

COMPARING THE CONTENT AND PEDAGOGICAL KNOWLEDGE OF
ALTERNATIVELY AND TRADITIONALLY CERTIFIED AGRICULTURAL EDUCATORS

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State University's regulations and meets the accepted standards for the degree of

MASTER OF SCIENCE

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ABSTRACT

The purpose of this research study is to determine and describe in-service SBAE teachers' perceived Pedagogical Content Knowledge (PCK) and challenges with non-content related classroom material. In general, PCK is the point where knowledge of teaching meets agricultural content knowledge. With the rising number of alternatively certified agricultural educators across the country, it is important to examine PCK in both traditionally and alternatively certified teachers as well as the differences between the two. Since successful classroom management is crucial to teacher retention, it is necessary to look at the differences in difficulty of implementation of various strategies. Agricultural education is diverse and involves numerous topics within the broad industry. This study also describes the sources of content knowledge among the two licensure types. It is recommended that future studies research the PCK of teachers based on years of experience and licensure route.

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unfinished thoughts, or work that was below my ability level. From a stubborn high school sophomore to a master's grad, I thank you.

DEDICATION

This work is dedicated to my incredible family. Mom, your constant support and love truly mean the world to me. For as long as I can remember, you have always told me that my education is something that can never be taken away from me. It is the reason I decided to take graduate classes and why I'm constantly looking for new ways to engage and connect with students. Thank you for encouraging me to be a lifelong learner. I appreciate you proofing my work at a moment's notice and for always being there when I need a sounding board. Your unconditional love and guidance got me here. Thank you.

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LIST OF ABBREVIATIONS

AAAE	American Association for Agricultural Education
AC	Alternatively Certified
CCK	Common Construct Knowledge Construct
CTE.....	Career and Technical Education
ESPB.....	Education Standards and Practices Board
FFA	The National FFA Organization
HCK	Horizon Content Knowledge Construct
KCC	Knowledge of Content and Curriculum Construct
KCS.....	Knowledge of Content and Students Construct
KCT.....	Knowledge of Content and Teaching Construct
MKT.....	Mathematical Knowledge for Teaching
NAAE	National Association of Agricultural Educators
PCK.....	Pedagogical Content Knowledge
SAE.....	Supervised Agricultural Experience
SBAE	School-Based Agricultural Education
SCK.....	Specialized Content Knowledge Construct
TC	Traditionally Certified

CHAPTER 1: INTRODUCTION

Career and Technical Education (CTE) programs have been making a difference in the lives of students for the past century (Wilkin & Nwoke, 2011). More specifically, school-based agricultural education (SBAE), a component of CTE, prepares students for the workforce with both academic and “soft” skills in the context of studying agricultural content (Dailey, Conroy, & Shelley-Tolbert, 2001). A comprehensive school-based agricultural education program follows three intra-curricular components comprising a Venn diagram: classroom instruction, experiential learning through Supervised Agricultural Experience (SAE) programs, and leadership development activities through the National FFA Organization (Dailey, Conroy, & Shelley-Tolbert, 2001). In their classroom and program, agricultural educators work to balance the three circles to engage students in real-world learning situations to contribute to student’s career and life preparation through critical thinking and hands-on activities. In addition, agricultural education teachers strengthen science and mathematics concepts through the context of agriculture (Dailey, Conroy, & Shelley-Tolbert, 2001). All in all, agricultural educators produce employable, well-rounded individuals. However, there are still numerous vacant positions around the country every year.

Annually, in K-12 education, approximately 500,000 educators choose to leave the profession (Solomonson et al, 2019). Just like the nation’s overall teacher shortage, the field of agricultural education continues to face a shortage of qualified teachers (Sutcher et al., 2016; Boone & Boone, 2007; Bowling & Ball, 2018; Foster & Smith, 2018; Solomonson et al, 2019). Although much of the teacher shortage is a result of teacher retirements (Sutcher et al., 2016), many current agricultural teachers are deciding to leave SBAE altogether (Smalley, Hainline, & Sands, 2019). The reasons for departure include increased teaching responsibility, challenges

with classroom management, heavy workloads with curriculum development and lesson planning, working with parents, teachers, and administrators, lack of time, dissatisfaction with the career, or pursuing another job opportunity (Smalley et al., 2019). Regardless of the reason behind teacher vacancies, school districts are facing an up-hill battle in filling these positions with qualified personnel. As a result, many state teacher licensure administrations and teacher preparation programs have investigated and developed alternative pathways to state teacher certification (Bowling & Ball, 2018).

The topic of a teacher shortage in agricultural education has been a focus of inquiry for the profession for several years. Most recently, the American Association for Agricultural Education's (AAAE) 2014-2016 report: Status of the U.S. Supply and Demand for Teachers of Agricultural Education (2018) helps to frame the nationwide scope of the teacher shortage in agricultural education. In that time frame, agricultural education across the country recorded an average of 787 teacher openings each year. The leading vacancy contributor was retirement (27.6%) followed by leaving for positions in agribusiness/industry (13.8%). During that same time frame, an average of 743 individuals completed programs and became license-eligible in agricultural education each year. This gap of supply versus demand has consistently challenged the profession for decades. There are only 18 states that produced more teacher candidates than vacant positions. It was not until 2016 that AAAE evaluated the alternative licensure route and included it as a separate category in the report. In recent years, on average, 18.83% of new hires in agricultural education nationwide were individuals who gained access to the classroom through an alternative route (Smith et al., 2017; Smith et al., 2018; Smith et al., 2019; Foster et al., 2020).

Individual states have differing requirements for each pathway of teacher certification beyond the typical bachelor's degree (Bussey et al., 2010), but in sum, alternative licensure allows for someone classified as an expert in the agricultural industry to obtain a provisional (temporary) teaching license. According to the National Research Council (2010), these differing pathways can be seen as a step in the right direction regarding solving the teacher shortage dilemma. Yet, "little evidence exists regarding the effectiveness of a particular pathway to teacher certification in regard to a teacher's impact on student learning" (Bowling & Ball, 2018, p. 110). The effectiveness of one program over another could be heavily debated with students' learning of the utmost concern. However, the path taken towards education is not necessarily at the forefront of this discussion. In reality, alternatively certified teachers are necessary to help reduce the teacher shortage. It does not seem to matter how many individuals choose to attend and complete a traditional teacher preparation program. It is inevitable that a certain percentage will decide to change careers somewhere along the line (Smith et al., 2018). With this understanding should come the realization that qualified teachers need to come from somewhere. This is where alternatively certified agricultural educators are needed.

Alternatively certified agricultural educators accounted for approximately 20% of new hires in school districts in 2017 (Smith et al., 2018). In general, alternative certification means any certification route other than a traditional four-year agricultural education preparation program. Claflin, Lambert, and Stewert (2020) studied the routes of certification and turnover intentions among early career educators in Wisconsin in an effort to discover why teachers leave the profession early on and to discover a connection to their route of certification. They discovered a "slightly higher turnover intention" in AC teachers compared to TC teachers; however, no clear differentiation between the two routes and their decision to leave emerged. In

sum, the research is scarce on this topic (Claflin et al., 2020). The decision to leave could be due in part to lack of preparation in lesson planning, classroom management, designing assessments and other non-content related teaching practices because they did not have the opportunity to complete an entire traditional preparation program. However, concrete reasons are lacking in the literature. According to Redding & Smith (2016), alternatively certified teachers feel much less prepared for the demands of a classroom than traditionally certified teachers. So, the question arises, what are the teaching and professional development needs to help them become more prepared and ready for a long career in agricultural education?

Developing Knowledge of Teaching

Perhaps the most influential piece of an educator's longevity in the profession is their development of Pedagogical Content Knowledge (PCK) (A. Rice, personal communication, May 27, 2020). The organized concept of PCK has roots dating back to the mid-1980s in the research conducted by Shulman (1986), but more recently, Rice has studied PCK in the context of agricultural education. Pedagogical Content Knowledge, as defined by Rice & Kitchel (2015), is where content knowledge expertise is put into practice by the educator. The foundation of PCK includes knowledge of content, students, students' understanding, teaching methods, assessment, and curriculum (Rice & Kitchel, 2015b). While alternatively certified teachers typically enter the profession with extensive occupational experience and/or focused content knowledge (Claflin, Lambert, & Stewart, 2020; and Rocca & Washburn, 2006), it is important to note that content knowledge is not equivalent to expertise in teaching that material. Pedagogical Content Knowledge, which takes years to develop, is the teacher's ability to take content and turn it into educational practice. This means being able to choose appropriate content matched with a variety of suitable teaching methods transformed into classroom lessons. Additionally, teachers must be

able to scaffold information, identify student misconceptions, and determine how to address those misconceptions (Rice & Kitchel, 2015a).

A teacher's PCK drives the development and implementation of teaching strategies, assessments, and hands-on activities to increase retention of the information. Rice & Kitchel (2017) point to importance of reflection in PCK development. Teachers need to accurately reflect on their own teaching experiences in order to revise and modify lessons for future classrooms. This reflection piece is crucial to the development of PCK and their growth as an educator. The overall development of PCK in educators begins in teacher preparation programs, which includes student teaching experiences. Alternatively certified (AC) teachers typically lack formally developed Pedagogical Content Knowledge because they never experienced a traditional teacher preparation program and consequently, never had a formal student teaching experience. Knowing that teachers are more likely to leave the profession within the first five years of experience (Solomonson et al., 2019), immediate work on teachers' PCK is crucial to their longevity. This is primarily because a thorough understanding and application of PCK allows teachers to make decisions as they relate to the sequencing of content related material and students' understanding of content as well as students' misconceptions (Rice & Kitchel, 2017). Although some work can be done in continuing education courses and in-service professional development workshops, an alternatively certified teacher is late to this development. The gap in their development can be overcome with proper training and reflection. However, that gap can also be the reason the teacher leaves the profession because it overshadowed their short career.

Alternative certification as we know it today has only been in the world of education for approximately 25 years (Walsh & Jacobs, 2007). Because of the relatively short time period

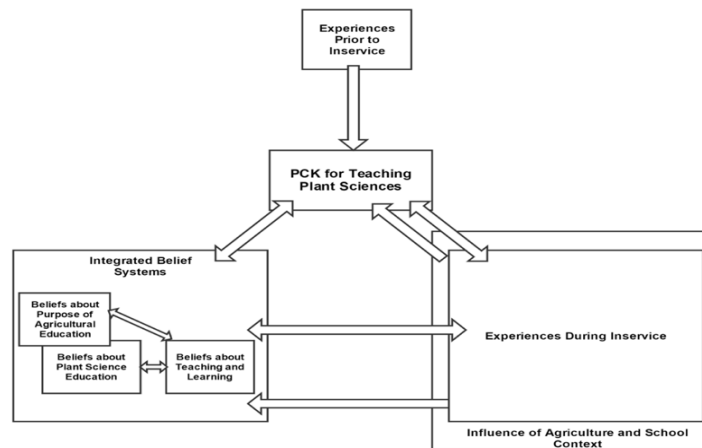
within the profession and the increasing number of these teachers in classrooms, there is a gap in the research focusing on the preparedness of alternatively certified teachers in SBAE.

Theoretical Framework

Rice and Kitchel (2015a; 2015b) and Shulman (1986) explain Pedagogical Content Knowledge as, “a specific type of knowledge for teaching existing at the intersection of pedagogy and subject matter. This knowledge base is where content knowledge expertise is put into practice.” (Rice & Kitchel, 2015a, p. 92). Pedagogical Content Knowledge (PCK) takes the educational theories on scaffolding classroom content, developing lesson plans and activities, effective classroom management, and instructional strategies and marries that with knowledge of a specific content area. In this case, that content area is agricultural education within CTE.

Figure 1.1

Substantive Theory Behind What is Shaping Experienced Agriculture Teachers’ PCK in the Plant Sciences



Note. (Rice, 2015, p 134).

PCK development in educators begins early in teacher preparation courses and truly comes to fruition about five to seven years into one’s career (Rice & Kitchel, 2016). In-practice reflection, professional development workshops, and teaching experience are all key pieces to

understanding and applying PCK in the classroom. Agricultural educators, regardless of certification route, have a vast knowledge and thorough understanding of a variety of topics within the agricultural industry such as animal science, plant and soil science, food science, agricultural mechanics, and biotechnology. Through an accredited teacher preparation program, traditionally certified (TC) agricultural teachers have a solid foundation in being able to break down content knowledge into useable, teachable content for students. Theoretically, their PCK continues to develop as their teaching career progresses because of the repeated experiences, professional growth, and reflective opportunities. On the other hand, alternatively certified teachers lack the pedagogy preparation from college and therefore, may have difficulty turning their expertise into educationally purposeful lessons. Just like traditionally certified teachers, alternatively certified agricultural education teachers continue to develop their PCK throughout the early years of their classroom experiences. According to Rice (2015), an important part of a teacher's PCK development is being a reflective teacher and a lifelong learner. Much of that responsibility on professional growth falls on the shoulders of the individual teacher to identify areas of needed improvement and seek opportunities to develop that skill. The varying components of PCK's theoretical foundation include a combination of pre-service and in-service experiences as well as professional development opportunities. Although alternatively certified instructors did not have the pre-service opportunities, their PCK development is just as important as their traditionally certified colleagues. Ultimately, the goal remains the same: assessing the content and pedagogical knowledge of both alternatively and traditionally certified agricultural educators. Pedagogical Content Knowledge serves as the framework for this study because of its effects on all teachers and consequently, their success in the profession. Overall, teacher retention could improve with the development of PCK in teachers.

Problem Statement and Need for Study

Traditional teacher preparation programs at four-year universities and colleges across the United States are, simply put, not producing enough qualified teachers to fill the number of vacant positions in agricultural education. Because of this, many states have developed alternative pathways to teacher certification in all content areas of education. When looking specifically at agricultural education within Career and Technical Education, alternative certification continues to make up a percentage of new hires each year. In fact, “in 2016, 1,447 agricultural teacher vacancies existed and only 772 individuals completed an approved teacher preparation program to become fully licensed” (Solomonson et al., 2019, p. 116). With rising teacher attrition costs and student success concerns, it is absolutely necessary to look at the needs of alternatively certified teachers. It is clear they are needed to fill the job roles. In many cases, alternatively certified teachers can bring a great deal of expertise in a specific area or industry within agriculture to the four walls of a classroom. But, in order for those alternatively certified teachers to grow as quality educators and to remain in the profession for years to come, their PCK development and professional needs must be evaluated. Some of these non-content related needs can include general classroom management strategies, advantages and disadvantages of a variety of instructional strategies, identifying student misconceptions, and sequencing class content. If state education departments, teacher preparation programs, instructional coaches, and school districts can better understand the needs of their alternatively certified school-based agricultural education (SBAE) teachers, professional development workshops that focus on said needs can be established and utilized in efforts of increasing teacher retention, helping reduce the teacher shortage, and most importantly, providing students with a high-quality education in agriculture.

Purpose of the Study

The purpose of this research study is to determine and describe in-service SBAE teachers' perceived Pedagogical Content Knowledge and self-reported challenges with non-content related classroom activities including: sequencing course curriculum, designing assessments, classroom management, creating student engagement, and instructional strategies.

