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

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Abstract

Agricultural Education faces continued challenges of filling open positions, and as a result, many states have expanded alternative certification pathways as a means of alleviating the problem. Typically, alternatively certified teachers are experts in their specific industry within agriculture but lack the pedagogical preparation that comes from a traditional post-secondary teacher preparation program. School districts must look at the classroom and professional needs of alternatively certified teachers compared to those of their traditionally certified colleagues for all educators to be successful in the classroom and to remain in the classroom for the long haul. This descriptive-relational study utilized teacher responses to a digital questionnaire distributed to school-based agricultural education (SBAE) teachers in 12 states. Traditionally certified teachers and alternatively certified teachers answered Likert-type questions related to their perceived Pedagogical Content Knowledge (PCK) in designing and implementing lessons in an agricultural education classroom, as well as various classroom management strategies. The findings indicate that within the Knowledge of Content and Teaching construct of PCK, alternatively certified teachers may experience more difficulty in implementing various questioning strategies to help students understand complex agricultural concepts. Related to classroom management strategies, statistically significant differences were observed in "planning for each period" and in "teaching procedures and routines" when comparing alternatively and traditionally certified agricultural education teachers. Recommendations include that school districts create and implement targeted professional development opportunities for alternatively certified teachers on questioning techniques, effective lesson planning, and teaching procedures to minimize disruptions.

Introduction and Literature Review

The field of school-based agricultural education (SBAE) is not immune to the nationwide teacher shortage and continues to be among the critical shortage areas (Boone & Boone, 2007; Bowling & Ball, 2018; Smith et al., 2018; Solomonson et al., 2019; Sutcher et al., 2016). Although much of the annual teacher shortage is a result of teacher retirements (Sutcher et al., 2016), many current agricultural teachers are deciding to leave the profession altogether (Smalley et al., 2019), and 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). School districts are facing an uphill battle in filling these positions with qualified personnel. In attempts to help curb this evolving reality, most state teacher licensure administrations and teacher preparation programs have investigated and developed alternative pathways to state teacher certification (Bowling & Ball, 2018). The United States Department of Education (NCES, 2022) reported that in 2015-2016, 18% of all teacher

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candidates were enrolled in or seeking an alternative certification program, an increase of 6% from 2009-2010 (U.S. Department of Education, 2013). In 2016, the American Association for Agricultural Education (AAAE) began evaluating Alternatively Certified (AC) professionals as one part of their supply and demand work. 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 (Foster et al., 2020; Smith et al., 2017; Smith et al., 2018; Smith et al., 2019), and this proportion appears to be growing.

Alternative certification is simply "anything but a four-year undergraduate program housed in a school of education" (Walsh & Jacobs, 2007, p. 13) and has been an option for SBAE teacher licensure since the 1980s in a few states, but it has not been actively sought until more recently (NCES, 2022). AC, 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). According to Bowling and Ball (2018), there are over 130 varieties of AC pathways nationwide, all of which are different in terms of program duration, entrance requirements, etc. Regardless, the goal of AC remains constant: to help relieve the ongoing teacher shortage, and because of that, the preparation path taken towards an education career is not necessarily at the forefront of this present discussion. Realistically, AC teachers are necessary to help reduce the teacher shortage. Beyond 2025, the demand for teachers is estimated to be well over 300,000, but the projected supply is to be under 200,000 (Sutcher et al., 2016). It does not seem to matter how many individuals choose to attend and complete a traditional teacher preparation program because, inevitably, 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 AC agricultural educators are needed.

The primary trend in research on this topic has been the lack of pedagogical preparation in AC programs. In this sense, pedagogy is associated with the non-content 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. Classroom and behavior management was a significant difference among traditional and alternatively licensed technology and engineering teachers' perceptions of their teaching preparedness (Bowen et al., 2019). Robinson and Edwards (2012) concluded that nearly 59% of traditionally certified (TC) teachers were still teaching two years later, whereas only 16.67% of AC teachers were still teaching in that same period. The gap in retention percentages alone should raise concern for the needs and professional viability of this group of teachers. Additionally, the intentional development of Pedagogical Content Knowledge (PCK), which can contribute to longevity in the career, begins in teacher preparation programs and is then fine-tuned throughout the in-service careers of agricultural educators (Rice & Kitchel, 2015a).

