

Assessing the Pedagogical Content Knowledge of School-Based Agricultural Education Teachers and Determining their Individualized Need for Professional Development by Licensure Type

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Abstract

This study aimed to describe school-based agricultural education (SBAE) teachers' perceived Pedagogical Content Knowledge (PCK) and individualized professional development needs by licensure type. A series of survey questions were used to describe the sample of SBAE teachers, their PCK, sources of knowledge, and professional development needs. Regardless of licensure type, participants mostly agreed on their sources of knowledge, with teaching experience and previous employment being the top sources of knowledge. However, there were differences in PCK, and professional development needs by licensure type. For example, traditionally certified teachers had higher PCK in Horizon Content Knowledge and Knowledge of Content and Students. In addition, they reported a greater need for professional development in content-specific topics and FFA & SAEs. On the other hand, alternatively certified teachers had higher PCK in Common Content Knowledge and Specialized Content Knowledge. In addition, they reported a greater need for professional development in curriculum development and instructional strategies.

Introduction

The most significant impact on student learning is the teacher and how they use their knowledge to teach (Sadler et al., 2013). Effective teachers must be able to determine the needs of their students, plan for and evaluate instruction, utilize a variety of teaching modalities, and demonstrate their knowledge of teaching, the learning process, and their content area (Rice & Kitchel, 2017). In 1986, Lee Shulman proposed the theory of Pedagogical Content Knowledge (PCK), which fuses teachers' knowledge of the content and understanding of how to teach that content (Shulman, 1986). Since its inception, PCK research has aided in creating a picture of what teachers do when teaching and has further established that content knowledge alone does not make an individual qualified to teach (Rice & Kitchel, 2018). In Career and Technical Education (CTE) and Science, Technology, Engineering, and Mathematics (STEM), it has been argued by teacher educators that PCK is essential to the success of teachers (Barendsen & Henze, 2017). Moreover, it has been reported by the science and math fields that deficiencies exist in PCK among their teachers (Ball et al., 2008; Halim & Meerah, 2002). While PCK has been widely studied in other disciplines, research in PCK among CTE areas, specifically agricultural education, has been limited to few studies.

With less than 50% of all traditionally certified pre-service teachers accepting teaching positions immediately following graduation (Cowan et al., 2016) and increasing attrition rates, more and more

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individuals are entering the classroom through alternative means (Claflin et al., 2020). To ensure a supply of highly qualified school-based agricultural education (SBAE) teachers, it has become imperative to assess their knowledge base and pedagogical abilities (Rice & Kitchel, 2015). According to the National Research Agenda for Agricultural Education and Communications, "prepar[ing] and provid[ing] an abundance of fully qualified and highly motivated agriscience educators at all levels" was a priority area (Robinson & Edwards, 2012, p.150). Although much of the teacher shortage is due to retirements, many SBAE teachers leave the profession for various reasons (Solomonson et al., 2019). While these reasons vary extensively, the uphill battle of finding qualified teachers to fill these vacancies has been a challenge (Guffey & Young, 2020). As a result, in 2016, AAAE began evaluating alternatively certified (AC) SBAE teachers as part of their supply and demand work. Since then, AC teachers have filled the void and widened the margin. Now, according to the National Supply and Demand data, nearly 35% ($f = 568$) of all new hires in 2021 ($N = 1680$) were licensed through an alternative program, were non-licensed, or their licensure status was unknown (Smith et al., 2022)

Using NAAE's regional map, regions IV and VI combined in 2021 comprised 30% of all teachers who left the profession, 27% of all SBAE teacher retirements, and 26.8% of all AC or non-licensed hirings. Moreover, these two regions saw over 600 students enroll in teacher preparation programs, with only 137 graduates entering the profession (Smith et al., 2022). However, this is not unique to just regions IV and VI. Due to increasing retirement rates, individuals leaving the profession, and a lower rate of teachers entering the profession from a teacher preparation program, alternative certification has grown in popularity. As a result, alternative certification has been sought out to help alleviate the teacher shortage problem (Claflin et al., 2022).

Alternative certification is "anything but a four-year undergraduate program housed in a school of education" (Walsh & Jacobs, 2007, p.13). According to Bowling and Ball (2018), there are over 130 varieties of AC pathways across the nation, differing in duration, entry requirements, and curriculum. While the goal of AC has remained constant, some have questioned the legitimacy of these programs despite the impact these programs have had on closing the teacher shortage gap. Robinson & Edwards (2012) believe the credibility of these teachers has been questioned, as AC teachers lack the pedagogical preparation that their counterparts receive through a teacher preparation program. Knowing the deficiencies that exist within both licensure types is critical in understanding the professional development needs of all SBAE teachers.