Research Objectives

The following research objectives guided this study:

1. Describe Pedagogical Content Knowledge of traditionally certified agricultural education teachers.
2. Describe Pedagogical Content Knowledge of alternatively certified agricultural education teachers.
3. Describe the differences in PCK between licensure types.
4. Describe teachers' perceptions of classroom management related to teacher licensure routes.
5. Describe teachers' perceived sources of knowledge in relation to teacher licensure routes.

Terms and Definitions

Alternative certification: a teacher who obtained certification through any state-approved route other than traditional, four-year teacher preparation programs (Walsh & Jacobs, 2007)

Education Standards and Practices Board (ESPB): the independent, governing board of North Dakota educators responsible for “teacher licensure, teacher education program approval, and professional development and professional practices”. (North Dakota Education Standards and Practices Board, 2020)

FFA: youth organization in all 50 states and 3 US territories that “prepares members for premier leadership, personal growth, and career success through agricultural education”. The National FFA Organization is an intracurricular component of agricultural education for those students interested in agriculture and leadership (National FFA Organization, n.d.)

Individual Education Program (IEP): a written plan developed by school districts to accommodate students with learning or emotional disabilities

In-service: licensed teachers actively teaching school-based agricultural education

Pedagogy: educational theory and practice of teaching and learning in the classroom

Pedagogical Content Knowledge (PCK): a specific type of knowledge for teaching existing at the intersection of pedagogy and subject matter. This knowledge base is where content knowledge expertise is put into practice. (Rice & Kitchel, 2015a; Shulman 1986; Rice & Kitchel, 2015b)

School-Based Agricultural Education (SBAE): structured program of instruction in public education giving students the opportunity to learn about science, business, technology of plant and animal production and/or about the environmental and natural resources systems (National FFA Organization, n.d.)

Section 504: a written plan developed by school districts and parents to accommodate for behavior or medical issues impacting classroom achievement

Supervised Agricultural Experience (SAE): work-based learning experience incorporated into agricultural education giving students the opportunity for hands-on experience in a desired area of agriculture (National FFA Organization, n.d.)

Traditional certification: teacher certification route where the candidate has attended and completed a four-year teacher preparation program from a state approved university or college (North Dakota Education Standards and Practices Board, n.d.)

Assumptions

1. We assume respondents answered the survey questions honestly and to the best of their ability.
2. We assume survey participants were currently teaching agricultural education in the United States within the 12 states.

CHAPTER 2: REVIEW OF LITERATURE

Although there has been extensive research and publications related to teacher retention in the United States, there is a gap in research describing in-service alternatively licensed school-based agricultural educators (SBAE). Consequently, state administrators, teacher preparation programs, and local school districts need direction in order to assist these teachers with such professional development needs. Alternatively certified teachers are beginning to make up a larger portion of the educational system due to a general shortage of teachers nationwide. It is crucial to assess their professional needs and devise solutions in an effort to retain them for years to come and help contribute to long lasting school-based agricultural education program quality.

Defining Traditional Certification

Traditional teacher certification refers to attending a four-year university and completing a teacher preparation program. Upon completion of required coursework including a student teaching experience in the public schools, teacher candidates can be recommended for and apply for state licensure within their appropriate content area(s). In addition to the required university/college coursework, the teacher candidate may also need to pass Praxis exams or other state mandated standardized assessments. In order to obtain an initial educator's professional license in the state of North Dakota through the traditional certification pathway, there are several requirements that must first be satisfied (ND ESPB, 2020). First and foremost, teacher candidates must have a "minimum of a four-year bachelor's degree from a state agency-approved teacher education program" (ND ESPB, 2020). In addition to the degree, the teacher preparation program must have included a recognized program area major, general studies component, and a professional pedagogy core meaning they are adequately prepared for all

major aspects of teaching (ND ESPB, 2020). The degree must include a minimum of 22 semester hours, excluding program-specific major courses, which have a basis in teaching and learning.

This coursework must be from the areas of educational foundations, educational psychology, child development, teaching and learning theory, educational diagnosis and assessment, inclusive education, educational technology, classroom and behavioral management, and human relations specific to teaching. The professional education component must also include classroom professional experience prior to student teaching and a minimum of ten weeks of full-time successful participation in student teaching at appropriate grade levels. (ND ESPB, 2020, p. 3)

Furthermore, the teacher candidate must have a minimum overall grade point average of 2.5 on a 4.0 scale, completed the student teaching component under institutional supervision, and submit for a fingerprint screening for criminal records (ND ESPB, 2020). Lastly, applicants for the initial licensure application are required to submit their preprofessional skills, Praxis II, and PLT test scores that meet or exceed the state cut score or composite score and a basic application fee (ND ESPB, 2020).

The five-year license is the next renewal available to North Dakota educators. This will be issued to applicants who have successfully been under a North Dakota teaching contract for eighteen months within the previous five years (ND ESPB, 2020). In addition to a renewal fee, the applicant must have completed six semester hours of reeducation credit (ND ESPB, 2020). Once a teacher has been licensed in the state of North Dakota to teach for thirty years, the applicant can apply for a lifetime certificate. Although reeducation credits and continued professional development is encouraged and recommended, it is not required for teachers with life certificates (ND ESPB, 2020).

In general, traditional preparation can be summarized as a program that includes courses on pedagogy, subject content, and teaching particular populations (Jang & Horn, 2017).

Generally, no matter the content area or university, traditional preparation programs are designed

to give teacher candidates a well-rounded education that provides them with foundational tools for a successful teaching career and lifelong learning experience.

Traditional Agricultural Education Teacher Preparation at North Dakota State University

A four-year bachelor's degree in agricultural education is required for a teaching license through traditional certification in North Dakota. At North Dakota State University, the agricultural education major provides students the opportunity to begin preparatory work in the agricultural field through the College of Agriculture, Food Systems, and Natural Resources. Then, students apply to the School of Education and begin the agricultural education major, which prepares pre-service agricultural educators to teach at the high-school, college, and adult levels. NDSU has been designated as the recognized institution for agricultural education preparation in North Dakota by the Career and Technical Education State Board (NDSU Agricultural Education, n.d.).

The program involves a variety of preparatory coursework including general post-secondary studies and a comprehensive background in the agricultural industry. Since agriculture is so broad and diverse, courses in agricultural economics, agricultural systems management – power and technology, animal science, plant, range, and horticulture science, and soil science provide a solid foundation in the industry (NDSU Agricultural Education, n.d.). The professional education courses include the general teaching courses such as introduction to teaching, classroom management, teaching diverse students, and instructional planning as well as the more advanced, major specific classes. These major specific classes include methods of teaching agriculture, STEM, and planning the community program in agricultural education (NDSU Agricultural Education, n.d.).

More specifically, the degree planner from NDSU contains the following requirements within the content areas:

- General Education Requirements – 40 Credits Required
- Teaching Specialty Requirements – 48 credits
 - Agricultural Economics – 9 credits
 - Agricultural Systems Management – 12 credits
 - Animal Science – 11 credits
 - Plant Science/Soil Science – 13 credits
 - Elective – 3 credits
- Professional Education Coursework

Upon completion of the undergraduate degree requirements (131 undergraduate credits) and the semester student teaching experience as well as passing the Principles of Learning and Teaching (PLT) Exam and the Subject Area Assessment Exam, the pre-service agricultural education teacher will earn a bachelor's degree and can apply for North Dakota teacher licensure (NDSU Agricultural Education, n.d.). In addition, this program is accredited by the Council for the Accreditation of Educator Preparation (CAEP), which means that students are qualified for certification in most states (NDSU Agricultural Education, n.d.). Within various professional education courses, there are required field experiences totaling approximately 40 hours. In these field experiences, students have the opportunity to work with experienced in-service teachers. They observe teaching strategies and methods, educational psychology principles, and classroom management techniques. In the student teaching semester, student teachers gradually take control of the in-service teacher's classroom. The student teacher designs and implements their own

lessons and activities. The student teacher and cooperating teacher work closely on reflection and the development of a well-rounded teacher.

Traditional Teacher Preparation at Other Upper Midwest Universities

Agricultural education preparation programs are often few and far between, with most states only offering traditional teacher preparation programs at one or two post-secondary institutions. According to the degree information and guides published on the respective school's websites, Iowa State University in Ames, Iowa has a similar curriculum guide to NDSU at 128 undergraduate credits with a reasonable mix of general education courses, major specific education courses, and major specific content courses. ISU requires 14 credit hours of student teaching experience. In Minnesota, the two college for choices are University of Minnesota – Twin Cities and University of Minnesota – Crookston at 120 and 124 undergraduate credits, respectively. Crookston and the Twin Cities Campus both require 11 credit hours in student teaching. Comparatively, South Dakota State University requires 120 undergraduate credits with 11 of those being the student teaching experience. Across the board, the colleges discussed in this section have similar rigor in the curriculum guides and place significant emphasis on the student teaching semester and the value that it provides to the teacher candidate. In addition to the bachelor's degree, the states also required state pedagogy and content tests.

Defining Alternative Certification

Rather than trying to define the cumbersome term “alternative certification”, Walsh and Jacobs (2007) defined it instead as what it is not: “it is anything but a four-year undergraduate program housed in a school of education” (Walsh & Jacobs, 2007, p. 13). Alternative certification, in general, can be defined as an expedited, “fast-track” type program or pathway to increase teacher availability in the United States (Jang & Horn, 2017). To put it in a realistic

perspective, the United States Department of Education (2013) reported that in 2009-2010, 12% of all teacher candidates were enrolled in or seeking an alternative certification program (Jang & Horn, 2017). According to Bowling and Ball (2018), there are over 130 varieties of alternative certification pathways across the nation. As a result, it is incredibly difficult to define the requirements for each alternative certification route or develop a summary of the certification as a whole (Bowling & Ball, 2018). Ultimately, there are differences in entry requirements, previous experience, content knowledge, duration, and location (Bowling & Ball, 2018). For the most part, the alternative certification pathway, whichever is available and taken, allows an individual to begin teaching secondary agricultural education on an immediate, but temporary license with the stipulations and guidelines to pursue further training and education (Stair et al., 2019). Regardless of the specifications or requirements of the differing pathways, the goal of alternative certification remains constant: to help relieve the teacher shortage that is affecting all of education. A sufficient supply of qualified teacher candidates is not a recent issue for many areas of education. In fact, agricultural education staffing at the secondary level has been an issue dating back to 1921 (Marx, Smith, Smalley, & Miller, 2017). Recruitment and retention of school-based agricultural educators is the subject of much research and debate across the nation. However, it's thought-provoking to look at the fact that this shortage is not due to lack of graduates from post-secondary agricultural education teacher preparation programs. The shortage is partially a result of graduates who do not pursue a secondary teaching position or choose to leave the profession early (Marx, et al., 2017). This could be due to any number of reasons related to the educators' personal lives or job satisfaction, but the issue of filling these vacant positions still remains at the forefront of school-based agricultural education. In an AAAE publication, Smith, Lawver, and Foster (2018) reported that from 2014 – 2016, the top two

reasons for agricultural education teachers leaving the classroom were retirement and agribusiness/industry, respectively. Illinois, Alabama, Ohio, Kansas, and North Carolina rounded out the top five list of states for the highest agricultural teacher shortfall. This means, their output of graduates did not meet the demand for new positions (Smith, et al., 2018).

Alternative Certification Options

In North Dakota, alternative license options must be initiated by the school district or school administrators. The Education Standards and Practices Board has a one-year license available called the “Alternate Access License”, which can be issued in a documented shortage area – agricultural education falls within that area (ND ESPB, 2020). According to ESPB, the individual seeking this license needs a content specific bachelor’s degree, but this degree does not need to be a teaching degree. If the position is to be long term, the individual must be actively working on a teaching degree (ND ESPB, 2020). The individual must work closely with a university and complete one-third of the teacher education program each year. Because of this collegiate plan of study, the Alternate Access License can be issued for three years, but only one year at a time (ND ESPB, 2020). More recently, North Dakota ESPB permits any licensed teacher to teach any content or grade level outside the original certification area (excluding special education, pre-kindergarten, and kindergarten) for one year before being required to pass the Praxis test for content knowledge. This endorsement aims at helping schools fill high-needs areas for the short-term (ND ESPB, 2020).

South Dakota Department of Education has very similar alternative certification options to North Dakota (South Dakota Department of Education, 2017). The certificate is defined as “An alternative process of completing teacher or administrator certification requirements while simultaneously employed as a teacher or administrator in a public or department-accredited

school.” (South Dakota Department of Education, 2017). Applicants must complete 12 credits, with a C or higher and pass the pedagogy test. Nine of those 12 credits must be in methods of Career and Technical Education (CTE), which can include adolescent psychology, classroom management, student assessment, and differentiated instruction. Additionally, the applicant must complete a three-credit course in South Dakota Indian Studies. The employer of an alternatively certified teacher in South Dakota must prove they attempted to hire a certified teacher before seeking an alternatively certified individual, as they do in North Dakota as well (South Dakota Department of Education, 2017).

Unlike the Dakotas, Minnesota Professional Educator Licensing and Standards Board recently implemented a tiered licensure structure, which includes four levels of varying requirements for obtaining a valid teaching license (Minnesota Legislature Office of the Revisor of Statutes, 2020; Education Minnesota, 2008). For CTE, which falls under Tier 1, teacher candidates must possess one of the following requirements: associate’s degree, a professional certification in a related area, or five years of relevant work experience (Minnesota Legislature Office of the Revisor of Statutes, 2020; Education Minnesota, 2008). Districts looking to hire a Tier 1 professional must prove they tried to find a Tier 2, 3, or 4 teacher. Tier 1 licenses are only issued for one year and can only be renewed up to three times. However, there are certain conditions in which school districts can renew further. According to the Minnesota Legislature Office of the Revisor of Statutes (2020) and Education Minnesota (2008), a Tier 1 license can be renewed beyond the three years as long as it is in the Career and Technical Education or Careers Pathway or if the licensed individual will be in a documented shortage area, which includes agricultural education (Minnesota Legislature Office of the Revisor of Statutes, 2020; Education Minnesota, 2008).

The State of Iowa’s Alternative Licensure option is called “Career and Technical Authorization”, which falls under the license type of Limited Teaching. According to the Iowa Board of Educational Examiners, an interested applicant “needs 6000 hours of experience or 4000 hours and a bachelor’s degree in a career and technical field” to obtain a three-year license (Iowa Board of Educational Examiners, n.d.). After completing the required CTE pedagogy coursework, the applicant can seek the Career and Technical Authorization, which is valid for 5 years. This alternative licensure option is limited to CTE fields only (Iowa Board of Educational Examiners, n.d.). In sum, it seems that of the states discussed, Iowa is the least restrictive when it comes to seeking long-term alternative licensure. However, Minnesota’s tiered licensure system makes it relatively simple to achieve a short-term fix since five years of work experience and no formal education is considered enough to teach career and technical education courses such as agricultural education – but that is limited to only three years.