Concerns have appeared regarding the retention of AC agricultural education teachers. Much of the research detailed the major teacher shortage in agricultural education is caused by TC teacher attrition. Consequently, school districts across the nation are turning to AC professionals to fill vacancies (Bowling & Ball, 2018; Rice & Kitchel, 2015a). However, just like TC staff, too many AC educators are choosing to end their teaching career early, which creates an unfortunate revolving door. According to Redding and Smith (2016), AC teachers feel much less prepared for the demands of a classroom than TC teachers. However, concrete reasons are lacking in the literature.

Bowling and Ball (2018) recommended state Career and Technical Education departments and teacher educators "develop professional development programs to meet the specific classroom and professional needs of AC individuals. These programs should focus on developing the teachers' Pedagogical Content Knowledge and classroom management techniques" (p. 119). Harrington and Walsh

(2020) examined school district-provided support to alternatively licensed teachers. Some of this district support included classroom management training (California CTC, 2019; Darling-Hammond et al., 2018; Guha et al., 2016) because "quality training and preparation is imperative to a teacher's overall success" (Harrington & Walsh, 2020, p. 72). Additionally, Harrington and Walsh (2020) discussed the importance of a mentorship between experienced teachers and AC teachers related to the effective application of classroom management strategies. In addition to PCK and classroom management techniques, the professional development should also enhance 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 TC and AC teachers. Even though teachers of both certification routes can benefit, the majority of the focus needs to be on AC teachers and closing the gap in PCK development.

As more people enter secondary classrooms through alternative means and without a nationwide standard format for teacher preparation, are these teachers different from their peers? Do AC teachers differ in their perceptions of their abilities in the classroom? While some empirical foundation does exist, it is not extensive, and the primary conclusions center on a lack of pedagogical preparation differences in AC programs.

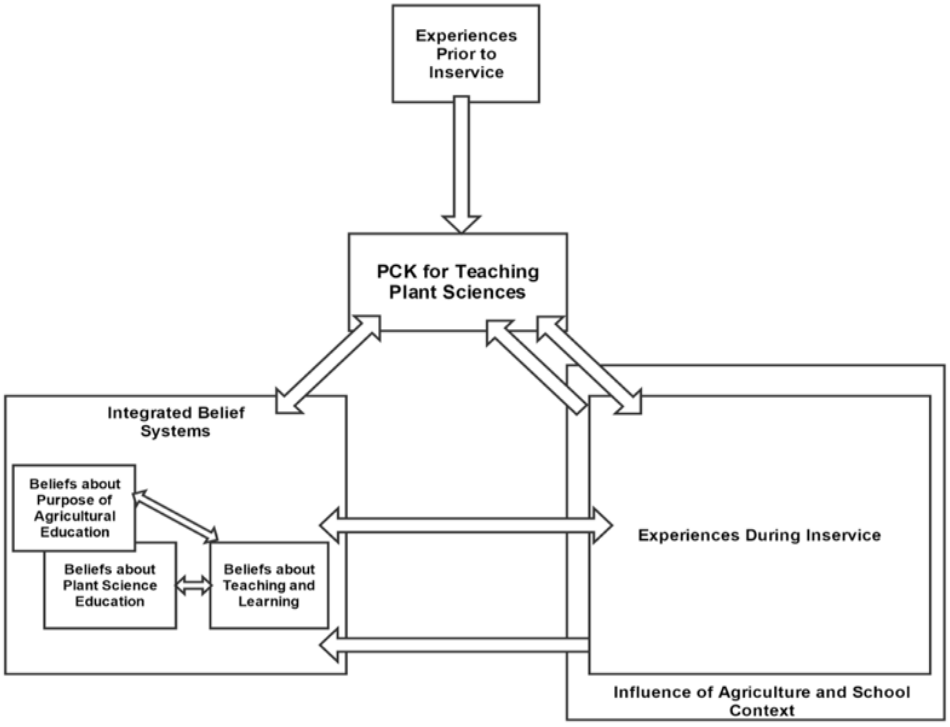
Theoretical Framework

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 comes from the research conducted by Shulman (1986), but more recently, Rice has studied PCK in the context of agricultural education. PCK, as defined by Rice and Kitchel (2015b), is where content knowledge expertise is put into practice by the educator. 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, in this case, agriculture. PCK development in educators begins early in teacher preparation courses and 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. These pieces are illustrated in Figure 1. The primary tenets of PCK development among teachers, whether TC or AC, provided the foundational lens for this study.