Theoretical Framework

Self-efficacy, a concept first developed by Albert Bandura within his social cognitive theory (Bandura, 1977), postulates that human achievement depends on the individual's interactions. The more an individual is exposed to something, the more confident they become in their abilities to address it. Related to teaching, research shows that teachers with high levels of self-efficacy are more open to new methods of teaching, challenge themselves more, and exhibit greater confidence in planning, solving problems, and seeking assistance (Lazarides & Warner, 2020).

Similarly, the development of an educator's Pedagogical Content Knowledge (PCK) coincides with Bandura's theory. Initially theorized by Lee Shulman (1986), PCK, in the context of agricultural education, is where educators put their content knowledge expertise to practice. The foundation of PCK includes knowledge of content, students, students' understanding, teaching methods, assessment, and curriculum (Rice & Kitchel, 2015). While PCK development does not occur overnight, teacher preparation courses, in-practice reflection, professional development, and teaching experience all play an essential role in the development of PCK (Park & Oliver, 2008).

If AC is going to be a viable option for the future of SBAE, agricultural education professionals must discover the PCK needs of all teachers, especially AC teachers. Knowing this, we can tailor

professional development to the needs of SBAE teachers, thus improving their self-efficacy and hopefully keeping them in the profession. The longevity of teachers in the SBAE profession and students' success may depend on the development and execution of an SBAE teacher's PCK.

Review of Literature

Research in agricultural education related to this topic has been limited to a handful of studies. Furthermore, the majority of research has only focused on identifying a need for greater recruitment and retention efforts (e.g., Blackburn et al., 2017; Lawver & Torres, 2012), the current presence of AC teachers in agricultural education (e.g., Bowling & Ball, 2018), and the in-service needs among traditionally certified (TC) or AC teachers (e.g., Stair et al., 2019; Smalley & Smith, 2017). Moreover, research has yet to address PCK coupled with these two cohorts of teachers, the influence of their PCK levels, and the professional development needs based on their reported PCK levels.

Within SBAE, a shortage of highly qualified agricultural educators is not a new phenomenon. While various factors have contributed to this teacher shortage, a simple solution does not seem to exist. According to the National Supply and Demand statistics, nearly 35% of graduates graduating from teacher preparation programs choose to teach in a different state or another profession. The report also mentioned that 674 individuals left the profession, the highest amount in the last three years (Smith et al., 2022). While the need is immense, recruitment and retention efforts have not been as successful (Sorensen et al., 2016). Barriers to certification have been identified as just one of the reasons individuals are less likely to seek certification (Bowling & Ball, 2018). As a result, research has indicated a need for diversifying the paths to the teaching profession (Claflin et al., 2020).

In some states, policymakers and school districts have embraced AC to address the teacher shortage (Ingersoll & Smith, 2003). While some have looked to alternative certification as a remedy to the ongoing teacher shortage, others have been quick to call out alternative certification, as these teachers enter the classroom with little to no pedagogical skills and are presented with far more challenges than their traditionally certified colleagues (Bowling & Ball, 2018; Hoerst & Whittington, 2009; Porter, 2011; Roberts & Dyer, 2004; Stair et al., 2019; Touchstone, 2015). Due to a lack of pedagogical preparation, it is important to understand how AC teachers compare to TC teachers regarding their understanding of the content, pedagogical practices, and perceived ability to teach their specific content area (Robinson & Edwards, 2012). According to Darling-Hammond et al. (2005), AC teachers are considered "less prepared" than their TC counterparts. Additionally, Watts (1986) also suggested that AC programs are deficient and less rigorous in at least one of the critical preparation areas: a) applicants may teach a subject area in which they have no experience; b) applicants may enter with less college preparation; c) applicants may complete the program with little to no pedagogical preparation; and d) applicants may not be required to pass a competency exam to receive licensure. On the contrary, in a research study examining PCK among biology teachers with two years of teaching experience, few differences in PCK were found between the study participants: teachers and pre-service teachers. While this study indicated that teaching experience or prior knowledge of teaching did not have a significant impact on an individual's ability to develop lessons, it was concluded that in order for individuals to develop PCK, engaging in meaningful field experiences that include mentoring was necessary (Friedrichsen et al., 2008).

While uncertainty exists in which path to licensure generates the best learning outcomes for students, research in agricultural education has identified a need to investigate the impacts of various teacher certification pathways (Bowling & Ball, 2018). Based on the critical preparation areas (Watts, 1980) mentioned, assessing the PCK levels of AC and TC teachers [in SBAE] may offer a greater understanding of the influence teachers have on their students and what supports are needed to ensure that the teacher is prepared and able to present their content effectively. To ensure teachers are meeting the needs of their students, not only must they be adept at teaching relevant content, but they also should be well-versed in

implementing pedagogical techniques at all phases of their program. While gaps are likely to exist in how SBAE teachers are prepared, identifying those gaps and providing intervention is the first step in ensuring teachers are effective in the classroom.

