

Examining the Certification Choices of Southeastern Agriculture Teachers in the Curriculum for Agricultural Science Education

Abstract

This study examined the certification choices of Southeastern agriculture teachers regarding the Curriculum for Agricultural Science Education (CASE), a national initiative designed to enhance STEM integration in school-based agricultural education (SBAE). CASE provides a structured, rigorous, and inquiry-based curriculum that aligns with science, technology, engineering, and mathematics (STEM) standards, offering a framework for embedding STEM concepts directly into agricultural courses. Using a survey distributed to agriculture teachers in seven Southeastern states, data were collected from 134 participants, including 54 CASE-certified teachers and 80 non-certified teachers. The study explored participant demographics, interests, perceptions, barriers, and correlations between certification status and key factors. Findings revealed that non-certified teachers had limited familiarity with the CASE curriculum, contributing to neutral interest in certification. Major barriers included financial constraints, lack of administrative support, and logistical challenges such as summertime commitments and limited training accessibility. CASE-certified teachers expressed generally positive perceptions of the curriculum, citing increased content knowledge, improved STEM concept delivery, and structured lesson plans as key benefits for student learning and engagement. However, certified teachers often adapted or selectively implemented the curriculum due to resource limitations. Rural educators and alternatively certified teachers showed higher interest in CASE certification because of its alignment with their needs for a ready-to-use curriculum and professional development focused on STEM integration. These findings underscore the potential of CASE to strengthen STEM education within SBAE and highlight the need for enhanced outreach, funding support, and accessible professional development to increase adoption and fully realize its benefits in preparing students for STEM-related agricultural careers.

Keywords: CASE, school-based agricultural education, STEM integration, teacher certification, professional development

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Introduction & Literature Review

The Curriculum for Agricultural Science Education (CASE) is a structured curriculum designed for secondary agricultural educators, emphasizing science integration and inquiry-based teaching approaches (CASE 4 Learning, 2023). As the national Agriculture, Food, and Natural Resources (AFNR) standards have continued to evolve for more student-centered interdisciplinary teaching and learning, there has been a notable push for teachers to obtain CASE certification (Bird &

Rice, 2021). This certification equips educators with skills to integrate science into their classrooms, fostering a student-centered learning environment and promoting critical thinking (Anderson, 2018; Lambert et al., 2014; Smalley et al., 2023; Wells et al., 2019). Despite the growing adoption of CASE, gaps remain in the empirical research addressing its broader impact, especially on the experiences of teachers who do not pursue certification.

CASE certification has been widely regarded as enhancing educators' capacity to integrate science into agricultural education effectively. Teachers who have completed CASE institutes reported increased confidence and efficacy in science teaching (Ulmer et al., 2013). Inquiry-based teaching, the primary foundation of curriculum development for CASE, allowed students to engage actively in their learning through hands-on experiments and problem-solving activities (Nelson et al., 2022). However, the implementation of this teaching method often depended on teachers' prior experiences and their ability to navigate challenges such as limited resources and varying student maturity levels (Bird & Rice, 2021; Lambert et al., 2014).

Teachers cited personal and professional development as key motivators for obtaining CASE certification (Nelson et al., 2022). CASE professional development institutes provided educators with hands-on experiences, enabling them to practice inquiry-based techniques and gain familiarity with CASE materials (Smalley et al., 2023). Participants also reported improvements in their ability to facilitate autonomous learning environments, aligning with the goals of inquiry-based instruction (Lambert et al., 2014; Nelson et al., 2022).

The director of CASE 4 Learning, Carl Aakre, highlighted that there are regions of the United States that have less overall adoption of CASE than other areas, including the Southwestern region (personal communication, August 9, 2024). Existing literature has predominantly focused on the perspectives and experiences of CASE-certified teachers, exploring their approaches to inquiry-based learning, science integration, and professional development (Bird & Rice, 2021; Lambert et al., 2014; Nelson et al., 2022; Smalley et al., 2023; Ulmer et al., 2013; Velez et al., 2015). Studies have also examined the barriers educators face during curriculum implementation, such as resource constraints, student resistance to inquiry-based methods, and the need for teacher adaptation to student-centered instruction (Bird & Rice, 2021; Lambert et al., 2014). However, there is limited understanding of why some educators abstain from pursuing CASE certification, a critical gap given the increasing emphasis on science integration in agricultural education.