Alternatively certified professionals are here to stay, and we must discover the PCK needs of such teachers. The longevity of their career and student success may depend upon their development and execution of PCK. The varying components of PCK's theoretical foundation include a combination of pre-service and in-service experiences as well as professional development opportunities, as illustrated in Figure 1. From the pre-service standpoint, all agricultural educators have a vast knowledge of a variety of topics within the industry, such as animal science, plant and soil science, food science, agricultural mechanics, and biotechnology. Traditionally certified agricultural teachers should ideally have a solid foundation in breaking down content knowledge into usable, teachable material for students because of their teacher preparation program and student teaching experience. On the other hand, generally speaking, AC teachers lack this direct pedagogical preparation and therefore may have difficulty turning their expertise into purposeful classroom learning experiences. From the in-service standpoint, according to Rice (2015), an important part of a teacher's PCK development is being a reflective teacher and a lifelong learner. Both TC and AC educators continue to develop their PCK throughout the early years of their classroom experiences. Much of that responsibility for professional growth falls on the shoulders of the individual teacher to identify areas of needed improvement and seek opportunities to develop those skills. Although AC instructors typically do not have the same pre-service preparation opportunities, their PCK development is just as important as their TC colleagues.

Figure 1

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



Note. (Rice, 2015, p 134).

If state education departments, teacher preparation programs, instructional coaches, and school districts can better understand the needs of their AC SBAE teachers, strategies can be developed in efforts of increasing teacher retention. Thereby, helping reduce the teacher shortage, and most importantly, providing students with a high-quality education in agriculture.

Purpose

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

Research Objectives

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

Methods

This descriptive-relational study utilized teacher responses to a digital questionnaire distributed to SBAE teachers in selected states. This inquiry is quantitative in nature as items within the survey utilize a Likert-type scale or required frequency responses. Responses from the sample were aggregated, and dependent variables were analyzed based on demographic variables. Data was analyzed in SPSS v27 for independent variables, which included demographic items. Additionally, statistics were run for dependent variables as well as research objective one (means and standard deviation), objectives two, three, and four (*t*-test, Cronbach's alpha).

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 state from Region III, because of the focus in this study being Midwest states due to researcher proximity for comparison. Table 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 1

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	

Instrumentation

A digital survey developed through Qualtrics was utilized as the instrument for this study. The survey link and participant invite letter were distributed via email to lists provided by state CTE staff members. The instrument consisted of five primary sections: 1) demographics, 2) PCK related to a self-identified unit the respondent knows and teaches well, 3) PCK related to a self-identified unit the respondent struggles with teaching and knows the content the least, 4) classroom management, and 5) sources of agricultural knowledge. The PCK-related questions and sources of agriculture knowledge were adapted from the 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 and Kitchel retained this construct "due to the exploratory nature" of the study (Rice & Kitchel, 2015b, p. 160), and ultimately, we retained it, too. The fourth section asked in-service SBAE teachers to rate the extent they experience difficulty with classroom management

strategies on a Likert scale. The development of this construct was exploratory in nature and is principally supported through a range of literature identifying that classroom management is a success measure for teachers (Bowen et. al., 2019; Bowling & Ball, 2018; Darling-Hammond et al., 2018). In an effort to approach this practically, the classroom management questions were developed from a teacher preparation text, *The Classroom Management Book* (Wong & Wong, 2014). Items were examined for face and content validity by a team (n = 4) which included two university teacher educators and two current classroom teachers. Further, post-hoc reliability measures produced a reliable construct ($\alpha = 0.88$) (Field, 2009). The fifth section, which included eight questions, asked SBAE teachers to use a seven-point Likert scale to rate the effectiveness each source of agricultural knowledge had on their ability to teach as developed and validated in Rice and Kitchel (2015b).