Regarding professional development, a study comparing TC and AC teachers found that AC teachers expressed a greater need for professional development in curriculum and instruction and program management and planning. In contrast, TC teachers had a greater need for professional development pertaining to content (Roberts & Dyer, 2004). Some believe that AC teachers come into the profession with unique skills that set them apart from TC teachers (Rose & Sughrue, 2020). This argument was supported by Rocca & Washburn (2006) when their research found that AC teachers tend to come into the profession with greater confidence in their ability to teach agriculture due to their additional life, education, and occupational experience. In a more recent article, Tonnessen (2021) articulated a need for individualized professional development as the needs of both cohorts of teachers vastly differ.

Moreover, Tonnessen (2021) recommended that school administrators and state agricultural education staff work to identify these differences and target the areas SBAE teachers struggle with so that professional development can be tailored. Offering unique professional development based on the individualized needs of these teachers will impact their behaviors and improve their effectiveness as educators (Darling-Hammond & Richardson, 2009; Wenglinsky & Silverstein, 2006). Rice & Kitchel (2018) also identified a need for additional research as PCK in agricultural education has yet to be defined. Additionally, they signaled a need for understanding what shapes PCK in SBAE teachers. This was supported by the statement, "what shapes PCK specifically in agriculture teachers can serve as the starting point for future PCK development studies" (p. 66). Identifying the PCK of all SBAE teachers, including their sources of knowledge, past experiences, and areas of deficiency, teacher preparation programs, and AC programs can change how they prepare their pre-service teachers. This also includes how SBAE teachers are supported through professional development.

Purpose and Objectives

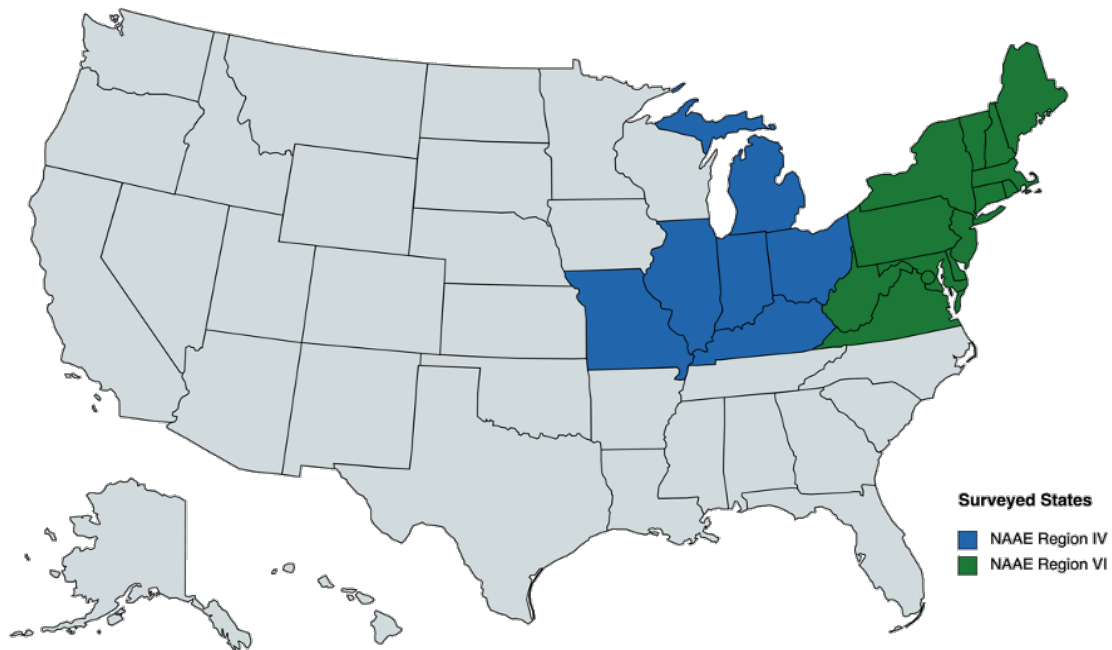
This study aimed to identify and compare the PCK levels (of all agricultural topics in general) of TC and AC teachers in the Northeast region of the United States. Additionally, this study sought to determine teachers' individualized professional development needs based on certification type. This research supports the first value statement outlined by the American Association for Agricultural Education. Specifically, this value statement addresses the need for "instruction to help individuals make informed decisions as AFNR consumers and to prepare them for skilled agricultural work" (AAAE, 2023, p. 6). The following research objectives guided this study:

1. Describe the sample of SBAE teachers who obtained TC through a teacher preparation program or AC through an alternative preparation program.
2. Describe the differences in Pedagogical Content Knowledge between licensure types.
3. Describe the sources of knowledge TC and AC SBAE teachers use.
4. Describe the professional development needs of both TC and AC SBAE teachers.

