

Determining the Effectiveness of CASE Professional Development for CASE-certified Agricultural Education Teachers

Anna Bowser¹
Scott Smalley²
Joe Ramstad³

Abstract

The researchers analyzed the traditional Curriculum for Agricultural Science Education (CASE) Institute professional development (PD) program as professional development can change teacher practice and improve student achievement. Researchers used the Garet et al. study which outlined the relationship between the six effective features of professional development and teacher outcome as a framework to analyze the traditional CASE Institute professional development courses. Participants who were certified in a traditional CASE Institute professional development course were surveyed, and their responses were analyzed using the Statistical Package for the Social Sciences (SPSS) to determine the mean and standard deviation of the data related to the assessment of CASE professional development and the assessment of CASE lead teachers. These data were used to determine the effectiveness of the CASE professional development program. Their responses illustrated the effectiveness of CASE as they had a firm understanding of the material and CASE model, the comfortability of implementing the learned material in their classroom, and the effectiveness of their lead teachers based on their teaching abilities. The researchers also concluded that three of the six effective features of professional development examined in this study had a positive relationship between the features of the professional development and the participants' responses. From the findings of this study, researchers created a list of recommendations and future research that should occur to bolster CASE Institute professional development courses and curriculum further.

Introduction

Agricultural education has been an integral part of the United States' education system since the early 1860s (Advance CTE, 2021). Over the past 100 years, the purpose of agricultural education changed from the preparation for farming as a livelihood to educating all students about the role of agriculture, food, and natural resources (Adelhart, 2006; National Association of Agricultural Educators, 2021). Along with this shift in purpose, the importance of professional development in education and agricultural education continued to grow (Frontline Education, 2021). After the federal government passed the Carl D. Perkins Career and Technical Education Act (Perkins IV) in 2006, the integration of Career and Technical Education (CTE) courses and academics were encouraged (Advance CTE, 2021). As agricultural education falls under the umbrella of CTE, this change in policy initiated the creation of programs that integrated agriculture and other CTE topics into the classroom. The emphasis on CTE in the classroom led to a directive from the

¹ Anna Bowser is an educator and a graduate of Iowa State University in the Department of Agricultural Education and Studies.

² Scott Smalley is an Associate Professor of Agricultural Education in the Department of Agricultural Education and Studies at Iowa State University, 217 Curtiss Hall, Ames, IA 50010, smalle16@iastate.edu. ORCID # 0000-0001-8386-4266

³ Joe Ramstad is a doctoral student and graduate assistant at Iowa State University in the Department of Agricultural Education and Studies, 227 Curtiss Hall, Ames, IA 50010, ramstad@iastate.edu. ORCID # 0009-0002-5594-399X

National Council of Agricultural Education to create a program that develops agricultural curriculum and professional development (Lambert et al., 2014). The Curriculum for Agricultural Science Education (CASE) was established out of this directive to provide an enriched curriculum and professional development program that emphasizes industry-validated, inquiry-based learning in school-based agricultural education (SBAE) (Bird & Rice, 2021; Lambert et al., 2014).

The CASE curriculum provides yearlong instructional materials such as daily activities, hands-on projects, laboratory guides, and assessments (CASE, 2024-a). There are currently 14 different CASE courses offered, including Introduction to Agriscience, Food Science and Safety, Agricultural Business Foundations, and Environmental Science Issues (CASE, 2024-a). Each CASE course investigates a specific pathway or pathways in agriculture. To access these instructional materials, interested teachers must complete a professional development program in a specific course, which results in a certification. For example, if a teacher wanted to be certified to teach Agricultural Business Foundations, they would need to participate in the CASE Institute professional development for that specific CASE course. During this professional development experience, the teacher would go through all the CASE material within that course under the direction of a lead teacher who is hired by CASE. The training includes opportunities for educators to experience the activities, labs, projects, and assessments within that course (CASE, 2024-a) to ensure that students are offered as consistent of an experience as possible, no matter which school they are enrolled in, and to ensure teachers understand the content so they are able to facilitate a quality learning experience for their students. Each CASE course is structured following the CASE model: curriculum, assessment, certification, and professional development (Carraway et al., 2015). The goal of the CASE model was to establish a consistent, nationwide agricultural education curriculum that provides high-level, inquiry-based, student-centered educational experiences for teachers and their students (CASE, 2024-a; NC State University, n.d.).