The PCK sections were later divided into constructs as defined by Hill et al. (2008) and are listed in Table 2. Teachers were asked to rate their competency level in an instructional unit they know well and teach well, and separately, a unit they struggle with in content they know the least using a sliding scale (1-100; with 1 being no competency and 100 being very competent). With that instructional unit in mind, participants used a five-point Likert scale to identify to what extent they agreed with 18 given PCK statements aligned with Rice and Kitchel (2015b). Common Content Knowledge (CCK) refers to the teacher's ability to identify when a student gives an incorrect answer. Specialized Content Knowledge (SCK) is the teacher's ability to take an incorrect answer and explain why the answer was incorrect. Horizon Content Knowledge (HCK) is the ability to link the subject matter to other units within and beyond agriculture. Knowledge of Content and Students (KCS) is the teacher's ability to predict challenging concepts and know where students are developmentally. Knowledge of Content and Teaching (KCT) refers to the teacher's ability to utilize questioning techniques to help understand content and concepts. Lastly, Knowledge of Content and Curriculum (KCC) is refers to overall curriculum design and sequencing/scaffolding lessons within a unit.

Table 2

Selected Teacher Questionnaire Items

Knowledge Construct	Example Questions
Horizon Content Knowledge (HCK)	I can explain how this unit links to other units within agriculture.
Common Content Knowledge (CCK)	When given information, I can easily discern accurate from inaccurate information.
Specialized Content Knowledge (SCK)	When presented with a problem, I can find multiple ways to get an answer.
Knowledge of Content and Teaching (KCT)	I can easily identify the advantages and disadvantages of various instructional strategies.
Knowledge of Content and Students (KCS)	I know where my students should be developmentally.
Knowledge of Content and Curriculum (KCC)	I am able to fluidly sequence my material.

Note. Each construct consisted of three items, totaling 18 items measuring PCK

Demographics

Data collection took place from January 24 to February 20, 2021. The survey yielded 551 respondents for an eight percent (8.0%) response rate. Of the total, 57.7% were female and 41.7% male. A majority of respondents had been teaching nine or less years at 59.0%. Traditional licensure was obtained by 420 teachers (76.2%), and 131 teachers (23.8%) were AC. The complete list of respondent demographics is provided in Table 3.

Table 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

Findings

Objective 1

In the first section of the instrument, teachers were asked to mentally position themselves in 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. Given the mean competence self-score of 89.19, TC teachers positioned themselves highly competent in the orienting unit they believe to teach well as did AC teachers at 87.53. Table 4 reports the rated competency in TC and AC agricultural educators regarding the chosen unit. The mean perceived competency value for AC teachers is numerically lower (1.66) than that of TC agricultural educators.

Table 4

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

Licensure Route	*Mean*	*Median*	*SD*
Traditionally Certified	89.19	91.00	10.92
Alternatively Certified	87.53	90.00	13.49

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

TC agricultural educators in this study reported at least to a *fair extent* in each of the constructs, meaning that on a scale of 1-5, respondents averaged between 4-5 for each construct. The perceived PCK of AC agricultural teachers is also broken down by construct in Table 5.

Table 5

Perceived PCK of Traditionally Certified Agricultural Educators (n=413) and Alternatively Certified Agricultural Educators by Construct (n=130)

Knowledge Construct	TC Teachers		AC Teachers	
	M	SD	M	SD
Common Content Knowledge (CCK)	4.54	0.46	4.51	0.46
Specialized Content Knowledge (SCK)	4.45	0.51	4.42	0.49
Horizon Content Knowledge (HCK)	4.61	0.42	4.60	0.43
Knowledge of Content and Students (KCS)	4.17	0.56	4.07	0.59
Knowledge of Content and Teaching (KCT)	4.32	0.55	4.21	0.58
Knowledge of Content and Curriculum (KCC)	4.13	0.66	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 2

Research objective two aimed to examine the differences in perceived PCK between TC and AC 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 TC agricultural education teachers would see higher average construct scores in all areas of PCK and be statistically significantly different from AC teachers. An independent samples *t*-test was employed to assist with determining the differences in PCK between the two groups of agriculture teachers (see Table 6). 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 perceived difference between licensure type. The Knowledge of Content and Teaching (KCT) construct was the only construct that was statistically significantly different at $p = 0.05$, with a small effect size.