Methods and Procedures

The target population of this descriptive relational study was all SBAE teachers from the Northeast region of the United States who were actively teaching during the 2021-2022 school year. We obtained the names and contact information of all SBAE teachers from each state's teacher directory. Each state in NAAE's Region IV and VI was represented (Figure 1). The attempted census consisted of all SBAE teachers in both regions ($N = 3635$).

Figure 1

Surveyed States by NAAE Region

Survey methods were utilized to collect data from these teachers. We administered the survey instrument and collected the data in June of 2022 using the online survey program Qualtrics. Using Dillman's (2007) tailored design method, a method branching from the social exchange theory, we made three contact points with participants to elicit responses. Our survey elicited 485 usable responses. We analyzed the data using IBM SPSS Statistics version 28.

The instrument utilized was adopted from Tonnessen (2021), which consisted of items adapted from the Missouri Agriculture Teacher Knowledge Questionnaire. The Missouri Agriculture Teacher Knowledge Questionnaire was found to have at least 0.70 reliability for all but one of the PCK constructs. The one construct, Horizon Content Knowledge, had a reliability of 0.60 due to its exploratory nature (Rice & Kitchel, 2015). Additionally, the survey instrument was reviewed for content and face validity by a panel of faculty and graduate student experts familiar with research design, SBAE, and the topic area. A pilot test was not completed as the Missouri Agriculture Teacher Questionnaire was found to have at least a 0.70 reliability, meeting or exceeding the alpha recommended by Nunnally & Bernstein (1994).

The instrument used for this study consisted of five sections: (1) demographics, (2) PCK related to the self-identified unit the respondent knows and teaches well, (3) PCK related to the self-identified unit the respondent struggles with teaching and knows the content the least, (4) sources of knowledge and (5) preferred professional development topics (Tonnessen, 2021). The independent variables for this study included education level, years of experience teaching, agricultural subjects taught, content area major, gender, state, and path to licensure (certification type). The dependent variables were the PCK levels related to a self-identified instructional unit the participant feels confident teaching, the PCK levels related to a self-identified instructional unit the participant does not feel confident teaching and/or knows very little about, sources of agricultural knowledge, and preferred professional development topics.

PCK levels were determined based on six different construct areas, as defined by (Hill et al., 2008). The PCK constructs consisted of (1) Horizon Content Knowledge, (2) Common Content Knowledge, (3) Specialized Content Knowledge, (4) Knowledge of Content and Teaching, (5) Knowledge of Content and Students and (6) Knowledge of Content and Curriculum.

Horizon Content Knowledge (HCK) is a teacher's ability to link content beyond their subject matter (Rice & Kitchel, 2015). Common Content Knowledge (CCK) refers to a teacher's ability to identify when a student gives an incorrect answer (Rice & Kitchel, 2015). Related to CCK, Specialized Content Knowledge (SCK) is the teacher's ability to explain why an answer is incorrect. Knowledge of Content and Teaching (KCT) refers to a teacher's ability to utilize questioning strategies to help students understand educational concepts (Rice & Kitchel, 2015). Knowledge of Content and Students (KCS) refers to a teacher's ability to predict challenging concepts and identify where students are developmentally and how to help them. Lastly, Knowledge of Content and Curriculum (KCC) refers to sequencing learning activities and how the teacher scaffolds the lesson (Rice & Kitchel, 2015).

The first section of the survey instrument elicited personal and programmatic information as it pertained to the survey participants. Individuals were asked to disclose non-identifying information, which consisted of age, gender, the state in which they currently teach, the agricultural areas they teach, their highest degree completed, years of teaching experience, their path to licensure, and their college major.

For the second section of the survey instrument, respondents were asked to identify a unit they felt most confident teaching. Keeping this unit in mind, participants then used a five-point Likert-type scale, determining to what extent they agreed to a series of sample construct statements. By rating levels of agreement to each construct statement, we anticipated that the results would determine which areas teachers have the greatest confidence in. The third section of the instrument replicated this using a unit the teacher felt less confident teaching. Table 1 showcases the six knowledge constructs and the statements aligned with them.