Purpose/Objectives

This study aimed to acquire data on agriculture teachers' perception of CASE regarding interest in obtaining or abstaining from certification in Southeastern states. This research followed the following objectives:

- I. Describe participant demographics.
- II. Describe the interest, perception, and perceived barriers of non-certified participants.
- III. Describe the interests, perceptions, and barriers of CASE-certified participants.
- IV. Examine correlations between perceptions, barriers, and interest in CASE certification with participant demographics.

Theoretical Framework

This study was grounded in Rogers' (2003) diffusion of innovation (DOI) theory, which provided a structured approach to understanding how new ideas, practices, or technologies are adopted and disseminated within a social system over time. DOI identifies key components of the adoption process, including the innovation itself, communication channels, time, and the social system, all interacting to expand the rate and extent of adoption (Rogers, 2003). It is emphasized that the adoption of an innovation is not merely an individual decision but is heavily influenced by social systems, communication networks, and the perceived attributes of the innovation itself (Rogers, 2003). DOI is particularly useful in examining the adoption of the CASE as an educational innovation representing a shift in curriculum design through science integration in SBAE (Thoron et al., 2016).

A central tenet of DOI is that the adoption of an innovation is influenced by individuals' perceptions of specific attributes (Rogers, 2003). Relative advantage, or the perceived improvement over existing practices, plays a key role in educators' decisions to adopt CASE, as they assess its impact on student learning, science integration, and inquiry-based instruction. Compatibility further shapes adoption by reflecting how well CASE aligns with teachers' values, philosophies, and institutional needs, with its alignment to National AFNR standards appealing to some but not all educators (Case4Learning, 2023). Complexity also influences adoption, as CASE's focus on hands-on, inquiry-based learning may be challenging for teachers with limited resources or experience (Rogers, 2003). Additionally, limited trialability, due to the requirement of professional development institutes (Case4Learning, 2023), may deter teachers seeking low-commitment options. Observability plays a final role, as teachers who witness the successful implementation of CASE by peers are more likely to adopt it themselves, demonstrating the importance of visible success stories in driving broader adoption (Rogers, 2003).

Given the limited empirical research on non-certified teachers' perceptions of CASE, DOI provided a valuable lens for understanding the barriers and motivators influencing adoption. By exploring factors such as relative advantage, compatibility, complexity, trialability, and observability, this study aimed to uncover varying rates of adoption and resistance to CASE certification within the context of agricultural education.

Methods

This study utilized a researcher-developed survey distributed via Qualtrics to collect data from agriculture teachers across seven Southeastern states: Georgia, Florida, Kentucky, Tennessee, Louisiana, Alabama, and South Carolina. The survey was sent through state-specific listservs, which were presumed to include all agriculture teachers within these states, totaling 2,421 potential participants. Following Dillman et al.'s (2014) tailored design method, the survey dissemination included four email communications: an initial invitation, a follow-up email with the survey link, and two reminder emails sent at seven- and 14-day intervals. A total of 155 individuals responded to the survey, with 134 responses deemed viable for analysis, resulting in a response rate of 5.5%.

While this low response rate substantially limited the generalizability of the findings to the broader population of agriculture teachers in the Southeastern United States, it is not uncommon

for web-based surveys targeting educators. The results should be interpreted with caution, as they may reflect the perspectives of those with stronger opinions or experiences related to CASE. However, the data still offer meaningful insights into the perceptions and barriers reported by a subset of teachers who engaged with the survey.

The 62-item questionnaire was organized into two main constructs designed to explore participants' perceptions of CASE and barriers to its implementation. A logic flow feature was included to tailor the instrument to the respondent's certification status, with separate paths for CASE-certified and non-certified participants (De Leew et al., 2008). Survey items were informed by prior research on CASE (Rice & Bird, 2021; Lambert et al., 2014; Velez et al., 2015) and reviewed by four university faculty members to establish content and face validity. A pilot test with 10 agriculture teachers from a state outside the study region yielded a Cronbach's alpha of 0.69. Revisions were made to improve clarity and internal consistency, and a post-hoc reliability analysis of the final instrument showed Cronbach's alpha scores exceeding 0.80 for both constructs, indicating strong reliability (Ford, 2020).