Table 6

Comparison by Licensure Type of Perceived PCK by Construct (TC n = 404; AC n = 129)

Knowledge Construct	*t* [a]	Sig. (2-tailed) [c]	df	MD[b]	Cohen's *d*
Common Content Knowledge [d]	0.67	0.51	531	0.03	0.06
Specialized Content Knowledge	0.54	0.59	531	0.03	0.05
Horizon Content Knowledge	0.22	0.82	531	0.01	0.02
Knowledge of Content and Students	1.70	0.09	531	0.10	0.15
Knowledge of Content and Teaching	1.94	0.05	531	0.11	0.17
Knowledge of Content and Curriculum	1.48	0.14	531	0.10	0.13

Note. a. 95% Confidence Interval b. Mean Difference c. *p* value d. Equal variances assumed

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 effect (Cohen's d = 0.15, 0.17, and 0.13, respectively) was calculated for the constructs more directly focused on the knowledge of teaching. Although significance did not emerge in five constructs, there is a greater practical difference in the means of the TC and AC teachers, referencing Table 5. In particular, relative to the three constructs that deal with knowledge of teaching: KCS, KCT, and KCC. 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.

Objective 3

Respondents were asked to identify their perceived difficulty with 10 different classroom management tasks on a four-point scale, where 4 = much difficulty and 1 = no difficulty. The minimum is 1 and maximum is 4 for all classroom management strategies. Given this was an exploratory measure, post-hoc reliability analysis was performed on the 10-item construct and was deemed a highly reliable measure (α = 0.88). The test for deleting items to improve scale reliability was also run. Among the 10 items comprising the classroom management scale, removing any one item would have reduced the overall reliability of the scale ($< \alpha = 0.70$). Within the inter-item correlation matrix, no significant relationships existed between items, indicating independence of measure within the scale and can be utilized together, henceforth. Due to the exploratory nature of this emergent construct, the items themselves are reported and were analyzed with an Independent Samples t-test, as well as the construct as a whole. The mean differences are reported in Table 8 along with the tests of significance. Table 7 is a display of the group statistics for the construct and each individual item. The null hypothesis (H_0) was that 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 TC agricultural education teachers would perceive less difficulty in all areas of classroom management.

Table 7

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

Classroom Management Strategy	Mean		SD	
	TC	AC	TC	AC
Construct	1.70	1.78	0.48	0.51
Getting students' attention	1.64	1.75	0.62	0.64
Keeping students on task	2.03	2.14	0.61	0.65
Facilitation of group work	1.73	1.76	0.72	0.75
Teaching procedures and routines	1.57	1.76	0.69	0.78
Effective classroom transitions	1.70	1.77	0.72	0.77
Managing arrivals and dismissals	1.56	1.56	0.72	0.76
Handling disruptions	1.75	1.68	0.73	0.73
Planning for each period	1.75	2.04	0.74	0.86
Facilitation of class discussions	1.65	1.68	0.73	0.67
Enforcing classroom expectations	1.65	1.69	0.73	0.76

Interpreting the t-test from the complete construct revealed no differences (p=0.21) between TC and AC teachers for classroom management and produced a negative t (-1.59) (see Table 8). However, given our exploratory approach to this construct, further analyses were performed for each of the items comprising the construct through a t-test for each item. Statistically significant differences were observed in "planning for each period" (p=0.00) and in "teaching procedures and routines" (p=0.01) when comparing AC and TC agricultural education teachers. There was no difference in the remaining classroom management strategies between the two groups. Seven of the ten classroom management strategies had a small effect size (Cohen's $d \leq 0.20$). 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 (0.21-0.50), indicating a greater difference between the two means, include teaching procedures and routines (d = -0.23) as well as planning for each period (d = -0.32). The strategy of implementing effective classroom transitions had the greatest effect size (-0.82) and is considered large (Ary et al., 2016). Given that the item mean for AC teachers in this calculation was generally larger than TC teachers, a negative Cohen's d was generated for most items. Non-parametric tests were not run in accordance with recommendations by Carifio and Perla (2007) due to robustness of the F-statistic, equality of variances was not violated, and correlation was not being sought. The null hypothesis was accepted for the construct as a whole and eight of the classroom management strategies. H_1 was accepted for the two classroom management strategies of teaching procedures and routines and planning for each period.