Table 1

Series of Knowledge Construct Statements

Knowledge Construct	Aligned Statement
Common Content Knowledge	"When given information, I can easily discern accurate from inaccurate information." "I am able to easily identify when a student gives an incorrect answer when teaching."
Specialized Content Knowledge	"When presented with a problem, I can find multiple ways to get an answer." "When a student makes an error, I can accurately interpret why that error was made."
Horizon Content Knowledge	"I can easily explain why a student answer is incorrect." "I can explain how this unit links to core content areas." "I can explain how this unit links to other units within agriculture."
Knowledge of Content and Students	"I am able to easily predict student misconceptions." "I know where my students should be developmentally." "I can easily predict what concepts will be most challenging for my students."
Knowledge of Content and Teaching	"I can easily explain the definitions of commonly used terms in the unit." "I am able to easily explain the process behind various concepts." "I can identify advantages and disadvantages of instructional strategies."

	"I can utilize questioning techniques to enhance student learning."
	"When a student makes a remark, I know when to effectively use it to make a point in my instruction."
Knowledge of	"I am able to fluidly sequence my material."
Content and	"I am able to easily locate outside resources to aid in my teaching."
Curriculum	"Curriculum design comes easy to me."

For the fourth section of the instrument, participants indicated their sources of knowledge. We felt these items should be considered when assessing the PCK of each teacher cohort, as prior knowledge and experience play an important role in determining PCK. Additionally, for each listed source of knowledge, participants used a Likert-type scale to rate the effectiveness of each source of knowledge in preparing them for the profession. From this, conclusions were drawn to determine which platform was the most effective in preparing both sets of teachers.

Finally, the fifth section consisted of one open-ended question asking participants to identify professional development areas they felt were of the greatest need. For each group of teachers, responses were thematically coded into fifteen categories: Content-Specific Topics, Curriculum Development, FFA & SAE, Technology, Classroom Management & Student Engagement/Motivation, Instructional Strategies/Teaching Methods, Supporting Students, Burnout/Work-Life Balance, Retirement, Standards/Industry Alignment, Work-Based Learning/Project-Based Learning, Funding, Program Direction, Community Involvement, and Time Management.

Results

The first research objective was to describe the sample of SBAE teachers who obtained certification through a traditional or alternative certification program. Four hundred eighty-five individuals participated in this study, yielding a 12.6% response rate. Of those who participated, 73.6% ($n = 357$) identified as TC teachers and the remaining 26.4% ($n = 128$) identified as AC teachers. Of the TC teachers, 64.7% were female, 33.3% were male, and the remaining 2.0% did not disclose. The ages of these teachers ranged between 21 and 82 years ($M = 39.33$, $SD = 11.93$), and they had between 1 and 56 years of teaching experience ($M = 14.62$, $SD = 10.78$). Additionally, the majority of these teachers reported having a master's degree (67.2%). While seventeen states were represented by the TC cohort, Missouri, New York, and Ohio yielded the greatest participation. When comparing by NAAE region, 56% of the TC teachers were from Region IV ($n = 200$), with the remaining 44% being from Region VI ($n = 157$).

Regarding the AC teachers, 69.5% were female, 29.7% were male, and the remaining 0.8% did not disclose. The ages of these teachers ranged between 22 and 69 years ($M = 43.65$, $SD = 11.62$), and they had between 1 and 33 years of teaching experience ($M = 9.32$, $SD = 7.52$). Additionally, most of these teachers reported having a master's degree (53.1%). While seventeen states were represented by the AC cohort, New York, Ohio, and Virginia yielded the greatest participation. When comparing by NAAE region, 38% of the AC teachers were from Region IV ($n = 48$), with the remaining 62% being from Region VI ($n = 80$). Therefore, from the data collected, region IV had a greater percentage of TC teachers, whereas Region VI had a greater percentage of AC teachers.

Table 2*Surveyed States by Licensure Type: TC (n = 357), AC (n = 128)*

State	Traditionally Certified		Alternatively Certified	
	<i>f</i>	%	<i>f</i>	%
Connecticut	10	2.8	5	3.9
Delaware	11	3.1	3	2.3
Illinois	30	8.4	13	10.2
Indiana	20	5.6	5	3.9
Kentucky	24	6.7	2	1.6
Maine	0	0	2	1.6
Maryland	6	1.7	4	3.1
Massachusetts	1	0.3	0	0
Michigan	16	4.5	7	5.5
Missouri	69	19.3	6	4.7
New Hampshire	2	0.6	4	3.1
New Jersey	8	2.2	3	2.3
New York	49	13.7	35	27.3
Ohio	41	11.5	15	11.7
Pennsylvania	27	7.6	8	6.3
Rhode Island	0	0	1	0.8
Vermont	2	0.6	0	0
Virginia	26	7.3	14	10.9
West Virginia	15	4.2	1	0.8

The second research objective was to describe differences in Pedagogical Content Knowledge between licensure types. Based on participant responses to each statement (Table 1), we found that both cohorts of teachers rated their PCK levels similarly. Our results show TC teachers reported higher Horizon Content Knowledge ($M = 4.41$, $SD = 0.65$) and Knowledge of Content and Students ($M = 3.79$, $SD = 0.75$). In contrast, AC teachers reported higher Common Content Knowledge ($M = 4.06$, $SD = 0.74$) and Specialized Content Knowledge ($M = 3.92$, $SD = 0.73$). Overall, PCK was determined by averaging the reported values for each trial (confident vs. not confident) (Table 3).