To allow for maximum flexibility and meet the needs of teachers, CASE professional development can be delivered in three different formats: 1) the traditional CASE Institute, 2) a BriefCASE Institute, and 3) Fast Track CASE Institute. CASE Institute is the name of the traditional professional development program that focuses on preparing teachers with content-based material and pedagogical methods for their agriculture courses through the usage of inquiry-based learning (Smalley et al., 2019). The BriefCASE and Fast Track Institutes are two other forms of professional development in CASE that are more condensed and focused on activities and curriculum knowledge (CASE, 2024-c). Each CASE Institute is peer-taught by a lead teacher. A lead teacher has previously taught the CASE curriculum in the classroom and has undergone training for their specific CASE Institute. A CASE Institute prepares teachers to use inquiry-based pedagogy and implement the content in their classrooms (NC State University, n.d.). While CASE Institutes were traditionally led in an in-person format, delivery modalities have adapted just as the education field has over the past several years. The COVID-19 pandemic has influenced the educational landscape and has created opportunities to diversify professional development for teachers, most notably in providing opportunities to engage in virtual professional development (Smalley et al., 2023). Virtual professional development has presented educators with the opportunity to build their content knowledge, pedagogical content knowledge, their beliefs about education, and self-efficacy overall (Bragg et al., 2021).

Prior CASE research has been conducted to answer a range of research questions related to how CASE influences a teacher's use of inquiry-based methods (Bird & Rice, 2021), the intentions of preservice teachers to integrate science in the classroom using CASE curriculum (Carraway et al., 2015), teachers' experiences implementing CASE (Lambert et al., 2014), interdisciplinary teaching potential with CASE (Pauley et al., 2019), and pre-service teachers' experiences at a CASE Institute (Tummons et al., 2020), which generally show positive use of CASE along with opportunities to enhance the CASE model. Most recently, the effectiveness of virtual CASE Institutes from the perspective of lead teachers has also been researched (Rice et al., 2024). However, this research aims to build on these areas of existing knowledge to

evaluate teachers' preparedness to take what they have learned from their virtual CASE Institute and integrate it within their own agricultural education program.

Though there has been extensive CASE research, there is a gap in the literature regarding the effectiveness of CASE Institute as a professional development source for agricultural educators, especially in regards to the new virtual delivery format that has recently been introduced. As CASE Institutes continue to be offered each year in order to provide professional development for many agricultural educators in the United States, there is a need for research examining the professional development component of the CASE model to evaluate its effectiveness.

Literature Review

Professional development is an important tool in developing effective teachers and improving positive student outcomes because professional development equips teachers with knowledge and skills that lead to enhanced student achievement (Mizell, 2010; Sancar et al., 2021). Student achievement is often measured to determine the success of a secondary school program (Shoulders & Myers, 2014). Further, since agricultural education covers nine different pathways (The National Council for Agricultural Education, 2023), the needs agricultural educators have within these pathways (Yopp et al., 2020) based on their pathway to licensure (Wood et al., 2024) and also throughout different stages within an agricultural educator's career (Figland, 2019; Smith & Smalley, 2017; Thornton et al., 2020; Touchstone, 2015) can be highly variable and contextualized. To improve student achievement and, in turn, the program, professional development needs to be a priority for educators as their teaching behaviors and practices gained because of these experiences can enhance student achievement (Ketelhut et al., 2019; Sancar et al., 2021). Through professional development, teachers gain a greater understanding of how their students learn, the content of the course, and the pedagogy that can be used (Garet et al., 2001). As professional development is noted as a key strategy for changing and improving teacher knowledge and beliefs, along with having direct impacts on student learning outcomes (Ketelhut et al., 2019; Sancar et al., 2021), it is an essential component to aid in the development of a successful teacher and program. Due to the important role professional development plays in the shaping of teacher practices, measurement of the quality of the professional development program must occur.

Studies in the past have produced six effective features of professional development that lead to changes in teacher outcomes (i.e., implementation of practices and curricula) and can be used as a means for measuring effectiveness (Desimone et al., 2009; Garet et al., 2001). These features are 1) form, 2) duration, 3) collective participation, 4) coherence, 5) content focus, and 6) active learning. The first three of these features are structural considerations: form of the activity, duration of the activity, and collective participation. There are two different forms of professional development - traditional and reform. Traditional professional development is similar to a long workshop or conference, while reform is similar to teacher coaching; the duration of the professional development considers the contact hours spent in the activity and the period that the activity spanned (Garet et al., 2001). Collective participation encourages teachers from the same department, school, or district to attend professional development training together to create an environment that stimulates deeper discussion and learning (Garet et al., 2001). When reviewing this idea from an agricultural education lens, this could be expanded to teachers from a particular region or state and then being able to utilize common language or best practices at larger conferences or gatherings as a result of attending a similar professional development experience. Additionally, the collective participation feature could be seen from the angle that both science and agricultural education teachers were attending the professional development together, as agriculture is a technical science and integrates a variety of science applications within its overall framework. If a science and an agricultural education teacher from the same school district attended, it could assist in developing a stronger relationship and adoption of a common scientific language across the two disciplines. The remaining three features are the core features, or substance, of the professional development: 1) content focus, 2) active learning, and 3) coherence of the

