTE Classroom/ Laboratory Facilities Design 3. Innovative Strategies for More Engaging Safety Instruction 4. Chemical Management Guide for School Administrators 5.	Weekly Lab Reflection
3	W: 9/8 Lecture	Management of agricultural teaching lab facilities	1. Talbert Ch. 10 Classroom and Laboratory Facilities 2. Talbert Ch. 21 Using Laboratories	Weekly Questions for Laboratory Site Visits
	TH: 9/9 Lab	Visit area Ag program to tour facilities and interview teacher regarding management practices *Tri-County Junior-Senior High School*		Weekly Lab Reflection **Laboratory Safety Assessment**
4	W: 9/15 Lecture	Utilizing school gardens in Agriscience instruction to teach Good Agricultural Practices (GAPs) *Mrs. Alicia Geesey*	1. Teaching from the Garden 2. Garden-Based Learning 3. Cornell Garden-Based Learning 4. National Good Agricultural Practices Program 5. Grant Helps Franklin Schools Expand Farm-to-Table Program	Weekly Questions for Laboratory Site Visits
	TH: 9/16 Lab	Garden management practices at Purdue Student Farm	https://www.purdue.edu/hla/sites/studentfarm/	Weekly Lab Reflection

Appendix I Continued

5	W: 9/22 Lecture	Goals of Lab-based instruction Experiential Learning Theory in Lab-based instruction	1. What is Experiential Learning? 2. Experiential Learning: Learning by Doing 3. Experiential Learning in the 21st Century Ag Ed Mag	Weekly Questions for Laboratory Site Visits
	TH: 9/23 Lab	Evaluating student learning in lab settings	1. Performance-Based Assessment: Reviewing the Basics 2. Authentic Assessment in Action	Weekly Lab Reflection
6	W: 9/29 Lecture	Teaching Virtual Labs *Mrs. Leslie Fairchild*	1. CTE Distance Learning Resources 2. "Implementing Inquiry Based Teaching Methods" 3. "Tips for Designing an Online Learning Experience Using the 5Es Instructional Model"	Weekly Questions for Laboratory Site Visits
	TH: 9/30 Lab Lilly 3-119	Teaching Virtual Labs *Mrs. Leslie Fairchild*		Weekly Lab Reflection
7	W: 10/6 Lecture	Managing test plots	1. School Test Plot Thread on NAAE Communities of Practice 2.	Weekly Questions for Laboratory Site Visits
	TH: 10/7 Lab	Trip to Purdue Agronomy Farm	https://ag.purdue.edu/agry/acre/pages/default.aspx	Weekly Lab Reflection
8	W: 10/13 Lecture	Teaching Anatomy and Physiology	1. Responsible Use of Live Animals and Dissection in the Science Classroom 2.	Weekly Questions for Laboratory Site Visits **Teaching Facility Proposal**
	TH: 10/14 Lab Lilly 3-119	Dissection Lab		Weekly Lab Reflection

Appendix I Continued

9	W: 10/20 Lecture	Elements of live animal evaluation	1. Livestock Judging Teaching Aids	Weekly Questions for Laboratory Site Visits
	TH: 10/21 Lab	Live animal evaluation – at Purdue ASREC		Weekly Lab Reflection
10	W: 10/27 Lecture	**National FFA Convention NO CLASS**		
	TH: 10/28 Lab	**National FFA Convention NO CLASS**		
11	W: 11/3 Lecture	Food Science resources and preparation *Mrs. Leslie Fairchild*	1. Science and Our Food Supply 2. Food Safety Investigation	Weekly Questions for Laboratory Site Visits
	TH: 11/4 Lab Lilly 3-119	Food Science Sensory Lab		Weekly Lab Reflection
12	W: 11/10 Lecture	Animal Food Product Hazards & Chemistry *Dr. Stacy Zuelly*		Weekly Questions for Laboratory Site Visits
	TH: 11/11 Lab	Tour Meats Processing Facility Designing Labs to explore principles of food safety and science		Weekly Lab Reflection
13	W: 11/17 Lecture	Food Chemistry and Dairy Foods *Dr. Stacy Zuelly*		Weekly Questions for Laboratory Site Visits
	TH: 11/18 Lab			Weekly Lab Reflection
	11/24-11/25	**NO CLASSES – THANKSGIVING BREAK**		