Table 3*Perceived PCK of TC (n = 357) and AC (n = 128) SBAE Teachers by Construct*

Knowledge Construct	TC		AC		<i>t</i>	<i>p</i> -value
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Common Content Knowledge (CCK)	3.91	0.70	4.06	0.74	-1.78	0.09
Specialized Content Knowledge (SCK)	3.83	0.66	3.92	0.73	-0.85	0.12
Horizon Content Knowledge (HCK)	4.41	0.65	4.33	0.74	1.17	0.14
Knowledge of Content and Students (KCS)	3.79	0.75	3.74	0.76	0.79	0.28
Knowledge of Content and Teaching (KCT)	3.97	0.61	3.98	0.68	0.08	0.17
Knowledge of Content and Curriculum (KCC)	3.79	0.81	3.79	0.82	0.20	0.24

Note. For observed means, 1 = Novice; 2 = Developing; 3 = Average; 4 = Proficient; 5 = Mastery

* $p < 0.05$

For the third research objective, we gathered the sources of knowledge that both TC and AC teachers use. A total of 92.5% of TC teachers and 80.6% of AC teachers agreed or strongly agreed with the statement, "my teaching experience is a source of knowledge that has a great impact on my ability to be effective at teaching." Additionally, 73.3% of TC teachers and 85.3% of AC teachers agreed or strongly agreed with the statement, "my previous employment in agriculture is a source of knowledge that has a great impact on my ability to be effective at teaching." While some similarities exist among sources of knowledge, the two cohorts were split on their third highest source of knowledge. 74.9% of TC teachers agreed or strongly agreed with the statement, "experts within the field are a source of knowledge that has a great impact on my ability to be effective at teaching." In comparison, 75.7% of AC teachers agreed or strongly agreed with the statement, "the internet and textbooks are sources of knowledge that has a great impact on my ability to be effective at teaching." (Tables 4 & 5)

Table 4

Sources of Knowledge among Traditionally Certified SBAE Teachers (n = 357)

	SA %	A %	N %	D %	SD %
My high school agriculture program is a source of knowledge that has a great impact on my ability to be effective at teaching.	32.0	36.1	18.4	7.0	6.6
My teacher preparation program is a source of knowledge that has a great impact on my ability to be effective at teaching.	26.4	40.8	18.2	10.0	4.7
My teaching experience is a source of knowledge that has a great impact on my ability to be effective at teaching.	71.4	21.1	5.7	1.1	0.6
My previous employment in agriculture is a source of knowledge that has a great impact on my ability to be effective at teaching.	44.9	28.6	12.9	6.1	7.4
Professional Development workshops are a source of knowledge that has a great impact on my ability to be effective at teaching.	29.1	40.9	17.3	7.2	5.5
The internet and textbooks are sources of knowledge that has a great impact on my ability to be effective at teaching	26.7	43.4	22.7	4.9	2.3
Experts within the field are a source of knowledge that has a great impact on my ability to be effective at teaching	39.8	35.2	18.0	4.4	2.6

Note. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree/Not Applicable.

Table 5

Sources of Knowledge among Alternatively Certified SBAE Teachers (n = 128)

	SA %	A %	N %	D %	SD %
My high school agriculture program is a source of knowledge that has a great impact on my ability to be effective at teaching.	27.6	33.7	16.3	5.1	17.4
My teacher preparation program is a source of knowledge that has a great impact on my ability to be effective at teaching.	17.0	26.4	29.2	13.2	14.2
My teaching experience is a source of knowledge that has a great impact on my ability to be effective at teaching.	54.0	26.6	12.9	4.0	2.4
My previous employment in agriculture is a source of knowledge that has a great impact on my ability to be effective at teaching.	54.3	31.0	9.5	1.7	3.5

Professional Development workshops are a source of knowledge that has a great impact on my ability to be effective at teaching.	26.0	30.9	28.5	8.1	6.5
The internet and textbooks are sources of knowledge that has a great impact on my ability to be effective at teaching	29.8	46.0	16.1	4.0	4.0
Experts within the field are a source of knowledge that has a great impact on my ability to be effective at teaching	37.1	37.9	19.4	2.4	3.2

Note. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree/Not Applicable.