program (Garet et al., 2001; U.S. Department of Education, Office of the Under Secretary, 2006). Content focus considers the degree to which subject matter is prioritized and focused during professional development training. Active learning within a professional development consists of any opportunity that engages and actively involves students in the learning process (Center for Educational Innovation, n.d.). Coherence of the program ensures that the activities and curriculum learned reflect state and national standards and goals set for agricultural education (Garet et al., 2001). Along with these six features, feedback and reflection, models of effective practice, and coaching and expert support are additional features that have been identified for effective professional development (Bates & Morgan, 2018).

Training of agricultural educators has changed over the past 40 years due to the development of career and technical education (CTE) in the late 1980s (Asunda, 2012; Phipps et al., 2008). The development and revision of CTE led to the investigation of integrating agriculture, and other CTE subjects, into the classroom. In 2015, a group of researchers studied the integration of science into an agricultural education program (Baker et al., 2015). From their research, they created a list of five emerging issues, barriers, or challenges that showcase the reasoning for the initial lack of integration of science into the agricultural education program they studied in their case study: 1) unclear ways on how programs can effectively integrate science, 2) integrating science without losing sight of agriculturally-driven content, 3) unfamiliarity with inquiry-based instruction, 4) lack of science knowledge, and 5) collaboration. (Baker et al., 2015). The five issues indicate the need for improved professional development programs for agricultural education teachers. When considering four of the six effective features of professional development (i.e., all features except form and duration) (Baker et al., 2015; Desimone et al., 2009; Garet et al., 2001) and the five themes discovered in the Baker et al. study (2015), a connection between the two topics is easy to see. For example, the issue of increased collaboration connects with the feature “collective participation,” while the challenge of lack of science knowledge connects with the professional development feature of content focus or even coherence. This connection indicates the need for measuring the effectiveness of professional development programs to ensure that the programs are providing effective and meaningful professional development. While a CASE Institute is a specialized institution for professional development, it provides many of the themes recommended in the Baker et al. study (2015). Upon completion of a two-week CASE Institute professional development, teachers have access to a year’s worth of curriculum (familiarity with inquiry-based instruction), relationships with a group of surrounding agricultural education teachers (increased collaboration), and an understanding of the curriculum given (knowledge of how to integrate science).

A CASE Institute professional development strives to equip and empower agriculture teachers to increase student engagement and achievement in agriculture (CASE, 2024-b). The mission of CASE is to “impact student career readiness by empowering teachers with improved instructional practices and relevant curricula sustained by professional development” (CASE, 2024-b). Though CASE research has previously been conducted, it has primarily been concentrated on curriculum, implementation, or experiences during the CASE Institute professional development (Bird & Rice, 2021; Carraway et al., 2015; Lambert et al., 2014; Pauley et al., 2019; Tummons et al., 2020). Little research has been conducted specifically looking at the effectiveness of the traditional CASE Institute professional development program. Research Priority Area Five: Efficient and Effective Agricultural Education Program within the American Association for Agricultural Education’s National Research Agenda (Thoron et al., 2016) was addressed in this study as we are investigating an agricultural education professional development program.

As effective professional development changes teacher knowledge and practice also evolve (Darling-Hammond et al., 2017; Nguyen, 2018). The aim of this study is to specifically examine the effectiveness of the traditional CASE Institute model using participants’ self-perceived preparedness for implementation of the CASE curriculum as the measure for effectiveness. Coaching, modeling, and expert support are effective features of professional development (Bates & Morgan, 2018), this study will also analyze the participants’ perceptions regarding CASE lead teachers. CASE Institute research is essential

for the agricultural education field due to the lack of prior research and the insight that can be gained from this professional development program.