Historical Importance and Need of Alternately Certified Teachers

Carver-Thomas and Darling-Hammond (2017) define “teacher shortages as the inability to staff vacancies at current wages with individuals qualified to teach in the fields needed” (p. 1). Although the teacher shortage has been felt for much of the last century in agricultural education (Marx et al., 2017), Career and Technical Education as a whole has experienced a more dramatic effect since around the 1980s. In fact, prior to the 1980s, CTE teacher preparation programs at post-secondary institutions were flourishing (Bowling & Ball, 2018). In the 1980s and 1990s, universities began eliminating those teacher preparation programs and saw a reduction in Perkins funding. An increase in CTE student enrollment also contributes to the continued shortage of agricultural education teachers (Bowling & Ball, 2018). Overall, CTE teacher preparation programs decreased by 11% from 1990 – 2000 (Wilkin & Nwoke, 2011). There are numerous

opinions surrounding the implementation of alternative certification in agricultural education. While some stakeholders believed that a solution to a teacher vacancy was to close the program all together, others thought an “almost fully” certified individual would be effective for a short period of time (Bowling & Ball, 2018, p. 115). Additionally, some believed alternative certified teachers could fill temporary vacancies left by certified agricultural education teachers before the end of a school year (Bowling & Ball, 2018). One of the driving factors behind the teacher shortage issue is high teacher attrition. Teacher attrition encompasses all the reasons a teacher decides to leave the profession, primarily before retirement age. Sutchter et al., (2016) depicts the national teacher shortage by looking at basic supply and demand. By 2025, the demand for teachers is estimated to be well over 300,000, but the projected supply is to be under 200,000 (Sutchter et al., 2016). Alternative certification has evolved as a potential solution. Bowling and Ball (2018) took a philosophical approach at the historical significance of alternatively certified pathways and the implementation into Career and Technical Education.

Why is there a need for alternatively certified teachers in the first place? With all of the alternative certification options and pathways available, it becomes necessary to examine the original need for them to fill teacher vacancies left by traditionally certified teachers. Across the nation, all areas of education are facing a teacher shortage (Bowling & Ball, 2018). In fact, in order to keep up with the current demand, it is estimated that 300,000 new teachers will be needed annually, through 2020 (Solomonson & Retallick, 2018). Agricultural education is fighting this issue along with other content areas. According to Smith, Lawver, and Foster (2018), from 2014 – 2016, the field of agricultural education lost 2,361 teachers – approximately 787 teachers each school year. While the reasons for leaving the classroom are quite diverse, retirement leads the way with 27.6% (Smith et al., 2018). Other highlights included nearly 14%

leaving for agribusiness or industry related jobs, and nearly 10% were terminated or nonrenewed by the employer (Smith et al., 2018). Regardless of the reason for a teacher vacancy, local school districts must explore several options to fill the position. In 2016, a majority of new hires (38.2%) were fully licensed teachers simply moving to new schools, and 36.6% of new hires were newly licensed teachers, either prepared in or out of state (Smith et al., 2018). In the three-year study, 2,209 students completed accredited agricultural education preparation programs and were eligible for teacher licensure for school-based agricultural education. A mere 72.2% of those students actually accepted teaching positions (Smith et al., 2018). With only 72% of graduates choosing to enter the profession, schools are forced to explore other options to fill the vacancies. The study, conducted from 2014 – 2016, first examined alternative licensure routes in 2016, and it revealed that 17.3% of new hires were alternatively certified (Smith et al., 2018). From 2016 to 2019, that number has risen to 18.83% on average (Smith et al., 2017; Smith et al., 2018; Smith et al., 2019; Foster et al., 2020).

Although there is a need for alternatively certified staff, school districts need to look at the significant cost associated with teacher attrition and teacher turnover. According to Carver-Thomas and Darling-Hammond (2017), alternatively certified teachers are 25% more likely to leave their school when compared to traditional certification. This is likely due to lack of pedagogical preparation alternatively certified teachers receive prior to their teaching career as well as support from school administrators while teaching (Carver-Thomas & Darling-Hammond, 2017). Additionally, it is estimated that upwards of \$20,000 (in an urban school district), can be spent on that turnover. Nationwide, the cost of teacher attrition nears \$2.2 billion each year (Solomonson et al., 2019) and have doubled in the last fifteen years (Rice & Kitchel, 2015a). Aside from the cost to the school district, student learning can also be negatively

affected (Carver-Thomas & Darling-Hammond, 2017). It is quite clear that alternatively certified teachers are absolutely needed to fill vacant agricultural educator positions across the country. Because of this realization, how can we begin to foster and develop their pedagogy and content knowledge related to agricultural education? When teachers have a solid foundation in understanding the way secondary students learn, think, and communicate as well as the appropriate methods and strategies to convey lessons, their teaching career just became a lot longer and more successful.

In sum, an entire study could be devoted to examining the effectiveness of one program over another. But, the reality of the matter is, our nation's public-school systems need alternatively certified teachers to fill the ever-growing number of vacant positions. Looking at the issue from a long-term view, the literature surrounding retention of alternatively certified teachers, specifically, remains relatively inconclusive (Zhang & Zeller, 2016). Therefore, a closer look is needed for teaching and professional development needs among the two routes.

Comparing Professional Needs of Traditional Certification vs. Alternative Certification

With both certification routes adequately defined, we must next look at the previous research on in-service needs of alternatively certified agricultural education teachers. Robinson and Edwards (2012) examined the perceived self-efficacy of agricultural instructors who were alternatively certified compared to those who were traditionally certified. Additionally, they observed the early career employment status of both certification types (Robinson & Edwards, 2012). Robinson and Edwards (2012) looked at the perceived self-efficacy in three different categories including student engagement, instructional practices, and classroom management at the beginning of the first year of employment and at the end of the school-year. Interestingly, the traditionally certified and the alternatively certified instructors had relatively similar self-efficacy

in the three areas at the beginning of the school year. Traditionally certified (TC) teachers viewed their own student engagement and instructional practices to be slightly higher compared to alternatively certified (AC). At the end of the school year, the TC decreased and AC increased in both the student engagement and instructional practices category. In the classroom management category, both increased (Robinson & Edwards, 2012). Robinson and Edwards (2012) also looked at the teaching status of the same teachers studied in their first year. The researchers concluded that nearly 59% of traditionally certified teachers were still teaching two years later; whereas, only 16.67% of alternatively certified teachers were still teaching. The gap of retention percentages, alone, should raise concern for the needs and professional viability of this group of teachers. Alternatively certified teachers are lacking early development in their Pedagogical Content Knowledge. This is mainly due to missing a student teaching experience and specific methods courses through a traditional teacher preparation program, which is one of the sources of knowledge (Rice & Kitchel, 2015b). Overall, alternatively certified teachers saw the most growth in their perceived self-efficacy in the three areas; however, when scored by the university supervisors since the study looked at first-year teachers, TC teachers consistently outperformed their AC counterparts. This finding brings up a question regarding growth of AC teachers (Robinson & Edwards, 2012). Is it possible that university supervisors have a slight bias towards TC teachers and see them as more productive because of their preparation? It is also a possibility that alternatively certified teachers perceive greater self-efficacy because they have the most room to grow and evolve. Jang & Horn's (2017) focused on the effectiveness of traditional and alternative certification programs, and they found that traditionally certified teachers showed significantly higher confidence levels and instructional knowledge of curriculum compared to alternatively certified teachers. Although that might seem an obvious

outcome, that's still not solving the problem of figuring out how to help alternatively certified teachers increase their current level of confidence, content knowledge, curriculum resources, and instructional methods to help them succeed in the profession and be a contributing factor to student success and achievement.

As part of the National Research Center for Career and Technical Education, Bussey, Sass, and Bottoms (2010), reported results from a model for preparing new CTE teachers pursuing alternative certification. Participants ranked themselves prior to the workshop on perceived self-efficacy in student engagement, instructional strategies, and classroom management and again after the workshop (Bussey et al., 2010). The professional development workshop focused on strategies that support learning, sequence of topics, revisions for audience needs, emphasis on student needs, clarification and organization of content, instructional delivery, and challenges and concerns of beginning CTE teachers (Bussey et al., 2010). It was revealed that participants saw an increase in all three areas, after three days. We can conclude that this three-day program can provide valuable information and insight when looking to implement more in-depth professional development opportunities for alternatively certified teachers. To support this, Bowling and Ball (2018), "recommended that state staff and teacher educators develop professional development programs to meet the specific classroom and professional needs of alternatively certified individuals" (p. 119).

Stair, Figland, Blackburn, and Smith (2019) discussed several conclusions made from various studies on certification types. For example, Knobloch and Whittington (2002), reported there was a significant confidence difference in new agricultural education teachers who completed a traditional certification program as compared to alternatively certification. They concluded this is largely due to traditional teacher preparation programs requiring a student

teaching experience, which made those individuals feel more confident than those who did not student teach. Ultimately, student success is of the utmost concern. With that in mind, Robinson and Edwards (2012) explained that alternatively certified secondary instructors were “less effective in fostering student achievement” (p. 156). This could be due in part to the lack of pedagogical preparation. Effective professional development could assist fostering higher student achievement. (Robinson and Edwards, 2012). Wayman, Foster, Mantle-Bromley, & Wilson (2003) discussed a concern regarding the “lack of pedagogical preparation” that was provided by alternative preparation programs. Surprisingly, Duncan & Ricketts (2008) reported that alternatively certified teachers are “less efficacious in technical knowledge”, which somewhat contradicts what Rocca and Washburn (2006) discussed in that alternatively licensed teachers may have more years of experience in a specific sector of discipline within the agricultural industry. This translates to alternatively certified teachers often have more technical expertise in specific segments of agriculture. Furthermore, Rocca and Washburn (2006), compared industry related job experience between alternatively certified agricultural education teachers and traditionally certified teachers. The finding was, on average, alternatively certified teachers have considerably more industry experience than traditionally certified teachers. (Rocca & Washburn, 2006).

Technical competence and mastery of specific content knowledge does not immediately mean success in a classroom of secondary students. Alternatively certified teachers might have substantial comprehension of specific agricultural content and that is incredibly helpful in solving real-life problems, but the Pedagogical Content Knowledge (PCK) is missing or severely underdeveloped. However, according to Dr. Amber Rice, who has extensive research in Pedagogical Content Knowledge in agricultural education, PCK is the single-most important

factor in the career longevity of an agricultural educator (A. Rice, personal communication, May 27, 2020).

Alternative Certification Concerns Outside of Agricultural Education

As discussed earlier in this review, the shortage of secondary teachers is prevalent in all areas of education according to Sutchter et al. (2016). This problem requires a closer look at the core academic content teachers in addition to career and technical education. Redding and Smith (2016) took a look at that problem including how success, or lack thereof, reduces teacher turnover. Additionally, they examined teacher characteristics, student teaching experiences, and school working conditions (Redding & Smith, 2016). They revealed that related to teacher characteristics, alternatively certified teachers were more likely to be to teaching in-demand subjects and did not attend selective colleges or universities. More specifically, two-thirds of AC teachers in this time period did not attend such colleges. Prior to teaching that first year, 28% of AC teachers were working outside of the realm of education, whereas TC teachers were at 5% (Redding & Smith, 2016). From a demographics viewpoint, AC teachers were more likely to be male, over 30 years old, and be part of an ethnic minority group – maybe due in part to agricultural education being a Career and Technical Education area.

Redding & Smith (2016) further revealed that the preparedness of AC teachers versus TC teachers saw a widening gap from the 1999-2000 to the 2011-2012 school years. Overall, alternatively certified teachers feel much less prepared than traditionally certified teachers (Redding & Smith, 2016). This is perhaps due to the finding that AC teachers had less practice in teaching or in teaching methods. With regards to working conditions, AC teachers were more likely to work at urban schools with more minority students and more students on free/reduced lunch as well as schools with lower principal effectiveness ratings (Redding & Smith, 2016).

Furthermore, AC teachers reported lower school collegiality, less access to materials and resources, and more student behavior problems (Redding & Smith, 2016). Could those alarming findings about working conditions be attributed to the level of difficulty for struggling local school districts to find highly qualified candidates? These factors could also be directly related to the significant turnover gap between AC and TC teachers. Interestingly enough, classroom management workshops could help curb some of the student behavior problems, and AC teachers could benefit from extra attention on developing their own interactive course materials.

When looking at student achievement, teacher preparation routes come into question. Whitford, Zhang, and Katsiyannis (2019) discuss the nature of alternatively certified staff being those who hold at least a bachelor's degree in a non-education area and are looking for a career change. The need for alternatively certified teachers is most prevalent in high poverty, rural areas, which see the highest teacher turnover rate – especially special education teachers (Whitford et al., 2019). Typically, alternative programs see enrollment numbers to be more diverse regarding demographics. For instance, 18% of all teachers in training enrolled at non-institutes of higher education were Black, and 18% were Hispanic. Non-institutes of higher education also see more alternatively certified program completion in special education, mathematics, and general science (Whitford et al., 2019). Perhaps the most startling statistic from this particular piece of literature is that the core content areas are still seeing significant teacher turnover in early-career educators. According to Whitford, Zhang, and Katsiyannis (2019), during the 2012-2013 school year, more than 50% of alternatively prepared teachers left their teaching career by the fourth year compared to 37% of traditionally prepared teachers. Overall, although alternative certification is helpful in filling core content areas such as science and mathematics and embodies more diverse individuals, the burnout, poor student outcomes,

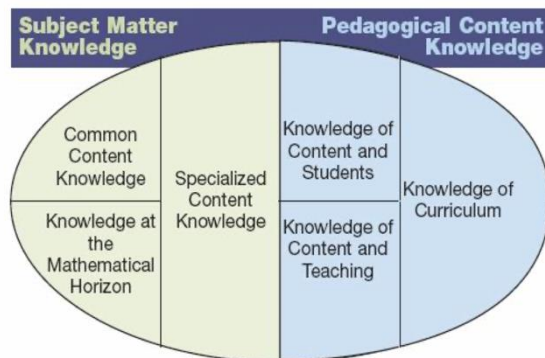
and attrition rates are still alarmingly high considering the time and money that goes in to training or mentoring these new individuals (Whitford et al., 2019). Haj-Broussard, Hall, Allen, Stephens, Person, and Johnson (2016) reveal that “five states are responsible for half of all alternative certification program completers in the United States: California, Florida, Louisiana, New Jersey, and Texas” (pg. 7). Alternatively certified teachers are absolutely necessary to filling high needs areas such as agricultural education. However, their professional development needs regarding their knowledge of teaching and understanding of how to teach the agricultural content they know becomes the most important focus to ensure their longevity in the career field.

Theoretical Framework - Pedagogical Content Knowledge

Shulman (1986) discusses the seven areas of teaching knowledge. The interdependence of content knowledge, pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational ends all play an important role in facilitating student learning (Shulman, 1986). For the purpose of this study, specific attention will be placed on Pedagogical Content Knowledge (PCK). Rice and Kitchel (2015a; 2015b) and Shulman (1986) explain PCK as, “a specific type of knowledge for teaching existing at the intersection of pedagogy and subject matter. This knowledge base is where content knowledge expertise is put into practice” (Rice & Kitchel, 2015a, p. 92).

Figure 2.1

Model of MKT



Note. (Hill, Ball, & Schilling, 2008; Rice & Kitchel, 2015b).