Descriptive statistics were used to summarize participant demographics, perceptions, and reported barriers. Correlation analyses were conducted between construct items, demographic variables, and CASE certification status to identify patterns associated with CASE participation. While the sample size is limited, these analyses offer preliminary insights into factors that may influence teacher engagement with CASE programming in the Southeastern United States.

Results

Objective I

Objective one of this study sought to describe the demographics of teachers who participated in the survey. Of the 134 participants who completed the survey, 124 provided demographic information, while 10 chose not to complete this section. Among those who shared their demographics, 54% were over the age of 35 (see Table 1). Half of the respondents were in their first 10 years of teaching agriculture, with nearly 30% having less than four years of experience. Over two-thirds of the participants taught in rural or urban cluster communities with populations under 50,000. Regarding CASE certification, 40% of respondents were certified.

Table 1

Descriptive statistics of participant demographics

Demographics	Frequencies	
	Frequency	Percent
Age		
<25	14	11
26-30	26	21
31-35	17	14
36-40	12	10
41-45	16	13
46-50	16	13

Demographics		Frequencies	
		Frequency	Percent
Gender	51+	23	19
	Male	37	30
	Female	86	70
Year Began Teaching Ag	1982-2000	11	10.1
	2001-2010	21	19.3
	2011-2015	23	21.1
	2016-2019	22	20.2
	2020-2023	32	29.3
Area Classification	Rural (Population <2,500)	49	40
	Urban Cluster (Population 2,501-50,000)	52	43
	Urbanized Area (Population >50,001)	21	17

Objective II

The second objective of this study was to describe the interests, perceptions, and perceived barriers of CASE to non-CASE certified participants. A total of 80 participants without CASE certification completed the survey (see Table 2). When asked about their understanding of the CASE curriculum, including the certification process, cost, and inquiry-based science integration, 51% reported having very limited to no understanding, while 45% indicated a moderate understanding. Participants generally expressed neutral interest in obtaining CASE certification, with many explaining that they either did not find a CASE course relevant to their needs or were satisfied with their own self-developed curriculum.

The construct of perceived barriers was reverse-coded, with lower means reflecting greater agreement with the statements. The most significant barriers identified were the cost of certification and materials. Many participants also noted a lack of support from their administration and district for pursuing CASE certification. One participant shared, “My district doesn’t want to pay because if I leave, the knowledge leaves too and does not stay with the program.” Summertime commitments were another common concern, with one participant explaining, “Cost in combination with planning summer training is the problem.” Travel costs were frequently cited as an additional barrier, with participants pointing out the lack of training opportunities “within a reasonable distance.”

Table 2

Descriptive Statistics of non-certified scaled items

Scale Points	Statistics		
	N	Mean	Std. Dev.
Interest and Perception			
There is NOT a CASE pathway/course that I am interested in*	80	3.86	1.06

Scale Points	Statistics		
	N	Mean	Std. Dev.
Interest and Perception			
I have developed my own curriculum that I am happy and satisfied with	80	3.86	1.22
I am interested in CASE's inquiry-based model integration	80	3.80	1.23
I have an interest in getting CASE certified	80	3.75	1.14
I have talked to a CASE certified teacher about the CASE curriculum	80	3.70	1.15
I am interested in CASE's science integration	80	3.44	1.47
I am interested in getting CASE certified to have a prepared curriculum available to me	80	3.10	1.31
I am interested in getting CASE certified to increase my content knowledge in a certain topic(s)	80	2.90	1.50
Other teachers in my region/state are encouraging me to get certified in CASE	80	2.46	1.59
Other teachers in my area/district are certified in CASE	80	2.41	1.37
I already utilize another prepared curriculum (not CASE)	80	2.25	1.40
Perceived Barriers			
The standards and expectations of my state's AG ED curriculum do NOT align with CASE*	80	3.10	1.37
My administration/district is NOT supportive of getting CASE certified*	80	2.45	1.48
I do NOT have time in the summer to attend a CASE institute*	80	2.36	1.35
Purchasing the materials for the curriculum is too expensive*	80	1.80	2.36
Getting certified in CASE is too expensive*	80	1.73	1.14