Appendix I Continued

14	W: 12/1 Lecture	**NO CLASS**		
	TH: 12/2 Lab	**NO CLASS**		**Final Teaching Facility Design & Narrative**
15	W: 12/8 Lecture	Reflections on Designing Effective Instruction – Group CoRe Ideation Session		
	TH: 12/9 Lab	Reflections on CoRes Group Discussion Utilizing Existing Facilities and Planning for the Future Course Wrap-up		**Lab Use Infographic 2**
16		Final Exam Week		**Lab Manager Portfolio Due 12/15 11:59 pm**

COURSE ASSIGNMENT SCHEDULE

Assignment	Due Date	Points Possible	Points Earned
Active Engagement (30 points per lab) x 4 random labs	Throughout	120	
Lab Use Infographic 1	9/1	25	
Laboratory Safety Assessment	9/9	100	
Teaching Laboratory Facility Proposal	10/13	100	
Weekly Questions for Laboratory Site Visits (10 points each) x 3 lab site visits	Continuous	30	
Weekly Laboratory Reflections (20 points each) x 12	Continuous	240	
Teaching Laboratory Facility Final Design & Narrative	12/2	100	
Lab Use Infographic 2	12/9	25	
Lab Manager Portfolio (20 points per weekly lab topic)	12/15	200	
Total Points		**940**	
Extra Credit Opportunities (Choose 1)			
Skills Assessment Tool	12/15	25	
Safety Quiz	12/15	25	

All assignments are due by 11:59pm on the due date indicated unless otherwise posted on Brightspace

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
97.0-100%	94.0-96.9%	90.0-93.9%	87.0-89.9%	84.0-86.9%	80.0-83.9%	77.0-79.9%	74.0-76.9%	70.0-73.9%	67.0-69.9%	64.0-66.9%	60.0-63.9%	0-59.9%

Purdue Honor Pledge

Purdue's Honor Pledge was developed by students to advance a supportive environment that promotes academic integrity and excellence. It is intended that this pledge inspires Boilermakers of all generations to stay "on track" to themselves and their University.
See https://www.purdue.edu/provost/teachinglearning/honor-pledge.html for more information.

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together – we are Purdue."

EMERGENCY PREPAREDNESS

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept – if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside.

- **Indoor Fire Alarms** mean to stop class or research and immediately **evacuate** the building.
  - Proceed to your Emergency Assembly Area away from building doors. **Remain outside** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.
- **All Hazards Outdoor Emergency Warning Sirens** mean to immediately seek shelter (**Shelter in Place**) in a safe location within the closest building.
  - "Shelter in place" means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. **Remain in place** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

**In both cases, you should seek additional clarifying information by all means possible…Purdue Emergency Status page, text message, email alert, TV, radio, etc…review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/ehps/emergency_preparedness/warning-system.html*

EMERGENCY RESPONSE PROCEDURES:

- Review the **Emergency Procedures Guidelines** https://www.purdue.edu/emergency_preparedness/flipchart/index.html
- Evacuation locations:

1) ***Primary location (should be outside, in an area away from the building):*** There are three assembly areas for Lilly Hall in an evacuation situation. If you are leaving Lilly Hall via the main entrance or via the northeast exits, walk to the grassy area in front of Smith Hall. Those leaving from the southwest (Corridor #2) and dock exits walk south, go around the greenhouses and meet in the grassy area south of the head house. Those leaving the southwest or northwest exits (Corridors 3 and 4) proceed to the grassy area east of Lilly Hall.
2) ***Secondary location (should be inside a nearby building in case of inclement weather):*** Those exiting the main and northeast entrances of Lilly Hall proceed to Smith Hall. Those leaving via the southeast (Corridor #1) and walk to the Hanson Building. Those exiting from the southwest and northwest doors (Corridors 3 and 4) may carefully cross Russell Street to Poultry and/or Grounds Department buildings. Those exiting the dock area and the south (corridor 2) may go to LSPS. Do not enter the greenhouses for shelter.