In Figure 2.1, the Model of Mathematical Knowledge for Teaching (MKT) explains the constructs related to both the subject matter knowledge and pedagogical content knowledge. The same constructs can be adapted to that of agricultural education and help to create a foundation for all the types of knowledge required in order for a teacher to be successful. Agricultural education, in general, requires a person to have an immense knowledge base for several areas of the agricultural industry. With this in mind, it is necessary for agricultural education teachers to master the ability to break down all of that knowledge of subject matter in order to create connections for students (Rice & Kitchel, 2015a). A teacher's PCK takes years to develop. In fact, true expertise is not established until between five and seven years of teaching experience (Rice & Kitchel, 2016). This expertise development begins in teacher preparation programs and specific methods courses (Rice & Kitchel, 2015b).

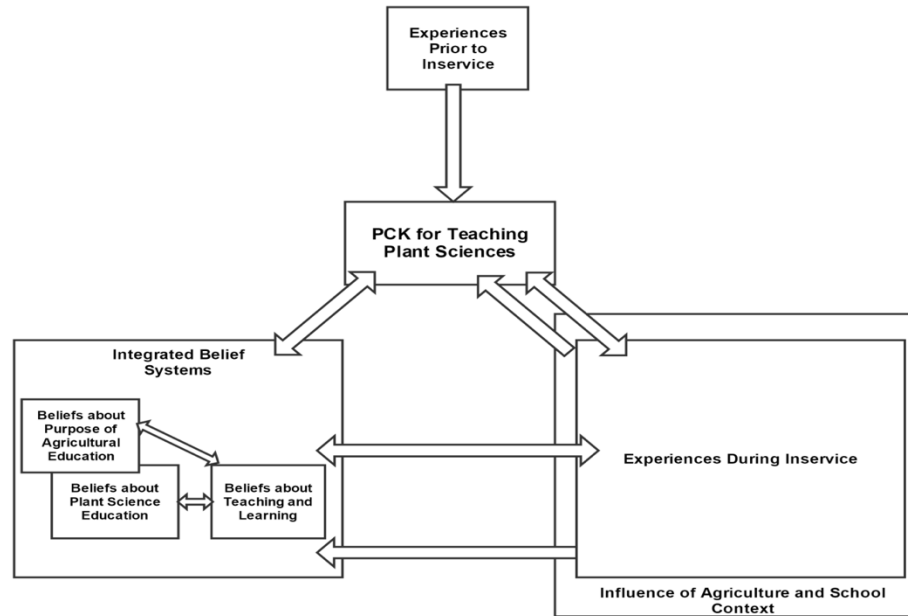
There have been major developments in the background information and supporting evidence surrounding PCK since Shulman's initial research. Rice and Kitchel have published much of the research related to agricultural education Pedagogical Content Knowledge. Rice (2015) examined the PCK of eight agricultural education teachers who specialized in the plant

sciences in Missouri. All teachers had been teaching for at least eight years and taught in multiple teacher programs, which gave them the opportunity to specialize in plant sciences. Rice studied the PCK of these teachers in both the planning stage of their plant science unit as well as their in-the-moment phases of teaching. In Rice's study, an important part of teaching and PCK development was revealed: being a reflective teacher and a lifelong learner. Many of the teachers in this study sought out their own professional development opportunities that fit their needs. Accumulating new knowledge and reflecting on that knowledge becomes the responsibility of the individual teacher. If a beginning agriculture teacher chooses not to continue to learn and reflect on content in-service, then their PCK development can be significantly obstructed (Rice, 2015). Agricultural educators need to be able to plan for differentiated learning, devise plans for and implement a variety of instructional strategies, demonstrate a wide variety of content knowledge, understand the learning process, and evaluate instruction (Rice & Kitchel, 2018). Agricultural educators who are effective in utilizing PCK in the classroom and preparation can take the agriculture content and transform it into usable, applicable knowledge for students from all backgrounds and ability levels (Rice & Kitchel, 2018).

There are several components of PCK's foundation and differences in how it is developed in teachers. These components include knowledge of content, students, students' understanding, teaching methods, assessment, and curriculum (Rice & Kitchel, 2015b).

Figure 2.2

Substantive Theory behind what is Shaping Experienced Agriculture Teachers' PCK in the Plant Sciences



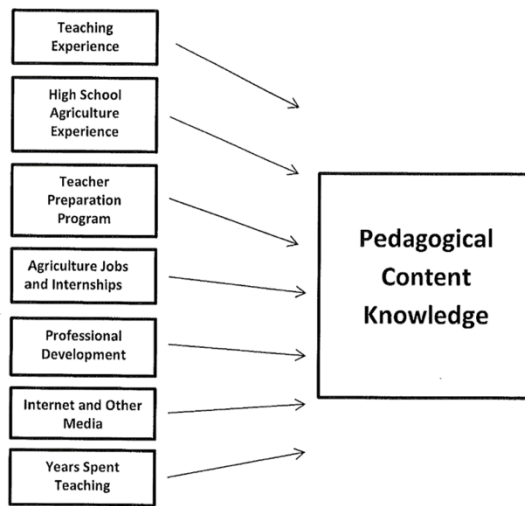
Note. (Rice, 2015, p 134).

PCK is developed in teachers in a variety of ways. In *Figure 2.2*, Rice depicts the various experiences that influence an educator's PCK. The figure explains how the experiences work together to develop PCK, but a large contributor are those in-service teaching moments. Alternatively certified teachers are missing this component, or it is fundamentally underdeveloped. Rice does discuss that some development occurs in high school agriculture classes (Rice, 2015) but, foremost, it is developed in teacher preparation courses. Obviously, teacher preparation programs place significant emphasis on general content knowledge and providing teachers with a foundation in such content knowledge. The seven sources of agriculture content knowledge all seven contribute to a teacher's PCK as shown in *Figure 2.3* (Rice, 2015). More importantly, teacher preparation programs include the student teaching

experience, methods classes, and mentorships (Rice & Kitchel, 2015b). As discussed earlier, many teacher preparation programs for agricultural education have a balance of content knowledge and PCK knowledge to foster the development of a well-rounded and prepared teacher (Rice & Kitchel, 2015b). Additionally, teacher preparation programs instill the idea of reflective practice into teachers for a sense of life-long learning. Reflection is integral to effective PCK development (Rice & Kitchel, 2017). It provides teachers with the reasoning necessary for revisions of classroom instruction and modification of teaching strategies for future lessons.

Figure 2.3

The Relationship Between Sources of Content Knowledge and PCK



Note. (Rice & Kitchel, 2015b).

Teacher PCK is continually developed through reflection and further professional development after college graduation. When those teachers are in the field, continuing education courses and professional development workshops help to continue the growth of PCK. This is where alternatively certified teachers can work to develop their PCK. Although they have essentially gotten a “late-start” on such development, professional development workshops still

can provide valuable influence on PCK development and can impact their future in education. Alternatively certified teachers, generally, have a foundation in content knowledge or have been deemed an expert in their respective field. Rice and Kitchel (2016) discussed the importance of such foundational content knowledge but recognize it's not the only type of knowledge required for success. In 2018, Rice and Kitchel discussed the importance of being a lifelong learner to their PCK development. In fact, they discovered there was a direct correlation between teachers who found it difficult to find time to reflect on instruction and those who struggled with being able to teach the content in multiple ways (Rice & Kitchel, 2018). Rice revealed that it is the responsibility of the individual teacher to engage in reflection (Rice, 2015; Rice & Kitchel, 2018). Therefore, all teachers, regardless of preparation route, need to frequently revisit PCK and truly be a reflective educator. Afterall, Rice & Kitchel (2016) believe PCK is the single, most important contributing factor towards the progression of student achievement.

The third aspect of PCK development of in-service teachers is the actual experience of teaching (Rice & Kitchel, 2016). Both alternatively certified and traditionally certified teachers have the opportunity to develop PCK while actively teaching content to students. However, without the context surrounding the importance of PCK and the framework that supports it, it can be difficult for practicing teachers to apply such development (Rice & Kitchel, 2016). This is why it is important to begin PCK development as early as possible and put it into context right away.

All three of the discussed aspects of PCK, teacher preparation programs, professional development workshops, and in-service learning, contribute to the success of a teacher and thus, the success of their students. It is reasonable to conclude that traditionally certified teachers get a kick-start in PCK development because of their teacher preparation programs, which presents a

gap in development when compared to alternatively certified teachers. Although alternatively certified teachers can learn and develop their PCK through different means, the gap that overshadows them can be hard to overcome. This presents the need for this study. What specific areas of PCK do in-service alternatively certified teachers need in order to remain in agricultural education?

Pedagogical Content Knowledge is associated with both the planning and the “in the moment” teaching actions (Rice & Kitchel, 2017). In-service teachers who possess PCK have the ability to scaffold individual lessons based on the student’s previous knowledge and to develop curriculum with higher-order thinking teaching methods. These teachers can make unique connections to increase retention of content and combat misunderstood instruction (Rice & Kitchel, 2016). PCK is believed to be content specific, which means that agricultural education PCK is a whole new category amongst education. Rice dives into PCK related to the plant sciences as discussed earlier, but this study aims at the pedagogical content knowledge professional development needs of alternatively certified agricultural education instructors compared to traditionally certified counterparts.

Summary

In concluding the literature review, gaps have emerged in previous research regarding perceived professional development needs of in-service alternatively certified agricultural educators related to Pedagogical Content Knowledge. First and foremost, although alternative certification has been an option for SBAE teachers since the 1980s, it has not been actively sought after until more recently.

The primary trend in research on this topic has been the lack of pedagogical preparation in alternative certification programs. In this sense, pedagogy is associated with the non-

agriculturally related areas of education. More specifically, it is putting educational theory into practice as it relates to students' developmental abilities. Non-content related teaching tasks include accommodating IEPs and 504s, general classroom management, disciplinary action, handling conflict with coworkers and administration, funding requests and budgeting, communicating with parents, developing challenging lesson plans, scaffolding classes, and general classroom and laboratory preparation. Additionally, the development of PCK, which is the idea of merging pedagogy and content knowledge to a level school-aged youth can comprehend, begins in teacher preparation programs and is then fine-tuned throughout the in-service careers of agricultural educators.

Second, concerns have appeared regarding the retention of alternatively certified agricultural education teachers. Much of the research detailed the major teacher shortage in agricultural education caused by traditionally certified teachers' attrition. School districts across the nation are turning to alternative certification as a means to fill vacancies. However, just like traditionally certified staff, too many are choosing to end their educational career early, which creates a cyclical teacher shortage.

Bowling & Ball (2018) recommend state Career and Technical Education departments and teacher educators "develop professional development programs to meet the specific classroom and professional needs of alternatively certified individuals. These programs should focus on developing the teachers' Pedagogical Content Knowledge and classroom management techniques" (p. 119). In addition to Pedagogical Content Knowledge and classroom management techniques, the professional development should also develop the teachers' abilities to manage various laboratory settings and the FFA (Bowling & Ball, 2018). Furthermore, because pre-service teachers cannot possibly learn everything in college, one of the bases of

developing PCK is through continued specific teacher workshops (Rice & Kitchel, 2015b). There is great potential for these workshops to add value to PCK development in traditionally certified and alternatively certified teachers. Even though teachers of both certification routes can benefit, a majority of the focus needs to be on alternatively certified teachers and closing the gap of PCK development. A more long-term study is needed regarding the effects of alternatively certified agricultural education teachers on student learning and achievement and program success.

Problem

Pedagogical Content Knowledge, as discussed earlier, is a substantial influencer in any educator's career, especially in the early years. Education, as a whole, is seeing more vacant positions than quality candidates to fill them. Agricultural education programs are not immune to this problem. As a result, many states have had to develop entirely new programs for certification or modify existing requirements for Career and Technical Education areas. The relatively new pathways to certification can bring content knowledgeable and industry experienced individuals to the teaching field; however, they are missing the most important part of teacher preparation: Pedagogical Content Knowledge. Professional organizations, state CTE staff, professional development committees, instructional teams, and school administrators need to know how to better develop alternatively certified teachers' PCK. The individual teacher needs to be able to examine their own perceived PCK and identify areas that need improvement. PCK is always changing and evolving – just as education requires a growth-oriented mindset and a reflective teacher. It is nearly impossible to retain every teacher who graduates from a post-secondary institution with a degree in education. That is exactly where the problem comes to light. Alternative certification is here to relieve the pressure and burden of retention. But if alternative certification professionals are here to stay, and if it is truly going to be a viable

solution, we must figure out the PCK needs of alternatively certified teachers. The longevity of their career and student success is dependent upon their development and execution of Pedagogical Content Knowledge.

Need for the Study

Since much of the initial literature on this topic originated around the mid-2000s and the need for alternative certified teachers has exponentially increased in the last decade, the need for this study has arisen. The following questions have developed and create a need for further research and examination of the alternative certification pathways and their development of PCK:

- What are the PCK needs of traditionally and alternatively certified agricultural educators?
- What differences in PCK currently exist among traditionally and alternatively certified agricultural educators?
- How can professional development be utilized to more effectively develop PCK in alternatively certified teachers?

CHAPTER 3: METHODOLOGY

Purpose of the Study

The purpose of this research study is to determine and describe in-service SBAE teachers' perceived Pedagogical Content Knowledge and self-reported challenges with non-content related classroom material.

Research Objectives

The following research objectives guided this study:

1. Describe Pedagogical Content Knowledge (PCK) of traditionally certified agricultural education teachers.
2. Describe Pedagogical Content Knowledge of alternatively certified agricultural education teachers.
3. Describe the differences in PCK between licensure types.
4. Describe teachers' perceptions of classroom management between licensure types.
5. Describe teachers' perceived sources of knowledge in relation to teacher licensure routes.

Research Design

This descriptive relational study utilizes teacher responses to a digital questionnaire distributed to school-based agricultural education (SBAE) teachers in selected states via email. This inquiry is quantitative in nature as items within the survey utilize a Likert-type scale or require frequency responses. Responses from the sample were aggregated, and dependent variables were analyzed based upon demographic variables (independent variables).

Variables

The independent variables for this research study included highest educational degree completed, years of experience teaching SBAE, agricultural subjects taught, content area major, gender, state, and path to licensure (or license type).

The dependent variables for this research study are Pedagogical Content Knowledge (PCK) related to a self-identified instructional unit the participant teaches well and knows the content well, PCK related to a self-identified instructional unit the participant struggles with teaching and knows the content least, sources of agricultural knowledge, and knowledge of classroom management strategies.

Sample Population

The target population for this study included in-service agricultural education teachers in a purposive sample from 12 states across the United States. Two states from each National Association of Agricultural Educators (NAAE) Region were chosen based on population plus a third from Region III because of the focus in this study is in the Midwest states. Table 3.1 includes the surveyed states. The sample population consisted of approximately 7,097 (*N*) prospective in-service SBAE teachers. The age range of participants is approximately 22-60.

Table 3.1
Surveyed States and Approximate Prospective Respondents

State	Prospective respondents
Arizona	114
California	971
Florida	450
Minnesota	265
Missouri	539
New York	316
North Carolina	546
North Dakota	102
Ohio	519
Oklahoma	454
Texas	2500
Wisconsin	321

Note. Approximate number of agricultural education teachers in each state was taken from National Association of Agricultural Educators (n.d.-a).