*- Item is reverse-coded. Items coded on a scale 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4- Agree, 5-Strongly Agree

Objective III

Objective three focused on describing the interests, perceptions, and barriers of CASE-certified teachers in the Southeast. A total of 54 participants with CASE certification completed the survey (see Table 3). Many certified teachers agreed that, prior to pursuing certification, they had a clear plan for incorporating CASE into specific classes and were the ones to propose certification to their administration. Conversely, certified teachers strongly disagreed with concerns about altering the provided lessons or units. When reflecting their initial interest in CASE, most certified teachers identified that they were drawn to CASE's science integration.

Perceptions of the CASE curriculum among certified teachers were generally positive but not conclusive. Teachers largely agreed that they would encourage others to pursue certification. They reported enjoying the implementation of the curriculum and showed neutral agreement on utilizing over 50% of the provided materials. However, barriers to implementation, including funding and resource availability, were met with neutral responses from certified participants.

In response to an open-ended question about their experiences with CASE certification, many teachers emphasized the difficulty of funding the curriculum and associated materials. One participant explained, "I love my CASE courses, but I had to fight and apply for grants to fund the certification courses and to buy the materials needed once I was certified. I am still battling funding for consumable materials." Another participant pointed out, "I feel that the initial cost of the course paired with the fact that the curriculum stays with the teacher is a barrier to getting more teachers certified in districts with high turnover." When discussing curriculum implementation, one participant noted, "Some of the labs are hard to complete because you need expensive equipment. I usually have to skip these labs."

Table 3*Descriptive Statistics of certified scaled items*

Scale Points	Statistics		
	N	Mean	Std. Dev.
Interest			
I proposed the idea of getting CASE certified to my administration/district.	54	4.26	1.33
I was intrigued with CASE's science integration	54	4.13	1.51
Before getting certified, I had a specific class in mind to integrate the CASE curriculum in	54	4.09	1.46
The teacher formerly in my position was already certified and implementing the CASE curriculum	54	3.89	1.60
Paying for the CASE institute was a barrier to getting certified *	54	3.76	1.87
I got CASE certified to have prepared curriculum available	54	3.43	1.80
Other teachers in my region/state encouraged me to get certified in CASE	54	3.13	1.53
Other teachers in my area/district were certified in CASE before me	54	2.80	1.63
I got CASE certified to increase my content knowledge on a certain topic(s)	54	2.50	1.81
I was intrigued with CASE's inquiry-based model integration	54	1.81	1.68
Before getting certified, I was nervous that I could not alter the lessons or units provided*	54	1.15	1.41
Perceptions			
I would encourage other teachers to obtain a CASE certification	54	4.02	1.64
I utilize more than 50% of the provided material (i.e. APPs, checks for understandings, PPTs)	54	3.87	1.74
I enjoy utilizing the CASE curriculum(s) I am certified in	54	3.85	1.64
Cost of materials is a barrier to implementing the CASE curriculum	54	3.41	1.71
I am wanting to get more CASE certifications	54	3.41	1.69
Restrictions of state curriculum and standards are a barrier to implementing the CASE curriculum.	54	3.19	1.57

Scale Points	Statistics		
	N	Mean	Std. Dev.
Interest			
Preparation for units and unit integration is a barrier to implementing the CASE curriculum.	54	3.15	1.56
Preparation for lessons is a barrier to implementing the CASE curriculum.	54	1.93	1.40

*- Item is reverse-coded

Items coded on a scale 1- Strongly Disagree, 2- Disagree, 3- Neutral, 4-Agree, 5-Strongly Agree

Objective IV

Objective four sought to explore the correlations between participant demographics and the scale points in both certified and non-certified participants. Using Pearson's correlation coefficient (r) with a significance threshold of $p < 0.05$, the analysis identified several small and medium correlations that provide insight into the factors influencing CASE certification decisions (Field, 2009). For the purposes of bivariate correlation analysis, gender was coded as a binary variable (1 = male, 2 = female), and area classification was coded on a three-point scale based on U.S. Census population categories: 1 = Rural (population under 2,500), 2 = Urban Cluster (population 2,501–50,000), and 3 = Urbanized Area (population over 50,000)