For the final research objective, we sought to describe the professional development needs of TC and AC teachers. The top professional development needs TC teachers reported were in the areas of Content-Specific Topics, Curriculum Development, FFA & SAE, Technology, and Classroom Management & Student Engagement/Motivation. On the contrary, AC teachers reported Content-Specific Topics, Curriculum Development, Instructional Strategies/Teaching Methods, FFA & SAE, and Classroom Management & Student Engagement/Motivation as the areas of greatest need. While both groups of teachers reported needing professional development in similar areas, TC teachers placed greater emphasis on the areas of Content-Specific Topics and Technology. In contrast, AC teachers placed greater emphasis on the areas of Curriculum Development and Instructional Strategies/Teaching Methods (Table 6).

Table 6

Professional Development Needs of TC (n = 290) and AC (n = 126) SBAE Teachers

Professional Development Area	Traditionally Certified			Alternatively Certified		
	Rank	f	%	Rank	f	%
Content-Specific Topics Ex. Ag Mechanics, Greenhouse Management, Aquaponics, etc.	1	137	47.24	1	46	36.51
Curriculum Development	2	28	9.66	2	19	15.08
FFA & SAE Ex. Using AET, Degrees, CDEs, etc.	3	25	8.62	4	12	9.52
Technology Ex. Integrating technology in the classroom, virtual teaching	4	21	7.24	7	4	3.17
Classroom Management & Student Engagement/Motivation	5	19	6.55	5	9	7.14
Instructional Strategies/Teaching Methods	6	13	4.48	3	17	13.49
Supporting Students Ex. Special Education (reading IEPs, providing accommodations), English-Language Learners (accommodating curriculum), IDE (fostering inclusion, diversity & equity in the classroom and in curriculum), Social-Emotional Learning	7	10	3.45	6	6	4.76
Burnout/Work-Life Balance	8	9	3.10	12	1	0.79
Retirement	9	7	2.41	10	2	1.59
Standards/Industry Alignment	10	7	2.41	13	1	0.79

Work-Based Learning/Project-Based Learning	11	6	2.07	8	4	3.17
Funding Ex. Writing grants, Permissible use of federal grants, etc.	12	3	1.03	14	0	0.00
Program Direction Ex. Support in leading new FFA program, sharing responsibilities among multiple teachers, etc.	13	3	1.03	9	3	2.38
Community Involvement	14	1	0.34	15	0	0.00
Time Management	15	1	0.34	11	2	1.59

Finally, regarding how professional development is delivered, 59% of TC and 54% of AC teachers agreed they prefer in-person professional development learning opportunities. Additionally, both cohorts overwhelmingly agreed that their state's summer agriculture teacher conference was the best time for professional development, followed closely by monthly/quarterly Agriculture teacher meetings.

Conclusion

This study aimed to identify and compare the PCK levels of traditionally certified and alternatively certified SBAE teachers in the Northeast region of the United States. Additionally, this study sought to determine teachers' individualized professional development needs based on certification type. Our objectives were achieved by collecting data from SBAE teachers in all 19 states encompassing NAAE regions IV and VI. As a result, we have drawn two conclusions: (1) A practical difference may exist between AC and TC teachers on individual aspects of their PCK; (2) Differing professional development needs exist between TC and AC teachers.

A practical difference may exist between AC and TC teachers on individual aspects of their PCK

Our findings show practical differences by licensure type when examining the six construct areas of PCK. For example, TC teachers had higher mean values in Knowledge of Content & Students (KCS) and Knowledge of Content & Curriculum (KCC). In contrast, AC teachers had higher mean values in Common Content Knowledge (CCK) and Specialized Content Knowledge (SCK). Furthermore, TC and AC teachers reported the lowest mean values in Knowledge of Content and Students (KCS) and Knowledge of Content and Curriculum (KCC). While little to no research has been conducted examining the difference between AC and TC teacher's PCK, it has been found that when examining teachers in biology that there were no differences found between TC and AC teacher's ability to use PCK when developing lessons (Friedrichsen et al., 2008). While slight practical differences exist between construct areas, no statistically significant differences were found between TC and AC teachers. This elicits some concern for teacher certification programs that students may be graduating with very limited conceptual knowledge of what PCK is and how it can be used in their planning and classroom instruction to enhance the learning environment for students. Specifically, in SBAE, both AC and TC teachers should have a firm understanding and ability to appropriately use PCK due to the variance in AFNR (Agriculture, Food and Natural Resources) curriculum.