Table 8

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 [d]	*t*[a]	Sig. (2-tailed)[c]	df	MD[b]	Cohen's *d*
Construct	-1.59	0.21	529	-0.08	-0.16
Getting students' attention	-1.72	0.09	548	-0.11	-0.15
Keeping students on task	-1.80	0.02	548	-0.11	-0.15
Facilitation of group work	-0.29	0.78	544	-0.21	-0.02
Teaching procedures and routines	-2.65	0.01	549	-0.19	-0.23
Effective classroom transitions	-0.96	0.34	545	-0.07	-0.82
Managing arrivals and dismissals	-0.04	0.97	547	-0.00	-0.00
Handling disruptions	0.87	0.38	546	0.06	0.07
Planning for each period	-3.78	0.00	549	-0.29	-0.32
Facilitation of class discussions	-0.42	0.67	547	-0.03	-0.04
Enforcing classroom expectations	-0.63	0.53	546	-0.05	-0.05

Note. a. 95% Confidence Interval b. Mean Difference c. *p* value d. Equal variances assumed

Objective 4

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. 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 AC teachers both rated that all sources of knowledge were 'somewhat effective' to 'effective' in their ability to teach. The 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, which was consistent with Rice (2015). H_1 is that TC teachers would see higher effectiveness for all sources of content knowledge in their ability to teach.

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 9. There was no difference (> 0.05) in the sources of knowledge related to the other defined areas. A medium effect size was calculated for the teacher preparation program and teaching experience (Cohen's $d = 0.38$ and 0.39, respectively). With respect to the mean differences (MD), the teacher preparation program and teaching experience display the greatest difference between the groups. Where a negative MD was computed, AC teachers had the higher mean for that item. This may indicate that teacher preparation programs and teaching experiences contributed to the difference in the means between AC and TC teachers. The H_0 was accepted for five of the sources of knowledge and effectiveness on their ability to teach. The H_1 was accepted for the teacher preparation program, teaching experience, and associated effectiveness on their ability to teach.

Table 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 [d]	*t*[a]	Sig. (2-tailed)[c]	df	MD[b]	Cohen's *d*
Your high school agriculture program	0.24	0.80	461	0.03	0.02
Teacher preparation program	4.28	0.00	502	0.48	0.38
Teaching experience (On the job)	4.52	0.00	531	0.37	0.39
Previous agriculture related jobs or internships	-1.43	0.16	513	-0.13	-0.13
Professional development workshops	0.45	0.66	544	0.05	0.04
Internet, textbooks, and other media	-1.48	0.14	547	-0.13	-0.13
Experts in the field consulted either formally or informally	-0.55	0.58	546	-0.05	-0.05

Note. a. 95% Confidence Interval b. Mean Difference c. *p* value d. Equal variances assumed

Conclusions, Recommendations, Implications

Practical and significant differences exist in the focused knowledge on and tasks of teaching between TC and AC teachers. It is the content preparation through their education that has AC teachers on the same page as TC teachers; it's the lack of pedagogical knowledge and training that separates them. While these findings are not generalizable beyond the respondents, we were able to paint a picture of how AC and TC teachers nationwide perceive their pedagogical standing.