Among non-CASE certified participants (see Table 4), teacher gender had a medium, negative correlation with satisfaction with their own developed curriculum ($r = -.303$, $p = .019$), suggesting that male teachers were more likely to report satisfaction with their self-created materials. Interest in CASE's inquiry-based model showed small but statistically significant correlations with two demographic variables: a negative correlation with age ($r = -.280$, $p = .048$), indicating younger teachers were more receptive, and a positive correlation with gender ($r = .279$, $p = .034$), indicating that female teachers showed slightly higher interest.

Regarding perceived barriers to certification, participant age had a medium, positive correlation with identifying CASE as not aligned with their state's curriculum ($r = .388$, $p = .009$), and a medium, negative correlation with citing lack of summertime ($r = -.344$, $p = .007$), indicating that older teachers were more concerned about alignment, while younger teachers were more likely to report time constraints. A small, positive correlation was also observed between area classification and identifying CASE as too expensive ($r = .266$, $p = .047$). This suggests that teachers in more urbanized areas (urban clusters or urbanized areas) were more likely to perceive cost as a barrier, potentially due to higher programmatic demands or regional budget limitations in those settings.

Table 4

Correlations of Demographics and Scaled Items in Non-CASE Certified Participants

Scale Points	Demographics					
	Age	Gender	Subject	Cert	Area	School Pop
Interest and Perception						
I have an interest in getting CASE certified	-.103	.124	.100	.160	-.134	.171
I have talked to a CASE certified teacher about the CASE curriculum	-.145	.183	.074	.032	-.002	-.089
There is NOT a CASE pathway/course that I am interested in	-.195	.236	.103	.007	-.128	.191
I have developed my own curriculum that I am happy and satisfied with	-.233	-.303*	.037	-.182	-.136	.137
I am interested in CASE's science integration	-.087	.002	.001	.079	.022	.132
I am interested in CASE's inquiry-based model integration	-.280*	.279*	.194	.147	-.201	.059
I am interested in getting CASE certified to increase my content knowledge in a certain topic(s)	.063	.207	-.015	-.042	-.059	.074
I am interested in getting CASE certified to have a prepared curriculum available to me	.055	.014	-.031	-.065	.106	-.052
I already utilize another prepared curriculum (not CASE)	.207	-.046	-.109	.014	.082	.107
Other teachers in my area/district are certified in CASE	.037	-.042	.110	.177	.004	.207
Other teachers in my region/state are encouraging me to get certified in CASE	.065	-.059	-.059	.255	.099	-.059
Perceived Barriers						
The standards and expectations of my state's AG ED curriculum do NOT align with CASE***	.388**	.024	-.147	.180	-.043	.172
My administration/district is NOT supportive of getting CASE certified***	.065	-.036	.028	.213	.046	.008
Getting certified in CASE is too expensive***	.235	.150	-.080	-.084	.266*	.184
Purchasing the materials for the curriculum is too expensive***	.197	.200	-.106	-.087	.089	.057
I do NOT have time in the summer to attend a CASE institute***	-.344**	.043	.074	.002	-.042	-.048

*. p < .05

**. p < .01

***Item is reverse-coded

In CASE-certified participants (see Table 5), there was a medium, positive correlation between school student population and paying for the CASE institute being an original barrier for certification ($r = .407$, $p = .007$). Furthermore, school student population also had a medium, positive correlation with wanting to pursue CASE certification to have access to a comprehensively prepared curriculum ($r = .324$, $p = .041$).