Instrumentation

A digital survey through Qualtrics was utilized as the instrument for this study. The survey link and participant invite letter were distributed via email. The instrument design consisted of five primary sections: demographics, PCK related to a self-identified unit the respondent knows and teaches well, PCK related to a self-identified unit the respondent struggles with teaching and knows the content the least, difficulty associated with classroom management strategies, and sources of agricultural knowledge. The PCK related questions and sources of agriculture knowledge were adapted from Missouri Agriculture Teacher Knowledge Questionnaire, which was found to have at least 0.70 reliability for all constructs except Horizon Content Knowledge. Horizon Content Knowledge had 0.60 reliability (Rice & Kitchel, 2015b). Rice retained this construct “due to the exploratory nature” of the study (Rice & Kitchel, 2015b, p. 160). The PCK sections were later divided into constructs as defined by Hill et al (2008), which include Common Content Knowledge (CCK), Specialized Content Knowledge (SCK), Horizon Content Knowledge (HCK), Knowledge of Content and Students (KCS), Knowledge of

Content and Teaching (KCT), and Knowledge of Content and Curriculum (KCC) (Hill et al, 2008). CCK refers to the teacher's ability to identify when a student gives an incorrect answer (Rice & Kitchel, 2015b). SCK is the teacher's ability to take an incorrect answer and explain why the answer was incorrect (Rice & Kitchel, 2015b). HCK is the ability to link the subject matter to other units within and beyond agriculture (Rice & Kitchel, 2015b). KCS is the teacher's ability to predict challenging concepts and knowing where students are at developmentally (Rice & Kitchel, 2015b). KCT refers to the teacher's ability to utilize questioning techniques to help understand content and concepts (Rice & Kitchel, 2015b). Lastly, KCC is referring to overall curriculum design and sequencing/scaffolding lessons within a unit (Rice & Kitchel, 2015b). In-service SBAE were asked to rate their competency level in an agricultural unit they know well and teach well using a sliding scale (1-100). With that particular unit in mind, participants used a five-point Likert scale identifying to what extent they agreed with 18 given statements. Examples of the statements included identifying student misinterpretations, explaining unit terminology, discerning accurate from inaccurate information, utilizing appropriate questioning techniques, sequencing unit material, designing curriculum, and implementing various instructional strategies. Participants then identified an agricultural unit they felt they struggle with teaching and know the content the least and rated that competency level using the sliding scale (1-100). The same 18 statements and five-point Likert scale were used as the previous scenario. The third section, which included eight questions, asked SBAE to use using a seven-point Likert scale to rate the effectiveness each source of agricultural knowledge had on their ability to teach, which was eight questions. Examples of the sources of knowledge included high school programs, teacher preparation programs, teaching experience, previous jobs, professional development, media, consultation with experts, and other. The last

survey section asked in-service SBAE to rate to what extent they experience difficulty in the following classroom management strategies on a Likert scale. The classroom management questions were developed from the literature in *The Classroom Management Book* (Wong & Wong, 2014). Examples of these statements included enforcing classroom expectations, facilitation of group work, getting students' attention, classroom transitions, and procedures. The complete list of classroom management strategies asked in the survey are listed in Table 3.2. There were 12 questions related to demographics throughout the survey. Some of these included highest degrees obtained, state of employment, years of experience, agriculture subjects taught, content major, content minor, gender, and pathway to teacher licensure.

Table 3.2
Classroom Management Strategies Included in the Survey

Question Stem
Getting students' attention
Keeping students on task
Facilitation of group work
Teaching procedures & routines
Effective classroom transitions
Managing arrivals and dismissals
Handling disruptions
Planning for each period
Facilitation of class discussions
Enforcing classroom expectations

Note. These strategies are found in *the Classroom Management Book* by Wong & Wong (2014); Likert scale: 1 (*much difficulty*); 2 (*some difficulty*); 3 (*occasional difficulty*); 4 (*no difficulty*)

Data Collection

This descriptive relational study utilized in-service SBAE responses to survey questions regarding perceived PCK related to specific agricultural units they both knew well and taught well as well as struggled with teaching. Additionally, SBAE identified specific classroom management strategies in which they experienced difficulty in implementation. The data

collection took place January 24 – February 20, 2021. The survey was available via Qualtrics and distributed via an email link which participants from 12 states could anonymously respond.

In November 2020, contact was made with state agricultural education supervisors in each state to obtain permission and access to state listservs and contact lists. All states responded with the exception of Virginia. Because of no access to Virginia's contact list, the state was removed from the study and not replaced. The survey link, participant letter, and a brief introduction was initially emailed on January 24, 2021 to 12 states with the first reminder email sent on February 1st and the second on February 8th. Texas requested to cease reminders on February 1st and thus only received the initial survey email. Arizona received the initial survey link on February 9th and North Carolina on February 15th. The survey officially closed to responses on February 20th. Participants chose to provide their name and email address at the conclusion of the survey to be entered to win 1 of 10 - \$50 Amazon gift cards. Winners were randomly selected on February 22nd and notified later via email with the electronic gift card information. Email addresses and names were then deleted from survey responses as they no longer served any purpose to the research study.

Data Analysis

The data for this descriptive study was analyzed utilizing Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) software version 27. Data was analyzed for independent variables, which included the demographic tables (Tables 3.3 and 3.4). Additionally, statistics were run for dependent variables as well as research objectives one and two (means and standard deviation), objective three (t-test, Cronbach's alpha), and objectives four and five (means, standard deviation, and t-test). A total of 551 responses were useable after partial and incomplete responses were deleted from the data set. Early and late respondents were compared

and no significant differences were revealed, thereby the entire remaining sample set could be analyzed. Upon analyzing the data set, an error in the instrument was found. For the section that asked respondents to identify a unit they struggled with teaching and knew the least, the fifth point on the Likert scale for the last nine questions of that section was not present. Therefore, it was not possible to compare the data and construct scores with the units they identified as being able to teach well. Additionally, content minor and agricultural subjects taught were discarded from reporting because of the large quantity and extreme diversity of responses.

Demographics

As shown in Table 3.3, out of the 551 usable respondents, 57.7% are female and 41.7% are male. The highest degree completed by respondents is 58.8% bachelor's degree, 37.9% master's degree, education specialist at 1.8%, and doctoral degree at 1.3%. For teaching experience, a majority of respondents have been teaching four or less years at 34.1%, followed by five to nine years at 24.9%, 25 years or more at 11.6%, 10-14 years at 10.7%, 15-19 years at 9.6%, and 20-24 years at 9.1%. When looking at path to licensure, 420 teachers (76.2%) obtained licensure through the traditional pathway, and 131 teachers (23.8%) obtained licensure through alternative certification.

Table 3.3
In-Service SBAE Demographics (n = 551)

Variable	n	%
Gender		
Male	230	41.7
Female	318	57.7
Prefer not to answer	3	0.5
Highest Degree Completed		
Bachelor's Degree	324	58.8
Master's Degree	209	37.9
Education Specialist	10	1.8
Doctoral Degree	7	1.3
Years Teaching Agriculture		
0-4 years	188	34.1
5-9 years	137	24.9
10-14 years	59	10.7
15-19 years	53	9.6
20-24 years	50	9.1
25+ years	64	11.6
Path to Licensure		
Traditional (University preparation program)	420	76.2
Alternative certification	131	23.8
Middle/High School Member Years of Experience		
Experience	422	76.6
No Experience	129	23.4
Major		
Content Area Other Than Agricultural Education	237	43
Agribusiness/Business/Economics	31	5.6
Agricultural Leadership	4	0.73
Agronomy/Horticulture/Landscape/Plant	16	2.9
Animal Science	92	16.7
Biological Science/Agriscience	23	4.2
Communications	4	0.73
Education (other content areas)	8	1.5
Environmental/Natural Resources/Fisheries	14	2.5
Veterinary Science/Veterinary Medicine	4	0.73
Other	41	7.4
No major other than Agricultural Education	306	55.5
Blank	8	1.5

North Dakota, at 43.1%, had the most respondents relative to the number of agricultural education teachers within the state (Table 3.4). The largest number of respondents came from Ohio at 89 total responses. There are approximately 12,000 secondary and postsecondary (two-

year programs) agricultural education teachers in the United States and the five US territories (National Association of Agricultural Educators, n.d.-b). With that being said, this study involved approximately 4.6% of the entire population of agricultural education teachers.

Table 3.4
In-Service SBAE Teachers in Each Responding State

Variable	Total Agricultural Educators	Responding Population	Responding % of State's Population
Arizona	114	17	14.9
California	971	15	1.5
Florida	450	19	4.4
Minnesota	264	56	21.2
Missouri	539	76	14.1
New York	316	19	6.0
North Carolina	546	16	2.9
North Dakota	102	44	43.1
Ohio	519	89	17.1
Oklahoma	454	68	15
Texas	2500	57	2.2
Wisconsin	321	71	22.1
Blank		4	

CHAPTER 4: FINDINGS

Objective 1: Describe Pedagogical Content Knowledge of Traditionally Certified

Agricultural Education Teachers

In the first section of the instrument, teachers were asked to position themselves alongside an instructional unit in which they feel they know and teach well. Although the exact unit identified held no value in this study, it served to focus and orient their responses throughout. Respondents rated themselves on a sliding scale of competence with 100 being very competent in teaching the unit and 0 being not competent. Table 4.1 reports the rated competency in traditionally certified agricultural educators regarding the chosen unit.

Table 4.1

Teaching Competence in the Unit Traditionally Certified Teachers Teach Well (n=417)

Mean	Median	SD
89.19	91.00	10.92

Note. Scale: 0 = not competent at all in teaching the unit, 100 = very competent in teaching the unit

In Table 4.2, the six constructs that comprise Pedagogical Content Knowledge are broken down. The constructs were examined from the Hill et al. (2008) Mathematical Knowledge for Teaching (MKT). The PCK constructs allow for a more defined look at areas within PCK. From the instrument, each of the six constructs had three specific questions that comprised each mean PCK construct score. Traditionally certified agricultural educators in this study reported at least to a fair extent in each of the constructs (Table 4.2), which means that on a scale of 1-5, respondents averaged between 4-5 for each construct. CCK refers to the teacher's ability to identify when a student gives an incorrect answer (Rice & Kitchel, 2015b). For Common Content Knowledge (CCK), the mean (M) was 4.54 with a minimum of 3 and a maximum of 5. SCK is the teacher's ability to take an incorrect answer and explain why the answer was incorrect (Rice & Kitchel, 2015b). Specialized Content Knowledge (SCK) had a mean of 4.45

with a minimum of 3 and maximum of 5. HCK is the ability to link the subject matter to other units within and beyond agriculture (Rice & Kitchel, 2015b). Horizon Content Knowledge (HCK) had a mean of 4.61 with a minimum of 3.33 and a maximum of 5. KCS is the teacher's ability to predict challenging concepts and knowing where students are at developmentally (Rice & Kitchel, 2015b). Knowledge of Content and Students (KCS) had a mean of 4.17 with a minimum of 2.33 and a maximum of 5. KCT refers to the teacher's ability to utilize questioning techniques to help understand content and concepts (Rice & Kitchel, 2015b). Knowledge of Content and Teaching (KCT) had a mean of 4.32 with a minimum of 2.33 and a maximum of 5. Lastly, KCC is referring to overall curriculum design and sequencing/scaffolding lessons within a unit (Rice & Kitchel, 2015b). Knowledge of Content and Curriculum (KCC) has a mean of 4.13 with a minimum of 2 and a maximum of 5.

Table 4.2

Perceived PCK of Traditionally Certified Agricultural Educators by Construct (n=413)

Knowledge Construct	M	SD
Common Content Knowledge (CCK)	4.54	0.46
Specialized Content Knowledge (SCK)	4.45	0.51
Horizon Content Knowledge (HCK)	4.61	0.42
Knowledge of Content and Students (KCS)	4.17	0.56
Knowledge of Content and Teaching (KCT)	4.32	0.55
Knowledge of Content and Curriculum (KCC)	4.13	0.66

Note. Scale: 1 = to no extent, 2 = to little extent, 3 = to some extent, 4 = to fair extent, and 5 = to great extent

Objective 2: Describe Pedagogical Content Knowledge of Alternatively Certified Agricultural Education Teachers

The second research objective of this study followed the same process as the first, except this objective analyzed the responses from the alternatively certified teachers. The competency related to the self-identified unit they felt they knew and taught well is shown in Table 4.3.

Table 4.3*Teaching Competence in the Unit Alternative Certified Teachers Teach Well (n=130)*

Mean	Median	SD
87.53	90.00	13.49

Note. Scale: 0 = not competent at all in teaching the unit, 100 = very competent in teaching the unit

Though minimal, it is important to note that the mean perceived competency value for AC teachers is numerically lower (1.66) than that of TC agricultural educators. The perceived PCK of agricultural teachers is broken down by construct in Table 4.4. For CCK, the mean (M) is 4.51 with a minimum of 3 and a maximum of 5. SCK has a mean of 4.42 with a minimum of 3 and maximum of 5. HCK has a mean of 4.60 with a minimum of 2.67 and a maximum of 5. KCS has a mean of 4.07 with a minimum of 2 and a maximum of 5. KCT has a mean of 4.21 with a minimum of 2.33 and a maximum of 5. KCC has a mean of 4.03 with a minimum of 2 and a maximum of 5.

Table 4.4*Perceived PCK of Alternatively Certified Agricultural Educators by Construct (n=130)*

Knowledge Construct	Mean	SD
Common Content Knowledge (CCK)	4.51	0.46
Specialized Content Knowledge (SCK)	4.42	0.49
Horizon Content Knowledge (HCK)	4.60	0.43
Knowledge of Content and Students (KCS)	4.07	0.59
Knowledge of Content and Teaching (KCT)	4.21	0.58
Knowledge of Content and Curriculum (KCC)	4.03	0.67

Note. Scale: 1 = to no extent, 2 = to little extent, 3 = to some extent, 4 = to fair extent, and 5 = to great extent

Objective 3: Describe the Differences in PCK Between Licensure Types

Research objective three for this study aimed to examine the differences in perceived Pedagogical Content Knowledge between traditionally certified and alternatively certified teachers. The null hypothesis (H_0) was there would be no difference in PCK between AC and TC agricultural education teachers. The research hypothesis (H_1) was that traditionally certified

agricultural education teachers would see higher average construct scores in all areas of PCK and be statistically significantly different than AC teachers. An independent samples t-test was employed to assist with determining the differences in PCK between the two groups of traditionally and alternatively certified agriculture teachers (Table 4.5). The scores were determined based on the average of the three questions associated with each construct within PCK for the unit identified as the respondent knew and taught well. For five of the six constructs, CCK, SCK, HCK, KCS, and KCC, there were no statistically significant differences in PCK between the two groups of agricultural educators. This suggests that when comparing the overall PCK and those five individual constructs, there is no difference between licensure type. The KCT construct was the only construct that was statistically significantly different at $p=0.05$, although still a small effect size. From this, it can be interpreted that alternatively certified teachers may experience more difficulty in implementing various questioning strategies to help students understand complex agricultural concepts.