- Review the **Building Emergency Plan** (available on the Emergency Preparedness website or from the building deputy) for:
  - evacuation routes, exit points, and emergency assembly area
  - when and how to evacuate the building
  - shelter in place procedures and locations
  - additional building specific procedures and requirements.

EMERGENCY PREPAREDNESS AWARENESS VIDEOS

- "Shots Fired on Campus: When Lightning Strikes," is a 20-minute active shooter awareness video that illustrates what to look for and how to prepare and react to this type of incident. See: http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campus-video.cfm (Link is also located on the EP website)

MORE INFORMATION

Reference the Emergency Preparedness web site for additional information: https://www.purdue.edu/ehps/emergency_preparedness/

"In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. You may get information about changes in this course by emailing the instructor: slarose@purdue.edu, checking Brightspace, or calling my office number phone: 765-494-8430

Indiana Content Standards for Educators: Career and Technical Education – Agriculture:

Standard 8: Core Knowledge and Skills for Agriculture Teachers

Agriculture teachers have a broad and comprehensive understanding of core knowledge and skills for agriculture teachers, including:

8.1 The structure and delivery of career and technical education in the United States and Indiana and state and federal laws and regulations pertaining to career and technical education

8.3 Interdisciplinary strategies, scientific processes and methods, and procedures used in laboratory and fieldwork investigations in the advanced life sciences

8.5 Social, political, legal, and ethical issues in agricultural education and current trends in agriculture-related fields.

8.6 Scientific methods and principles and their application in teaching agriculture

8.7 Principles and practices for ensuring the safety of students in the classroom, field, laboratory, and supervised agricultural experiences (SAEs)

8.11 Strategies for professional development through participation in professional organizations in agriculture and agriculture education, including the National Association of Agricultural Educators (NAAE)

Standard 9: Agricultural Education Program

Agriculture teachers have a broad and comprehensive understanding of the three-part agricultural education program model, including:

9.1 Elements of the three-part agricultural education program model and how these elements complement each other to provide a total program approach to agricultural education

9.2 Relationships among classroom and laboratory learning, supervised agricultural experiences (SAEs), and active participation in FFA

9.3 Elements of a comprehensive agricultural education program, including community involvement, and systems for program evaluation, school financing and budgeting, and creative program funding

Standard 10: Agriculture Instruction and Assessment
Agriculture teachers have a broad and comprehensive understanding of instruction and assessment in career and technical education and agricultural education, including:

10.1 Indiana Academic Standards for Agriculture Education
10.2 Instructional strategies and resources for integrating instruction that promotes students' achievement of Common Core Standards in English language arts, mathematics, and science
10.3 Strategies and resources for integrating Science, Mathematics, Engineering, and Technology (STEM) instruction; Curriculum for Agriscience Education (CASE); and Advance Life Science standards into agriculture instruction
10.4 Instructional strategies and resources, including inquiry-based, and project-based instruction, and the application of these methods in teaching agriculture and advanced life sciences
10.5 Strategies and skills for planning, designing, and delivering instruction in agricultural education, including the use of techniques and approaches that meet the needs of diverse learners
10.6 Instructional strategies for promoting student learning and fostering the development of critical-thinking, higher-order thinking, problem-solving, and performance skills in agriculture education
10.7 Strategies and skills for creating a productive learning environment using knowledge of student behavior, organizational skills, and classroom management skills
10.9 Strategies and skills for selecting, adapting and using technological resources to enhance teaching and learning about agriculture
10.10 Strategies for promoting students' skills and knowledge required for future success in the workplace, in agricultural occupations, and in post-secondary education

10.10 Strategies and skills for effectively assessing students' understanding and mastery of essential concepts and skills in agricultural education

College of Education Theme:
COE Theme #3: Commitment to Professional Growth.

InTASC (Interstate Teacher Assessment and Support Consortium):

INTASC Standard #3: The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation
INTASC Standard #4: The teacher under stands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.
INTASC Standard #5: The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.
INTASC Standard #6: The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.
INTASC Standard #7: The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context...
INTASC Standard #9: The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.
INTASC Standard #10: The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.