Table 5

Correlations of Demographics and Scaled Items in CASE-Certified Participants

Scale Points	Demographics						
	Age	Gender	Years Teaching	Subject	Cert	Area	School Pop
Interest and Perception							
Paying for the CASE institute was a barrier to getting certified***	-.010	.093	-.046	-.016	.173	.247	.407**
Before getting certified, I was nervous that I could not alter the lessons or units provided	-.163	.346	.099	.137	-.094	-.030	.195
Before getting certified, I had a specific class in mind to integrate the CASE curriculum in	.169	-.003	-.040	-.031	.195	-.004	.084
I proposed the idea of getting CASE certified to my administration/district.	.095	-.097	-.093	-.051	.023	.065	.261
The teacher formerly in my position was already certified and implementing the CASE curriculum	.031	.092	-.127	-.039	-.176	-.259	.141
I was intrigued with CASE's science integration	.169	-.093	-.106	-.172	-.017	.001	.236
I was intrigued with CASE's inquiry-based model integration	.072	-.007	.051	-.129	.005	-.154	.029
I got CASE certified to increase my content knowledge on a certain topic(s)	-.013	.010	-.175	-.183	.026	-.106	-.070
I got CASE certified to have prepared curriculum available	-.027	.099	-.116	-.224	.050	.108	.324*
Other teachers in my area/district were certified in CASE before me	-.357*	-.150	.203	-.073	.029	.006	.107

Scale Points	Demographics						
	Age	Gender	Years Teaching	Subject	Cert	Area	School Pop
Interest and Perception							
Other teachers in my region/state encouraged me to get certified in CASE	.146	.027	.262	-.106	-.079	-.063	-.171
Perceptions							
I enjoy utilizing the CASE curriculum(s) I am certified in	.098	-.014	-.057	-.211	.120	.153	.231
I would encourage other teachers to obtain a CASE certification	.023	-.009	-.020	-.161	.242	-.054	.078
I utilize more than 50% of the provided material (i.e. APPs, checks for understandings, PPTs)	.055	.067	-.101	-.154	.162	-.059	.107
Cost of materials is a barrier to implementing the CASE curriculum	.176	.155	-.068	-.218	-.024	-.038	.159
Preparation for lessons is a barrier to implementing the CASE curriculum.	-.065	.109	.069	.074	.071	.189	.116
Preparation for units and unit integration is a barrier to implementing the CASE curriculum.	-.084	-.019	-.018	.091	.035	-.044	-.074
Restrictions of state curriculum and standards are a barrier to implementing the CASE curriculum.	-.125	.050	.004	.035	-.050	-.006	-.052
I am wanting to get more CASE certifications	-.124	.129	.139	.081	-.074	.249	.277

*. p < .05

**. p < .01

***Item is reverse-coded

Conclusions, Discussions, & Recommendations

Respondents were primarily experienced educators, with most teaching in rural or small urban communities with fewer than 50,000 residents (USDA, 2024), highlighting a continued opportunity to expand CASE adoption in the Southeastern United States. Although many participants were seasoned teachers, CASE certification rates suggested room for increased outreach and engagement. The demographic distribution underscores the importance of tailoring recruitment and support efforts to diverse school contexts across the region.

Non-certified teachers reported limited knowledge of the CASE curriculum, with over half indicating little to no familiarity. Consistent with Rogers' (2003) DOI theory, limited awareness likely contributed to neutral interest in certification, as knowledge is the first stage of adoption. Barriers such as cost, limited administrative support, and scheduling conflicts reflected concerns related to relative advantage, compatibility, and complexity. Certification cost emerged as the strongest deterrent, reaffirming prior research (Bird & Rice, 2021; Lambert et al., 2014; Smalley et al., 2023). Scholarships and grants were cited as important enabling factors that reduced perceived barriers and supported movement toward adoption (Smalley et al., 2023).

CASE-certified teachers generally viewed the curriculum positively and often entered certification with a clear integration plan, aligning with Nelson et al. (2022). While most recommended certifications were implemented, implementation varied considerably. Teachers frequently adapted or selectively used materials to better align with local standards and classroom needs, reinforcing the importance of flexibility and contextual customization (Bird & Rice, 2021). Funding challenges remained a primary concern, and limited access to training continued to constrain full implementation in some settings.

Demographic differences also shaped interest and perceptions. Younger and female teachers demonstrated greater interest in inquiry-based approaches, while female educators expressed lower satisfaction with self-developed curricula. Older teachers were more likely to perceive misalignment with state standards, and rural teachers reported greater financial concerns. These findings, consistent with prior research (Bird & Rice, 2021; Lambert et al., 2014; Smalley et al., 2023), suggest that adoption patterns are influenced by career stage, gender, and school context.