A key finding across objectives two and three, in particular, is that the mean difference (MD) between TC and AC teachers was greatest for constructs or items that focused on the teacher's pedagogical development. Further, significant results were reached or nearly reached in each of those areas, including the knowledge constructs of KCS, KCT, and KCC, and in the classroom management items of Getting students' attention, Keeping students on task, Teaching procedures and routines, and Planning for each period. Meaning that AC teacher's foundation in knowledge of teaching needs support. Nationwide, this outcome substantiates a focused effort toward AC teachers gaining the instruction, resources, feedback, and reflection opportunities earlier in their career transition. They (AC) reported more confidence in and less difficulty with the aspects of accessing and translating content knowledge. States are certainly addressing these needs in varied ways through program requirements aligned with licensure. However, based upon our findings, focus should be placed on classroom management strategies and scenarios, instructional planning, modern methods of classroom instruction, laboratory pedagogy, and assessment. To enhance further, encourage access to these courses via university agricultural education programs in the region. University agricultural education programs can also respond by creating distance delivery options for their courses to advance the people choosing to enter the profession. Additional considerations regarding these findings follow in this section.

That outcome for AC teachers fulfills the development of knowledge, but does not necessarily address how they develop their PCK. Teacher preparation programs provide teachers with specialized methods and instructional strategy courses exclusive, for the most part, to agricultural education that help prepare and begin fostering PCK in pre-service educators. Typically, AC teachers are not getting that same deliberate experience; however, according to our findings, the knowledge contributing to PCK development is coming from other sources. That said, they cannot acknowledge PCK development if they do not know what it is and how to recognize the components. Their experiences outside of the classroom appear to be equally valuable based on the findings in sources of agricultural knowledge and the effectiveness of their ability to teach. Again, in recommending AC teachers engage in focused instructional methods coursework, they will be able to constantly reflect on and revise their practices and instructional decisions.

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 TC agricultural education teachers should have specific training through university teacher preparation programs on instructional methods. Thereby, helping those teachers make real-world connections with agriculture content and applications of agricultural knowledge across other disciplines within the education landscape, as a whole. Alternatively certified agricultural education teachers, as a group, also saw their highest construct score in Horizon Content Knowledge (HCK), followed by CCK. This is possible because these teachers will typically have different career experiences outside of education. This, in turn, 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. There could be great value in learning from people who have first-hand experience in the job they are teaching students about. However, AC teachers are likely experts in one area within agriculture, which means they may not be as well-rounded in relation to agricultural content knowledge as a TC teacher. Because AC teachers have not typically 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 on-the-job experience.

The classroom management component of the study revealed interesting factors and differences in teachers who obtained licensure through traditional pathways versus alternative pathways. Each of these strategies is 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. Planning class periods and teaching procedures and routines creates a domino effect for all things classroom management related (Wong & Wong, 2014). 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 content in a way that students cannot only comprehend but also apply to their own lives as well (Darling-Hammond & Bransford, 2005). Perceptions regarding classroom and behavior management have emerged as a perceived difference between AC and TC teachers (Bowen et al., 2019), and these challenges are one of the reasons that SBAE teachers are choosing to leave the profession each year (Smalley et al., 2019). The first step in helping AC and TC teachers with those challenges is to clearly identify which specific parts of classroom management are challenging. Specific classroom management professional development for AC teachers should focus on creating and implementing plans for the entire class period and teaching appropriate, enforceable procedures and routines that contribute to an overall successful classroom environment. 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.

School administrators and state agricultural education staff can use this study to effectively design and implement more specific professional development opportunities for in-service SBAE teachers. Our 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 that 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. These tasks develop the KCT, KCS, and KCC constructs within PCK.

Our study does raise some questions in regard to years of teaching experience and PCK development. PCK for in-service SBAE teachers is not considered fully developed until achieving five to seven years of teaching experience (Rice & Kitchel, 2016). The largest respondent group in this study had been teaching for less than four years (34.1%). Meaning 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 better target challenging areas of PCK if those educators are divided out by experience level.

Agricultural Educators who arrive in SBAE through switching careers and by other pathways are here to stay, and they are certainly welcome. Reports from the AAAE Supply and Demand studies (Smith et al., 2019) continue to indicate growth in this demographic and we as a profession need to continue working to understand their unique needs. They too, are educators by choice and not by chance (NAAE, n.d) and as our professional composition changes we need to evolve how we assist in the career longevity of all teachers, through recognizing unique needs. This study points to a few interesting indicators that reinforces the best practices of teacher preparation.

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