Table 4.5

Comparison by Licensure Type of Perceived PCK by Construct (traditional certification n=404; alternative certification n=129)

Knowledge Construct	F	<i>t</i> ^a	Sig. (2-tailed) ^c	df	MD ^b	Cohen's <i>d</i>
Common Content Knowledge (CCK)						
Equal variances assumed	0.00	0.67	0.51	531	0.03	0.06
Equal variances not assumed		0.66	0.51	213.77		
Specialized Content Knowledge (SCK)						
Equal variances assumed	0.91	0.54	0.59	531	0.03	0.05
Equal variances not assumed		0.55	0.58	220.39		
Horizon Content Knowledge (HCK)						
Equal variances assumed	0.08	0.22	0.82	531	0.01	0.02
Equal variances not assumed		0.22	0.83	210.43		
Knowledge of Content and Students (KCS)						
Equal variances assumed	0.04	1.70	0.09	531	0.10	0.15
Equal variances not assumed		1.64	0.10	204.47		
Knowledge of Content and Teaching (KCT)						
Equal variances assumed	0.41	1.94	0.05	531	0.11	0.17
Equal variances not assumed		1.88	0.06	205.13		
Knowledge of Content and Curriculum (KCC)						
Equal variances assumed	0.11	1.48	0.14	531	0.10	0.13
Equal variances not assumed		1.47	0.14	212.75		

Note. a. 95% Confidence Interval b. Mean Difference c. *p* value

The effect size (Cohen's *d*) for each comparison is considered to be a small effect as they are less than 0.20 (Ary et al., 2006). However, for constructs KCS, KCT, and KCC a slightly larger, small effect (Cohen's *d*=0.15, 0.17, and 0.13, respectively) was calculated for the constructs more directly focused on the implementation of teaching skills. Though there is no significant difference in five constructs, there is a greater difference in the means of the TC and AC teachers. The CCK construct had 0.06 for Cohen's *d*, 0.05 for SCK, and 0.02 for HCK. These three are all considered quite small. The H_0 was accepted for CCK, SCK, HCK, KCS, and

KCC. The H_1 was accepted for the KCT construct of pedagogical content knowledge because the calculated significant difference was 0.05.

Objective 4: Describe Teachers' Perceptions of Classroom Management Between Licensure Type

Respondents were asked to identify their perceived difficulty with 10 different classroom management tasks with the scale being 4 = much difficulty and 1 = no difficulty. The means and standard deviations of the classroom management strategy and associated difficulty are reported in Table 4.6. For this objective, a post-hoc reliability analysis for the classroom management portion of the instrument and t-test was performed to compare the differences in perceptions of classroom management between licensure routes. The Cronbach's alpha of 0.879 was calculated for the 10 items; therefore, the instrument related to classroom management components is considered reliable. The minimum is 1 and maximum is 4 for all classroom management strategies. The null hypothesis (H_0) was there would be no difference in associated difficulty with classroom management strategies between AC and TC agricultural education teachers. The research hypothesis (H_1) was that traditionally certified agricultural education teachers would perceive less difficulty in all areas of classroom management.

Table 4.6

Perceived Difficulty in Classroom Management Strategies for Traditionally Certified (TC n=418) and Alternatively Certified (AC n=129) Agricultural Education Teachers

Classroom Management Strategy	TC	TC	AC	AC
	Mean	SD	Mean	SD
Getting students attention	1.64	0.62	1.75	0.64
Keeping students on task	2.03	0.61	2.14	0.65
Facilitation of group work	1.73	0.72	1.76	0.75
Teaching procedures and routines	1.57	0.69	1.76	0.78
Effective classroom transitions	1.70	0.72	1.77	0.77
Managing arrivals and dismissals	1.56	0.72	1.56	0.76
Handling disruptions	1.75	0.73	1.68	0.73
Planning for each period	1.75	0.74	2.04	0.87
Facilitation of class discussions	1.65	0.73	1.68	0.67
Enforcing classroom expectations	1.65	0.73	1.69	0.76

Note. Scale: 1 = no difficulty, 2 = occasional difficulty, 3 = some difficulty, 4 = much difficulty

Statistically significant differences (Table 4.7) were observed in planning for each period ($p=0.00$) and in teaching procedures and routines ($p=0.01$) when comparing alternatively and traditionally certified agricultural education teachers. There was no difference for the following classroom management strategies: getting students attention, keeping students on task, facilitation of group work, effective classroom transitions, managing arrivals and dismissals, handling disruptions, facilitation of class discussions, and enforcing classroom expectations.

Seven of the ten classroom management strategies had a Cohen's d of less than 0.20, which means they have a small effect size. These included getting students' attention, keeping students on task, facilitation of group work, managing arrivals and dismissals, handling disruptions, facilitation of class discussions, and enforcing classroom expectations. The classroom management strategies that had a medium effect size (<0.50) indicating a greater difference between the two means include teaching procedures and routines as well as planning for each period. The strategy of implementing effective classroom transitions had the greatest effect size (-0.82) and is considered large (Ary et al., 2016).

Table 4.7

Comparison of Perceived Difficulty in Classroom Management Strategies for Traditionally Certified (TC n=418) and Alternatively Certified (AC n=129) Agricultural Education Teachers

Classroom Management Strategy	F	t^a	Sig. (2-tailed) ^c	df	MD ^b	Cohen's d
Getting students' attention						
Equal variances assumed	0.69	-1.72	0.09	548	-0.11	-0.15
Equal variances not assumed		-1.70	0.09	210		
Keeping students on task						
Equal variances assumed	5.42	-1.80	0.07	548	-0.11	-0.15
Equal variances not assumed		-1.73	0.09	205		
Facilitation of group work						
Equal variances assumed	0.27	-0.29	0.78	544	-0.21	-0.02
Equal variances not assumed		-0.28	0.78	213		
Teaching procedures and routines						
Equal variances assumed	1.89	-2.65	0.01	549	-0.19	-0.23
Equal variances not assumed		-2.50	0.01	199		
Effective classroom transitions						
Equal variances assumed	0.08	-0.96	0.34	545	-0.07	-0.82
Equal variances not assumed		-0.94	0.35	204		
Managing arrivals and dismissals						
Equal variances assumed	0.67	-0.04	0.97	547	-0.00	-0.00
Equal variances not assumed		-0.04	0.97	208		
Handling disruptions						
Equal variances assumed	0.05	0.87	0.38	546	0.06	0.07
Equal variances not assumed		0.88	0.38	217		
Planning for each period						
Equal variances assumed	0.59	-3.78	0.00	549	-0.29	-0.32
Equal variances not assumed		-3.48	0.00	193		
Facilitation of class discussions						
Equal variances assumed	0.88	-0.42	0.67	547	-0.03	-0.04
Equal variances not assumed		-0.44	0.66	229		
Enforcing classroom expectations						
Equal variances assumed	0.36	-0.63	0.53	546	-0.05	-0.05
Equal variances not assumed		-0.62	0.54	209		

Note. a. 95% Confidence Interval b. Mean Difference c. p value

The null hypothesis was accepted for eight of the classroom management strategies and associated difficulty in implementation. These strategies were getting students' attention, keeping students on task, facilitation of group work, effective classroom transitions, managing

arrivals and dismissals, handling disruptions, facilitation of class discussions, and enforcing classroom expectations. H_1 was accepted for the two classroom management strategies of teaching procedures and routines and planning for each period.

Objective 5: Describe Teachers’ Perceived Sources of Knowledge in Relation to Teacher Licensure Routes

The final objective of this study aimed to describe teachers’ perceived sources of knowledge in relation to teacher licensure routes. Respondents were asked to rate the effectiveness each source of knowledge has had on their ability to teach (Table 4.8). This section of the instrument aimed at identifying where agricultural education teachers obtain their general content knowledge. Additionally, respondents rated to what effect each source had on their ability to teach using a seven-point Likert scale (including not applicable). Traditionally and alternatively certified teachers both rated that all sources of knowledge were somewhat effective to effective on their ability to teach. H_0 was there would be no significant difference in sources of content knowledge and the associated effectiveness that each source has had on their ability to teach. H_1 is that traditionally certified teachers would see higher effectiveness for all sources of content knowledge on their ability to teach.

Table 4.8
Sources of Knowledge and Their Effect on Ability to Teach (traditionally certified n=366 and alternatively certified n=94)

Source of Content Knowledge	TC Mean	TC SD	AC Mean	AC SD
High school agriculture program	4.74	1.1	4.71	1.2
Teacher preparation program	4.76	0.92	4.28	1.2
Teaching experience	5.34	0.73	4.97	0.91
Previous agriculture related jobs or internships	5.14	0.89	5.27	0.86
Professional development workshops	4.71	0.91	4.67	1.18
Internet, textbooks, or other media	4.67	0.87	4.80	0.94
Experts in the field consulted either formally or informally	5.10	0.85	5.15	0.85

Note. Scale: 0 = not applicable, 1 = very ineffective, 2 = ineffective, 3 = somewhat ineffective, 4 = somewhat effective, 5 = effective, 6 = very effective

There was a significant difference at a 95% confidence interval in the teacher preparation program ($p=0.00$) and teaching experience ($p=0.00$) as shown in Table 4.9. There was no difference (<0.05) in sources of knowledge related to high school agriculture program, previous agriculture related jobs/internships, professional development workshops, internet, textbooks, or other media, and experts in the field consulted either formally or informally and the sources' effectiveness on their ability to teach. Sources of content knowledge that had a small effect size included high school agriculture program when in high school, previous agriculture related jobs or internships, professional development workshops, internet, textbooks, and other media, and experts in the field consulted either formally or informally. These areas also had an effect size of less than 0.20; therefore, considered a small effect size (Ary, et al., 2016). A medium effect size was calculated for teacher preparation program and teaching experience (Cohen's $d = 0.38$ and 0.39 , respectively). This may indicate that teacher preparation programs and teaching experiences contributed to the difference in the means between alternatively certified traditionally certified agricultural education teachers.

Table 4.9

Comparison of Sources of Knowledge and Their Effect on Ability to Teach Between Licensure Type (traditionally certified n=366 and alternatively certified n=94)

Source of Content Knowledge	F	<i>t</i> ^a	Sig. (2-tailed) ^c	df	MD ^b	Cohen's <i>d</i>
High school agriculture program when in high school						
Equal variances assumed	1.02	0.24	0.80	461		0.02
Equal variances not assumed		0.24	0.81	141	0.03	
Teacher preparation program						
Equal variances assumed	7.63	4.28	0.00	502	.048	0.38
Equal variances not assumed		3.63	0.00	119		
Teaching experience						
Equal variances assumed	2.13	4.52	0.00	531		0.39
Equal variances not assumed		3.98	0.00	160	0.37	
Previous agriculture related jobs or internships						
Equal variances assumed	0.17	-1.43	0.16	513		-0.13
Equal variances not assumed		-1.45	0.15	221	-0.13	
Professional development workshops						
Equal variances assumed	6.57	0.45	0.66	544		0.04
Equal variances not assumed		0.41	0.68	191	0.05	
Internet, textbooks, and other media						
Equal variances assumed	0.02	-1.48	0.14	547		-0.13
Equal variances not assumed		-1.42	0.16	205	-0.13	
Experts in the field consulted either formally or informally						
Equal variances assumed	0.22	-0.55	0.58	546		-0.05
Equal variances not assumed		-0.55	0.58	214	-0.05	

Note. a. 95% Confidence Interval b. Mean Difference c. *p* value

The H_0 was accepted for five of the sources of knowledge and effectiveness on their ability to teach. These sources of knowledge included high school agricultural program in high school, previous agriculture related jobs or internships, professional development workshops, internet, textbooks, and other media, and experts in the field consulted either formally or informally. The H_1 was accepted for teacher preparation program and teaching experience and associated effectiveness on their ability to teach. It is important to note that the mean scores for all sources of knowledge for both certification types were calculated to be in the range of somewhat effective to effective. This means that AC and TC teachers rate every source of

content knowledge as somewhat effective to effective on their ability to teach. Because the agricultural education curriculum is quite diverse and involves several content areas, outside sources of content knowledge are important to the development of a successful teacher.

CHAPTER 5: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

In reviewing the rationale, this study aimed at determining and describing the in-service needs of SBAE teachers' perceived Pedagogical Content Knowledge and self-reported challenges with non-content related classroom material. School districts across the country are experiencing an apparent need for alternatively certified agricultural education teachers to help fill vacant positions. As teacher attrition costs continue to rise year after year (Rice & Kitchel, 2015a), the school districts as well as state agricultural education departments and teacher preparation programs can use this study to create and implement more targeted professional development opportunities for in-service teachers. In-service teachers find the most value in professional development workshops that suit their needs, which means those differences in needs must be clearly identified and defined.

There is a clear gap in research from when alternative certification was first introduced in education to the current increased presence of alternatively certified (AC) staff in school systems. When looking at the topic of alternative certification specifically in agricultural education, this study can be compared to that of Clafin, Lambert, and Stewert (2020), where they studied what influences a teacher's decision to leave the profession and its correlation with certification type. When looking at perceived PCK of in-service SBAE, much of the research has been conducted by Dr. Rice and, therefore, this study can be compared to her and Kitchel's research (Rice & Kitchel, 2015a; Rice & Kitchel, 2015b; Rice, 2015; Rice & Kitchel, 2016; Rice & Kitchel, 2017). Rice & Kitchel have studied various applications of PCK in SBAE and sources of content knowledge and its influence on PCK development. All of the aforementioned research studies have made considerable contributions to the general body of knowledge on SBAE alternative certification and Pedagogical Content Knowledge. However, there has not been any

research conducted on the combination of PCK and its relation to alternative and traditional certification (TC) routes.

The biggest strength of this study is that it is currently the only one of its kind. Examining PCK in alternatively certified teachers and traditionally certified teachers creates valuable resources for school administrators, teacher preparation programs, instructional coaches, state agricultural education staff, and more. PCK is the single-most important factor in creating successful career educators (A. Rice, personal communication, May 27, 2020). Therefore, it is crucial to determine the PCK needs of AC and TC teachers to help increase the longevity of their careers. There is a focus on the Midwest states because of the geographic origins of this study; however, with respondents from 12 states in all areas of the United States, this study offers information that can be utilized by many organizations in an effort to create professional development workshops specific to the needs of the two groups. The next strength of this study is the number of alternatively certified respondents compared to traditionally certified teachers. Of the 551 respondents in 12 states, 23.8% were alternatively certified teachers. From 2016-2019, on average, 18.83% of all new hires in agricultural education across the country obtained licensure through alternative means (Smith et al., 2017; Smith et al., 2018; Smith et al., 2019; Foster et al., 2020). Additionally, exclusive to this study is the classroom management strategies and associated difficulty in implementation and comparison of AC and TC agricultural education teachers. In the review of literature, various reasons for teacher vacancies were discussed (Smith et al., 2018). It is quite possible that difficulty with classroom management contributes to the bigger reasons for leaving the career (Smalley, 2019). This study sheds some light on the how to better prepare both AC and TC teachers for success with classroom management strategies. Through this study, AC teachers could benefit from help with planning for each period and

teaching procedures and routines. TC teachers could benefit from help in handling and overcoming classroom disruptions.