Based on these findings, it is recommended that CASE 4 Learning and state agricultural education leaders expand targeted outreach efforts, particularly toward early-career and rural teachers. Increasing access to scholarships, grants, and flexible training options may reduce financial and logistical barriers. Clear communication regarding curriculum alignment with state standards and the adaptability of CASE materials may also strengthen perceived compatibility and relative advantage, key components of Rogers' (2003) DOI theory. Continued empirical research examining CASE's impact on teacher development and student STEM outcomes is warranted to further support sustainable implementation.

References

- Anderson, K. (2018). *Beginning teachers' perceptions of curriculum for agricultural science education training and classroom implementation*. (Publication No. 13419060) [Master Thesis, Iowa State University]. ProQuest Dissertations and Theses Global.
- Bird, T. D., & Rice, A. H. (2021). The influence of CASE on agriculture teachers' use of inquiry-based methods. *Journal of Agricultural Education*, 62(1), 260–275. <https://doi.org/10.5032/jae.2021.02160>
- CASE4Learning. (2023). *Mission and vision*. <https://www.case4learning.org/about-case/mission-and-vision/>
- De Leew, E. D., Hox, J. J., & Dillman, D. A. (2008). *International handbook of survey methodology*. European Association of Methodology.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. (4th ed.). John Wiley & Sons, Incorporated.
- Field, A. (2009) *Discovering statistics using SPSS*. (3rd ed.) Sage Publications.
- Ford, C. (2020). *Understanding robust Standard Errors*. UVA Library Stat Lab. <https://library.virginia.edu/data/articles/understanding-robust-standard-errors/>
- Lambert, M. D., Velez, J. J., & Elliott, K. M. (2014). What are the teachers' experiences in implementing the Curriculum for Agricultural Science Education? *Journal of Agricultural Education*, 55(4), 100–115. <https://doi.org/10.5032/jae.2014.04100>
- Nelson, B., Wang, H. H., & Tucker, M. (2022). Teachers' perceptions and practices of inquiry-based teaching and learning using CASE curriculum. *Journal of Agricultural Education*, 63(3), 117–134. <https://doi.org/10.5032/jae.2022.03117>
- Rogers, E. M. (2003). *Diffusions of Innovations* (5th ed.). Free Press.
- Smalley, S., & Hainline, M. (2024). SBAE teachers' perceptions of science integration and inquiry-based learning. *Journal of Agricultural Education*, 65(1), 23–39. <https://doi.org/10.5032/jae.v65i1.50>
- Smalley, S., Hainline, M., & Grein, K. (2023). Beginning SBAE teacher perception of CASE training and curriculum implementation. *Journal of Agricultural Education*, 64(3), 26–42. <https://doi.org/10.5032/jae.v64i3.56>
- Smalley, S., Rice, A., & Hasselquist, L. (2023). The effectiveness of virtual CASE institute professional development: A participant perspective. *Journal of Agricultural Education*, 64(2), 85–98. <https://doi.org/10.5032/jae.v64i2.89>

- Thoron, A. C., Myers, B. E., & Abrams, K. (2016). Perceptions of school-based agricultural education programs toward science integration. *Journal of Agricultural Education*, 57(1), 1–16. <https://doi.org/10.5032/jae.2016.0100>
- Ulmer, J. D., Velez, J. J., Lambert, M. D., Thompson, G. W., Burris, S., & Witt, P. A. (2013). Exploring Science Teaching Efficacy of CASE Curriculum Teachers: A Post-Then-Pre Assessment. *Journal of Agricultural Education*, 54(4), 121–133. <https://doi.org/10.5032/jae.2013.04121>
- United States Department of Agriculture. (2024). *What is Rural?* Economic Research Service. <https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/what-is-rural/>
- Wells, T., Hainline, M. S., & Smalley, S. W. (2019). Identifying challenges pre-service teachers encountered when teaching Curriculum for Agricultural Science Education (CASE) coursework during student teaching. *Journal of Agricultural Education*, 60(3), 128–140. <https://doi.org/10.5032/jae.2019.03128>