Differing professional development needs exist between TC and AC teachers

This research provides insight into teachers' individualized professional development needs. For example, our findings related to SBAE teachers' PCK levels suggest TC teachers claim to be proficient at knowing their students. This includes understanding where their students are developmentally and identifying items that will be challenging for them. Additionally, they reported proficiency in sequencing material, locating teaching resources, and designing curricula. On the other hand, AC teachers claim to be

proficient in identifying when students give incorrect answers, understand why students make specific errors in their work, and feel they can easily explain why answers are correct or incorrect.

The findings from objective two coincide with the self-reported professional development needs of both groups of teachers. More specifically, the findings from objective two suggest that TC teachers are more proficient in the pedagogical areas of the profession and would likely benefit more from content-specific professional development. For AC teachers, the findings from objective two suggest that they have a good grasp of the content they teach but would likely benefit more from professional development in pedagogical practices. The findings of objective three supported these claims, as almost half of the TC teachers reported a need for content-specific professional development, while just over one-third of AC teachers reported a need for professional development in specific content topics. While this finding is different from some previous research (Roberts and Dyer, 2004), this finding could exemplify a change in the teaching appointments of SBAE teachers from being entirely focused on one content area to having a more diverse course load, leading both TC and AC teachers to need professional development in specific content areas. Furthermore, approximately 15 percent of all AC teachers reported a need for professional development in curriculum development and instructional strategies/teaching methods (pedagogical knowledge). While other professional development areas were noted as possible areas for SBAE teacher development, the remaining factors had less than ten percent of the respondents indicating each topic as a potential need area. These findings support prior literature claiming that what makes these teachers unique is their preferred professional development needs (Roberts & Dyer, 2004; Rocca & Washburn, 2006; Tonnessen, 2021). Finally, it was found that at least one TC teacher found each item on the survey instrument to be a potential area for professional development, and zero AC teachers reported funding or community involvement as a potential need area for professional development. While no data was collected about their previous jobs, this leads the researchers to question where these skills were developed by all AC teachers in this study.

Recommendations

Based on the findings of this study, we make the following recommendations for practice:

(1) Improving pre-service PCK: teacher education programs should integrate more hands-on, practical opportunities where pre-service teachers can develop PCK. This could involve simulations, shadowing, and supervised teaching experiences that focus on the intersection of subject matter and teaching methods; (2) Developing mentor programs: custom mentorship programs should be established, pairing experienced teachers with TC and AC teachers. These programs would provide guidance tailored to their unique pathways into teaching, focusing on bridging gaps in experience or subject-specific teaching strategies; (3) Examining offering for AC certification in SBAE: teacher education programs must review and potentially redesign their curriculum for AC certification to ensure it includes relevant SBAE content. This could involve partnerships with agricultural experts or updates to courses to include current agricultural practices and educational techniques; (4) Organizing state-specific professional development: teacher preparation programs and state agricultural education staff should collaborate to assess and address the specific professional development needs of teachers in their region. This could mean creating workshops, seminars, or continuous learning modules that focus on local agricultural issues, teaching methods, and student engagement strategies; (5) Focusing on pedagogical practices in AC preparation: AC preparation programs should prioritize teaching methods that are most effective in the classroom. This could include diversified teaching strategies, classroom management, lesson planning, and assessment design tailored to the SBAE context; and, (6) Updating curriculum with new research and best practices: agricultural education teacher preparation programs must continually update their curriculum with the latest research findings and best pedagogical practices. This could involve regular curriculum reviews, faculty development, and the integration of new technology and teaching tools.

Additionally, we propose the following recommendations for future research: (1) Expanding the study nationally: the study should be extended to include a broader range of participants and states to ensure the findings are representative and applicable across different educational contexts in the United States; (2) Comparing TC and AC preparation programs: research should be conducted to identify differences between TC and AC preparation programs. This will help determine if program modifications are necessary to ensure all teacher candidates are equally well-prepared; (3) Investigating perceived versus actual PCK: studies should look into the discrepancies between what teachers believe about their PCK and what they actually demonstrate in the classroom. This will help in understanding the effectiveness of teacher education programs; and, (4) Measuring the impact of PCK: research should be conducted to assess how PCK affects student learning outcomes, particularly focusing on how well students retain the agricultural content taught in SBAE courses over time.

While this study is not generalizable beyond the study population, it has scratched the surface in examining PCK among SBAE teachers. While much of the literature in agricultural education focuses on the differences between PCK by licensure type, efforts should be made to narrow the gaps between traditionally and alternatively certified teachers. By identifying deficiencies by licensure type and providing individualized support to these teachers, they will be better prepared and more likely to stay in the profession as their self-efficacy will increase. Additionally, seeing the impact of PCK on student achievement by licensure type could provide insight into how teacher preparation programs could better prepare future teachers. As agricultural education grapples with a shortage of qualified agriculture teachers, identifying how all teachers can be supported and retained in the profession is essential.

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