This study contributes towards knowledge advancement on PCK of alternatively certified and traditionally certified agricultural educators as well as sources of content knowledge and difficulty in implementing classroom management strategies. However, all studies have their flaws so it's important to reveal the limitations of this study (Cooper, 2011). First and foremost, a limitation of this study is the error in the instrument for the content unit that AC and TC teachers know the least and struggle to teach. Because the last point on the Likert scale was inadvertently missing, the data could not be compared to the unit they know the best and teach well. Another limitation would have to be in the years of teaching experience of the respondents. Although the study offers a wide variety of respondents, with the most being teaching less than four years, followed by less than 10 years, and then more than 25 years, it does create several questions about the gap in respondents from 11-24 years of experience. This research did not study the PCK development based on years of experience at all. While measures were put into place to draw from different geographical areas of the United States and the survey yielded respondents from all 12 states as well as all years of experience groups, the generalizability of this study and the corresponding conclusions and recommendations is limited to that of the responding population and not the entire population of agricultural education teachers.

School administrators, instructional coaches, and state agricultural education departments can use the findings of this study to create targeted professional development for in-service SBAE teachers, which is the most prominent implication of this study. Alternatively certified teacher workshops should focus on lesson planning, teaching procedures and routines, and questioning techniques to help students understand complex ideas. In general, all teachers can

benefit from work in the Knowledge of Content and Curriculum (KCC) area. This includes overall curriculum design and sequencing of lessons. Alternatively certified and traditionally certified teachers need specific professional development workshops based on their identified needs. PCK is the most important influencer on agricultural education teachers' careers (A. Rice, personal communication, May 27, 2020); therefore, research and data should drive the decisions that foster its development in all teachers. Understanding that PCK is developed through years of reflection and practice, this study can be utilized by traditional teacher preparation programs as well as certain alternative certification programs that require coursework to foster PCK development. The classroom management component of this study will be valuable to school districts including administrators and instructional coaches. In general, effective classroom management directly relates to a teacher's ability to deliver content to students in a way they can understand and retain (Wong & Wong, 2014).

This study supports Pedagogical Content Knowledge as the theoretical framework because each question of the first two sections of the survey directly correlates with the individual constructs that make up PCK. PCK is developed through repeated experiences, professional growth, and reflective opportunities and development starts in traditional teacher preparation programs. Alternatively certified teachers miss the foundational development of PCK which a traditional teacher preparation program help to establish and develop in graduates. Their PCK development is equally as important as their TC colleagues; therefore, it is important to determine where AC teachers need the most focused professional development. Additionally, AC teachers could benefit from a mentorship program to help their PCK development, especially in the areas they missed out on in a teacher preparation program. This study aligns with PCK as the theoretical framework because the survey questions correspond with PCK constructs, which

served as the basis for comparison between licensure types. That comparison, however, is what sets this study apart from previous research and makes it unique. Previous PCK published research has not compared the development between alternatively and traditionally certified agricultural educators. The outcomes of this study support and fit in with the theory of Pedagogical Content Knowledge in a variety of ways. Shulman (1986) and Rice and Kitchel (2015a; 2015b) describe PCK as the marriage of pedagogy and subject matter. Additionally, it is where content knowledge expertise is put into practice (Rice & Kitchel, 2015a). With that understanding, connections between PCK theory and this study can be made. Respondents identified a unit they felt they knew well and taught well, which means the respondents had a deep understanding of the subject matter. This fulfills one portion of PCK, which is subject matter. The statements associated with that content unit they knew and taught well help identify PCK development by construct. For example, the question, “I can utilize questioning techniques to enhance student learning.” was calculated into the average score for the Knowledge of Content and Teaching (KCT) construct. The 18 different questions all correlated to the six different construct scores. The construct scores identify the respondent’s ability to take their subject matter expertise and put it into practice, thus developing PCK. The findings of this study show TC and AC agricultural education teachers PCK development as well as their differences. PCK is associated with the planning and the in-the-moment teaching actions (Rice & Kitchel, 2017). A unique feature of this study includes the classroom management component of TC and AC teachers. As discovered in this study, a major area of difference between TC and AC teachers with regards to classroom management is planning for each period. As stated earlier, planning for the class period is a contributing factor of PCK development by Rice & Kitchel (2017).

A unique demographic of this study in relation to national agricultural education teachers is gender. This study yielded responses from 41.7% male and 57.7% female. Nationally, 53.4% are male and 44% are female (Smith et al, 2018). Years of teaching experience, since it is so crucial to PCK development (Rice 2015b), is also an interesting point for discussion. This study saw 34.1% of respondents teaching less than four years followed by 24.9% teaching between five and nine years. Then, the next highest group included 25 or more years of teaching experience (11.6%).

**Objective 1: Describe Pedagogical Content Knowledge of Traditionally Certified
Agricultural Education Teachers**

In comparing this study to that of Rice & Kitchel (2015b), which had a responding population of 77, the average scores for all six of the constructs were in the “to fair extent” range. In their study, the highest construct average score was Common Content Knowledge at 4.64 followed by Horizon Content Knowledge (Rice & Kitchel, 2015b). The findings from this study support those of the Rice & Kitchel (2015b) because all six constructs were in the “to fair extent” range as well with the highest mean score in Horizon Content Knowledge followed by Common Content Knowledge. To fair extent means, on the scale of 1 – 5, respondents averaged at least a 4 for to what extent they agreed with each given statement.

Traditionally certified agricultural educators had the highest average construct score in Horizon Content Knowledge (HCK). This construct directly relates to a teacher’s ability to link the subject matter with other units within agriculture as well as beyond agriculture (Rice & Kitchel, 2015b). These agricultural education teachers have specific training through university teacher preparation programs on instructional methods that help them make real-world

connections with agriculture content and applications of agriculture knowledge across other disciplines within education as a whole.

The next highest average construct score for traditionally certified agricultural education teachers is in the Common Content Knowledge (CCK) construct. This is perhaps the most fundamental construct within PCK. Teachers with high CCK simply understand agricultural industry concepts and are able to discern between accurate and inaccurate information (Rice & Kitchel, 2015b). Traditionally certified agricultural educators develop this knowledge through so many ways such as undergraduate courses in a traditional teacher preparation program and outside jobs/experiences in agriculture.

Developed Specialized Content Knowledge (SCK) gives teachers the ability to take incorrect student answers and explain why it was incorrect and identify where the misunderstanding occurred. Knowledge of Content and Students (KCS) is the teacher's ability to predict challenging concepts and knowing where they are at developmentally (Rice & Kitchel, 2015b). Work on these two constructs for traditionally certified teachers primarily takes place through teaching methods courses in teacher preparation courses because it requires an understanding of how the adolescent brain works.

Knowledge of Content and Teaching (KCT) and Knowledge of Content and Curriculum (KCC) comes from years of teaching experience and being able to effectively plan for course sequence, curriculum design, questioning and engagement techniques, and deciding which instructional strategy best suits the age level. Teachers continue to develop these constructs well into their career. When these constructs are mastered, it is safe to say that PCK development is at its peak. Even at a peak, though, there is still a need for reflection in the teaching practice.

Objective 2: Describe Pedagogical Content Knowledge of Alternatively Certified Agricultural Education Teachers

There has not been any previous research on perceived PCK in alternatively certified teachers so it cannot be compared to previous research. However, it can be compared to the Rice & Kitchel (2015b) study just like the previous research objective. All six constructs, for this study, were found to be in the “to fair extent” range as well. However, it did see numerically lower mean scores for all PCK constructs except for HCK.

Alternatively certified agricultural education teachers also saw the highest construct score in Horizon Content Knowledge (HCK) followed by CCK. This is possible because these teachers have different experiences outside of education. This has the potential to give them the unique ability to use personal real-world examples and experiences to make those same connections for students in the HCK construct. CCK for alternatively certified teachers is in the “to fair extent” range as well because they are teaching the content to prepare students for careers beyond the high school classroom – the exact careers they likely transferred from when those teachers made the decision to switch to career and technical education. There could potentially be great value in learning from people who have actually performed the job they are teaching students about. However, alternatively certified teachers are likely expert in one area within agriculture, which means they may not be as well-rounded as a traditionally certified teacher in relation to agriculture content knowledge.

Because alternatively certified teachers have not had teacher preparation programs, their SCK, KCS, KCT, and KCC constructs are likely developed through a variety of means such as professional development opportunities, learning from experts in the field, and years of teaching experience.

Objective 3: Describe the Differences in PCK Between Licensure Types

In all six individual PCK constructs, traditionally certified teachers were numerically higher. This initially tells us that traditionally certified teachers perceive their PCK and constructs within to be higher than alternatively certified teachers. The significant difference in KCT between alternatively and traditionally certified teachers saw a small effective size; however, the significant difference itself still merits some discussion. According to Rice and Kitchel (2015b), an example of KCT in practice would be applying various questioning techniques to help students grasp challenging or complex topics of instruction. Traditionally certified and alternatively certified teachers have different preparation experiences. The routes have differences in post-secondary courses, outside experiences, and classroom teaching experience. Simply put, it may not matter exactly what that preparation includes because all of the experiences are valuable and effective regarding their ability to be successful in the classroom. Certainly, teacher preparation programs provide teachers with specialized methods and instructional strategies courses exclusive, for the most part, to agricultural education that help prepare and begin fostering PCK in pre-service educators. Alternatively certified teachers are not getting that same experience; however, according to the research data, the knowledge contributing to PCK development is coming from other sources, but, in the end, they cannot acknowledge PCK development if they do not know what it is to begin with. It can be concluded that their experiences outside of the classroom are equally as valuable based on the finding in sources of agriculture knowledge and the effectiveness on ability to teach. It is recommended that alternatively certified teachers still participate in the education-specific instructional courses, even if it is during their first few years of teaching. Since educators need to constantly reflect on

their practices and instruction, those courses can be valuable at any stage. Afterall, PCK development takes years and is never perfected (Rice & Kitchel, 2016).

School administrators and state agricultural education staff can use this information to effectively design and implement more specific professional development opportunities for in-service SBAE. The data shows that most agricultural educators, regardless of certification type, feel very comfortable with general content knowledge as well as the ability to link subject matter to other units within agriculture and beyond. A key item for this conclusion is all six constructs saw a small effect size, which can be interpreted as a negligible difference even though a significant difference was observed in the KCT construct. The next step for these entities would be to implement professional development workshops in questioning techniques, understanding student development to predict challenging concepts, choosing appropriate instructional strategies for the concepts at hand, designing curriculum, and sequencing lessons because these tasks develop the KCT, KCS, and KCC constructs with PCK.

Objective 4: Describe Teachers' Perceptions of Classroom Management Between Licensure Type

For the most part, traditionally certified teachers found no difficulty to occasional difficulty in all 10 classroom management strategies. The lowest mean difficulty level for traditionally certified teachers was 1.56 (managing arrivals and dismissals) and highest was 2.03 (keeping students on task). Alternatively certified teachers were also between no difficulty and occasional difficulty for the 10 strategies with the lowest being 1.56 (managing arrivals and dismissals) and highest being 2.14 (keeping students on task). Alternatively certified teachers saw higher average difficulty in all classroom management strategies with the exception of handling disruptions (TC = 1.75 and AC = 1.68).

This area of the study proved the biggest difference in teachers who obtained licensure through traditional pathways versus alternative pathways. There was a significant difference in the planning for each period ($p=0.00$) and teaching procedures and routines ($p =0.01$). Both of the classroom management strategies also were found to have a medium effect size indicating a stronger difference between the two groups. The classroom management strategy of effective classroom transitions saw a large effect size. All of these strategies are discussed and developed in teacher preparation program courses. However, it can be argued that effectively planning for each period and teaching classroom procedures and routines are the two most important categories because it is the foundation for everything that follows. A properly planned class period can get and keep students' attention, incorporate quality instructional strategies such as group work and discussions, create effective transitions from one piece to another, and minimize disruptions. Teaching procedures and routines in a classroom allow for a planned period to be executed. When a properly planned class period is executed well, it becomes easier to deliver agricultural content in a way that students can not only comprehend but apply to their own lives (Darling-Hammond & Bransford, 2005). Planning class periods and teaching procedures and routines creates a domino effect for all things classroom management related. According to Smalley, Hainline, and Sands (2019), classroom management challenges are one of the reasons that SBAE are choosing to leave the profession each year. The first step in helping AC and TC teachers with those challenges is to clearly identify which specific parts of classroom management are challenging.

Surprisingly, alternatively certified teachers experience less average difficulty in handling disruptions in the classroom compared to traditionally certified teachers. It is challenging to determine why that might be evident as traditional university preparation programs develop these

skills in the classroom management courses. Regardless of the reason, a major goal of this study is to identify which areas of classroom management traditionally certified educators may require targeted professional development opportunities. While alternatively certified educators will benefit from specific professional development on planning for each period and teaching procedures and routines, traditionally certified educators would benefit from professional development workshops on handling and overcoming disruptions in the classroom.

Because of the differences in those two classroom management strategies, it is important to determine how to address those and create professional development opportunities for alternatively certified teachers to work on growing. After all, the goal of this study is to identify exactly what alternatively certified teachers need to be successful in the classroom thus leading to retention in the agriculture education career.

School administrators and state agricultural education staff have a common mission of retaining quality educators for many years. Specific classroom management professional development for alternatively certified teachers should focus on creating and implementing plans for the entire class period and teaching appropriate, enforceable procedures and routines that contribute to overall successful classroom management. Traditionally certified teachers can always benefit from professional development opportunities as well. This group's particular professional development should focus on handling classroom disruptions and learning how to overcome them. As the world of education continues to evolve every day, it is important to continue to train and teach educators how to best work with all students whether in-person or in virtual environments.

Objective 5: Describe Teachers' Perceived Sources of Knowledge in Relation to Teacher Licensure Routes

This study saw the seven sources of content knowledge to be all in the “somewhat effective” to “effective” range as having an effect on their teaching. This study supports the Rice & Kitchel (2015b) study quite well when being compared. In their study, all sources of knowledge were in the same range of “somewhat effective” to “effective”. Their study saw the highest average in previous agriculturally related jobs or internships (Rice & Kitchel, 2015b). This study saw the previous agriculturally related jobs or internships source of knowledge to be the highest average score for alternatively certified teachers. It was second for traditionally certified teachers after teaching experience. The teacher preparation programs and teaching experience had medium effect sizes, and all other sources of knowledge had a small effect size.

For traditionally certified teachers, the highest mean for sources of content knowledge and associated effectiveness on their ability to teach was teaching experience (5.34), followed by previous agriculturally related jobs or internships (5.14), and experts in the field (5.10). Alternatively certified teachers placed the highest emphasis on previous agriculturally related jobs or internships (5.27) and experts in the field (5.15). Rice & Kitchel (2015b) discuss the importance of teaching experience on content knowledge because the teacher must evaluate how the content knowledge can be purposefully utilized in the classroom. Because alternatively certified teachers have not typically gone through a university teacher preparation program, the sources of content knowledge must be made up for somewhere. The data clearly shows the importance of the industry related job experiences that they bring to the classroom. Experiences in the agricultural industry outside of the classroom is important to any teacher, regardless of certification type. Newcomb, McCracken, Warmbrod, and Whittington (2004, p. 23) stated,

“Actual work experience in agriculture is essential if teachers are to achieve the level of technical competence required for teaching agriculture successfully.”

Surprisingly, both licensure types had the lowest mean for their high school program as a student for source of content knowledge. However, it is still important to note that both rated it as somewhat effective. This goes to show that quality agricultural educators do not have to come from high school programs themselves as their content knowledge can come from a variety of sources. Nevertheless, knowledge from those high school programs is still valuable.

As expected, there was a statistically significant difference between licensure types when looking at teacher preparation programs and teaching experience as sources of content knowledge and their effect on teaching. The teacher preparation program is the foundation for traditional certification. Additionally, longer teaching experience is evident in traditionally certified teachers compared to alternatively certified. Teachers are constantly reflecting on their own practice and continue to make adjustments year after year. If alternatively certified teachers are not in the career as long as traditionally certified, then teaching experience as a source of knowledge will be lower.

Recommendations for Future Research

This study does raise some questions in regard to years of teaching experience and PCK development. According to Rice & Kitchel (2016), PCK in in-service SBAE teachers is not considered fully developed until five to seven years of teaching experience. A majority of respondents in this study had been teaching less than four years (34.1%). With this in mind, it means that 34.1% of the respondents are considered to still be working on their foundational PCK development. It is recommended that future studies focus on years of teaching experience based on licensure route and their PCK development. It is possible that greater differences

between licensure type could be evident at different stages of early career educators. School administrators and state agricultural education staff could potentially be able to better target challenging areas of PCK if those educators are broken apart by experience level. The findings of this study indicate that AC agricultural educators primarily need assistance in the construct area of Knowledge of Content and Teaching in addition to classroom management strategies of teaching procedures and routines and planning for each period. With those areas identified, the next step in research would be to develop specific professional development workshops to meet those needs. Future research could focus on the content and delivery methods for those professional development experiences.

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APPENDIX A. SURVEY

Are you currently teaching middle school or high school agriculture classes?

Comparing the Content and Pedagogical Knowledge of Alternatively and Traditionally Certified Agricultural Educators

Dear Secondary Agricultural Education Teacher:

I am Kristi Tonnessen, a graduate student in the School of Education at North Dakota State University in Fargo, ND. I am conducting a research project to determine in-service needs of agricultural educators who obtained licensure through alternative certification routes as well as the traditional pathway. My research is under the direction of Dr. Adam Marx at NDSU. Our goal is to identify professional development needs of alternatively certified SBAE teachers, and traditionally certified, in an effort to retain them for years to come.

Because you are a secondary agricultural education teacher, you are invited to take part in this research project. Your participation is entirely your choice, and you may change your mind or withdraw from participation at any time. The choice to quit the study is at no penalty to you.

There are no perceived risks in participation of this study. You are not expected to get any benefits from being a participant in this research study. However, it is likely that agricultural education as a whole and teacher preparation programs will benefit since the professional development needs of in-service SBAE teachers, regardless of certification type, will be more clearly identified.

The survey should take about 10-15 minutes to complete about the perception of preparedness and ability to perform non-content related classroom instruction and demographic information. The survey will be completed on Qualtrics. This can be done from your computer or cell phone. This will be submitted online. If you choose, the final page of the survey will include instructions to follow should you desire to be entered into a

drawing for 1 of 10 Amazon gift cards (\$50 each). In order to maintain anonymity, the identifiable information shared for the drawing will not be linked to your survey responses.

This study is anonymous. That means that no one, including members of the research team, will know the information you provide has come from you.

If you have any questions about this project, please contact me at (701) 340-0435 or kristi.m.tonnessen@ndsu.edu, or contact my advisor, Dr. Adam Marx at (701) 231-7439 or adam.marx@ndsu.edu.

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at (701) 231-8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at NDSU HRPP Office, NDSU Dept 4000, PO Box 6050, Fargo, ND 58108-6050.

Thank you for your time in taking part in this research. If you wish to receive a copy of the results, please email kristi.m.tonnessen@ndsu.edu.

Are you currently teaching middle school or high school agriculture?

- Yes
- No

Do you consent to participate in this study?

- Yes
- No

What is your highest degree earned?

⌵

- Bachelor's Degree
- Master's Degree
- Education Specialist
- Doctoral Degree

How many years have you taught agriculture?

What agriculture subjects have you taught? Check all that apply.

- Agricultural Biotechnology
- Agricultural Business
- Agricultural Communications
- Agricultural Leadership
- Agricultural Mechanics
- Agriscience
- Animal Science
- Natural Resources
- Plant Science
- Other (please describe):

For 'Other' above, please describe:

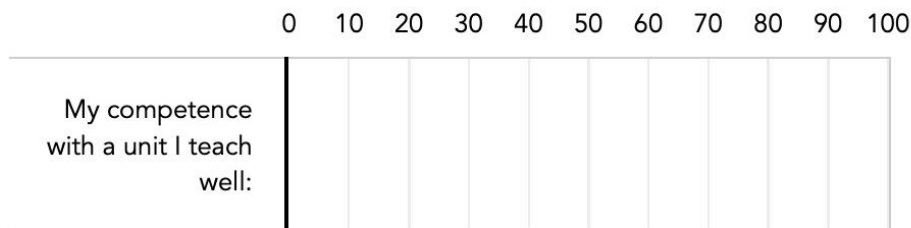
Please indicate the State where you currently teach:

Choose a single agriculture instructional unit that ***you feel you teach well and know the content well***. A unit is a group of lessons within a particular course. An example would be a genetics unit in an animal science course. Identify your chosen unit below:

Below, rate how competent you currently feel you are in teaching your chosen unit by moving the slider bar.

0 = you are not competent at all in teaching the unit

100 = you are very competent in teaching the unit



Please read each statement below and answer based on the unit you identified that you teach well and know the content well.
 Select the extent to which you agree with each statement.

	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Completely E
When given information, I can easily discern accurate from inaccurate information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When presented with a problem, I can find multiple ways to get an answer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily explain the definitions of commonly used terms in the unit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can explain how this unit links to core content areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When a student makes an error, I can accurately interpret why that error was made.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Completely E
I can explain how this unit links to other units within agriculture.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to easily explain the process behind various concepts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to easily identify when a student gives an incorrect answer when teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily explain why a student answer is incorrect.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Completely E

Please read each statement below and answer based on the unit you identified

that you teach well and know the content well.
 Select the extent to which you agree with each statement.

	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Great Extent
I am able to easily predict student misconceptions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily identify the advantages and disadvantages of various instructional strategies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know where my students should be developmentally.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can utilize questioning techniques to enhance student learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to fluidly sequence my material.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Great Extent
I am able to easily locate					

outside resources to aid in my teaching.

I can easily predict what concepts will be most challenging for my students.

When a student makes a remark, I know when to effectively use it to make a point in my instruction.

Curriculum design comes easily to me.

To No
Extent

To
Little
Extent

To
Some
Extent

To
Fair
Extent

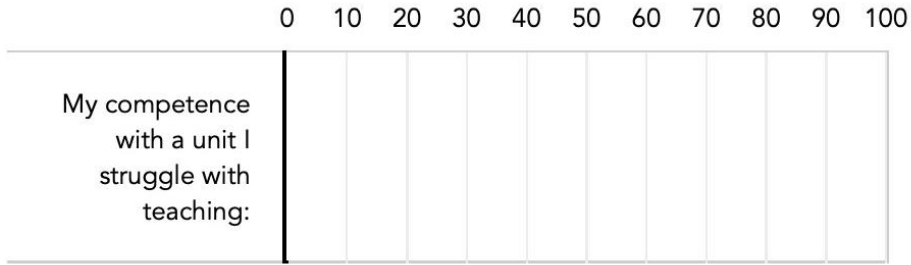
To
Great
Extent

Choose a single agriculture instructional unit that you feel you **struggle with** teaching and know the content the least. A unit is a group of lessons within a particular course. An example would be a genetics unit in an animal science course. Describe your chosen unit below:

Below, rate how competent you currently feel you are in teaching your chosen unit by moving the slider bar.

0 = you are not competent at all in teaching the unit.

100 = you are very competent in teaching the unit.



Please read each statement below and answer all questions based on the unit you identified that you struggle with teaching and know the content the least. Select the extent to which you agree with each statement.

	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Great Extent
When given information, I can easily discern accurate from inaccurate information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When presented with a problem, I can find multiple ways to get	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

an answer.

I can easily explain the definitions of commonly used terms in the unit.

I can explain how this unit links to core content areas.

When a student makes an error, I can accurately interpret why that error was made.

To No
Extent

To
Little
Extent

To
Some
Extent

To
Fair
Extent

To
Great
Extent

I can explain how this unit links to other units within agriculture.

I am able to easily explain the

process behind various concepts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to easily identify when a student gives an incorrect answer when teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily explain why a student answer is incorrect.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent	To Great Extent

Please read each statement below and answer all questions based on the unit you identified that you struggle with teaching and know the content the least. Select the extent to which you agree with each statement.

	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to easily predict student misconceptions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent

I can easily identify the advantages and disadvantages of various instructional strategies.

I know where my students should be developmentally.

I can utilize questioning techniques to enhance student learning.

I am able to fluidly sequence my material.

To No
Extent

To
Little
Extent

To
Some
Extent

To
Fair
Extent

I am able to easily locate outside resources to aid in my teaching.

I can easily predict what concepts will be most challenging for my students.

When a student makes a remark, I know when to

effectively use it to make a point in my instruction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Curriculum design comes easily to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	To No Extent	To Little Extent	To Some Extent	To Fair Extent

Were you a former middle or high school agriculture student?

Yes

No

How many total years were you involved in a middle and/or high school agriculture program?

Please read each statement below. For this section, please rate the effectiveness that each source of agriculture knowledge has had on your ability to teach.

	Not Applicable	Very Ineffective	Ineffective	Somewhat Ineffective	Somewhat effective	Effective	Very Effectiv
Your high school agriculture program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

when you were in high school							
Your teacher preparation program (University training)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your teaching experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your previous agriculture related jobs or internships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional development workshops you have attended	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet, textbooks, or other media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experts in the field you consulted either formally or informally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other if applicable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please read each statement below For this section, please rate to what extent you

experience difficulty in the following classroom management strategies.

	Much difficulty	Some difficulty	Occasional difficulty	No difficulty
Getting students' attention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Keeping students on task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitation of group work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teaching procedures & routines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective classroom transitions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managing arrivals and dismissals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Handling disruptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning for each period	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitation of class discussions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enforcing classroom expectations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Do you have a major in a content area other than agricultural education? For example: animal science or agricultural economics.

- Yes
- No

Please enter in your content area major(s) here:

Do you have a minor in a content area other than agricultural education? For examples: animal science or agricultural economics.

- Yes
- No

Please enter your content area minor(s) here:

What is your gender?

- Male
- Female
- Prefer not to answer

How did you obtain your teaching license?

- Traditional certification (University teacher preparation program)
- Alternative certification

If answered 'alternative certification' in previous question, please explain that process below:

To THANK YOU for your time...

If you are interested in taking part of the drawing for 1 of 10 \$50.00 Amazon Gift Cards, please insert your full name below in the first line and your email in the second line. This is for randomization and contact of award only. Your name and email will be separated from your responses above.

For award notifications only, please provide your name below:

For award notifications only, please provide your email address below:

APPENDIX B. SBAE TEACHER EMAIL

Comparing the Content and Pedagogical Knowledge of Alternately and Traditionally Certified Agricultural Educators

Dear Secondary Agricultural Education Teacher:

I am Kristi Tonnessen, a graduate student in the School of Education at North Dakota State University in Fargo, ND. I am conducting a research project to determine in-service needs of agricultural educators who obtained licensure through alternative certification routes as well as the traditional pathway. My research is under the direction of Dr. Adam Marx at NDSU. Our goal is to identify professional development needs of alternately certified SBAE teachers, and traditionally certified, in an effort to retain them for years to come.

Because you are a secondary agricultural education teacher, you are invited to take part in this research project. Your participation is entirely your choice, and you may change your mind or withdraw from participation at any time. The choice to quit the study is at no penalty to you.

There are no perceived risks in participation of this study. You are not expected to get any benefits from being a participant in this research study. However, it is likely that agricultural education as a whole and teacher preparation programs will benefit since the professional development needs of in-service SBAE teachers, regardless of certification type, will be more clearly identified.

The survey should take about 10-15 minutes to complete about the perception of preparedness and ability to perform non-content related classroom instruction and demographic information. The survey will be completed on Qualtrics. This can be done from your computer or cell phone. This will be submitted online. If you choose, the final page of the survey will include instructions to follow should you desire to be entered into a drawing for 1 of 10 Amazon gift cards (\$50 each). In order to maintain anonymity, the identifiable information shared for the drawing will not be linked to your survey responses.

This study is anonymous. That means that no one, including members of the research team, will know the information you provide has come from you.

If you have any questions about this project, please contact me at (701) 340-0435 or kristi.m.tonnessen@ndsu.edu, or contact my advisor, Dr. Adam Marx at (701) 231-7439 or adam.marx@ndsu.edu.

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at (701) 231-8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at NDSU HRPP Office, NDSU Dept 4000, PO Box 6050, Fargo, ND 58108-6050.

Thank you for your time in taking part in this research. If you wish to receive a copy of the results, please email kristi.m.tonnessen@ndsu.edu.

APPENDIX C. INSTITUTIONAL REVIEW BOARD APPROVAL



12/10/2020

Dr. Adam Alan Marx
School of Education

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #IRB0003303, "Comparing the Content and Pedagogical Knowledge of Alternatively and Traditionally Certified Agricultural Educators"

NDSU Co-investigator(s) and research team:

- Adam Alan Marx
- Kristi Marie Tonnessen

Approval Date: 12/10/2020
Expiration Date: 12/09/2023

Study site(s): The research will be conducted online. The data will be collected from in-service agricultural educators in Arizona, California, Florida, Missouri, New York, North Carolina, North Dakota, Ohio, Oklahoma, Texas, Virginia, and Wisconsin.

Funding Agency:

The above referenced human subjects research project has been determined exempt (category 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*).

Please also note the following:

- The study must be conducted as described in the approved protocol.
- Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Promptly report adverse events, unanticipated problems involving risks to subjects or others, or protocol deviations related to this project.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

NDSU has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

RESEARCH INTEGRITY AND COMPLIANCE

NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | ndsu.research@ndsu.edu

Shipping Address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

NDSU is an EO/AA university.

APPENDIX D. INSTITUTIONAL REVIEW BOARD APPROVAL OF CHANGE

From: no-reply@erac.ndsu.edu <no-reply@erac.ndsu.edu>
Sent: Tuesday, January 12, 2021 11:36 AM
To: Marx, Adam <adam.marx@ndsu.edu>
Cc: Tonnessen, Kristi <kristi.m.tonnessen@ndsu.edu>
Subject: IRB Approval of Change - IRB0003303



The protocol amendment request and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the North Dakota State University Institutional Review Board.

Thank you for cooperating with NDSU IRB procedures, and best wishes for a successful study.

Sincerely,

Kristy Shirley, CIP

Administrator / Institutional Review Board
NORTH DAKOTA STATE UNIVERSITY

phone: 701.231.8995
fax: 701.231.8098
kristy.shirley@ndsu.edu
ndsu.irb@ndsu.edu

For more information regarding IRB Office submissions and guidelines, please consult https://www.ndsu.edu/research/for_researchers/research_integrity_and_compliance/institutional_review_board_irb/. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

The IRB change that was granted added Minnesota agricultural education teachers to the sample population. The state was not on the list of prospective respondents but was added after the original IRB application was submitted.