Theoretical Framework

The theoretical framework for this study was adapted from the Garet et al. (2001) study on the relationship between the six features of effective professional development and teacher outcome. The six features are: 1) type, 2) duration, 3) collective participation, 4) active learning, 5) coherence, and 6) content focus. The first three features are the structural features, or how the professional development is structured, while the remaining three features are the core features, or the characteristics of the substance of the professional development (Desimone et al., 2009). This model discusses the importance of professional development and the features required for an effective professional development program. We used the six features for effective professional development as a guide to determine the effectiveness of the traditional CASE Institute professional development courses and guide the development of the instrument used within the study. These features were utilized in order to design and evaluate the findings of the study. A complete summary of these key features of effective professional development can be found in Figure 1.

Figure 1

Key features of effective professional development (Garet et al., 2001)

Features	Description
Form	Reform (longer time period; informal) vs. traditional (2-week session in a designated setting);
Duration	Number of hours, days, weeks or months that the professional development spans
Collective participation	Degree to which school districts or content areas have teachers engage in the same professional development training
Content focus	The amount of content or information shared at the professional development that is aimed at increasing disciplinary knowledge
Active learning	Degree to which the professional development uses activities that stimulate active learning; meaningful analysis of teaching and learning
Coherence	Degree of consistency between professional development and local, state or national standards or educational objectives

Purpose and Research Objectives

The purpose of this study was to determine the effectiveness of the traditional CASE Institute professional development program delivered in a virtual format, using the participants' self-perceived preparedness for implementation as a measure of determining the effectiveness of the traditional CASE Institutes. The following research objectives served as a guide for this effectiveness assessment:

1. To determine the effectiveness of the traditional CASE Institute professional development program delivered in a virtual format.
2. To assess the effectiveness of the CASE Institute lead teachers facilitating the professional development program in a virtual format.

Methods

Research Design

The purpose of this IRB-approved quantitative questionnaire was to determine the effectiveness of the virtual CASE Institute professional development program through assessing teacher preparedness to implement the CASE curriculum in their classroom. The electronic questionnaire included a series of quantitative questions, including multiple-choice items, checklists, and Likert-type scale items. Agricultural education experts in survey research were asked to measure the instrument for face validity resulting in minor adjustments to the questionnaire (Creswell & Creswell, 2018). To reduce the threat to internal validity and reduce measurement error, the questionnaire was developed using Ary et al.'s (2018) guidelines for writing questionnaire items. To control for external validity, we ensured an accurate list of participants was recorded, verifying with CASE Institute coordinators before analyzing the data to reduce frame error (Ary et al., 2018).

Population

The intended target population for this research study was newly certified CASE Institute professional development program participants who engaged in participation in a virtual institute in summer 2021. The researchers contacted CASE Institute national coordinators to request the list of participants for all the CASE Institute programs. To minimize frame error, the researchers checked for duplicated or missing names on the list (Ary et al., 2018). The CASE participants identified themselves as agricultural education teachers ($n = 381$; 84.5%), science teachers ($n = 25$; 5.5%), and other CTE teachers ($n = 23$; 5.1%) teachers. Upon their completion of the virtual CASE Institute professional development programs, certified participants were recruited for their participation in the study. Only teachers who participated in a traditional CASE Institute professional development program offered in a virtual format were invited to participate in this study.

Of the 477 participants in the traditional CASE Institute professional development, 453 responded, resulting in a 94.9% response rate. Many of the participants were female ($n = 339$; 74.8%) and between the ages of 20 and 40 years old ($n = 158$; 34.9%). A majority of participants volunteered to participate in CASE professional development ($n = 373$; 82.4%), and have their primary teaching license in Agricultural Science ($n = 381$; 84.5%). While their experience varies, over half of the participants have had 5 years or less of secondary teaching experience (Table 1). Participants in CASE Institute are from all over the country with the largest populations from Iowa ($n = 56$; 12.2%), Illinois ($n = 30$; 6.6%), and Missouri ($n = 32$; 7.1%). More information about participants can be found in Table 1.

Table 1*Selected demographic data of responding CASE professional development participants (N = 453)*

<i>Variable</i>	<i>n</i>	<i>%</i>
Gender		
Female	339	74.8%
Male	113	25.0%
Other	1	0.2%
Age		
Less than 23 years	94	20.7%
24-30 years	158	34.9%
31-40 years	97	21.4%
41-50 years	66	14.6%
More than 50 years	38	8.4%
CASE Participation		
Assigned	55	12.1%
Volunteered	373	82.4%
Other	25	5.5%
Experience		
Preservice	67	14.8%
1-2 years	101	22.3%
3-5 years	100	22.1%
6-10 years	79	17.4%
11-20 years	72	15.9%
More than 20 years	34	7.5%
Primary Teaching License		
Agricultural Science	381	84.5%
Industrial Arts	1	0.2%
Other Career and Technical Education	23	5.1%
Science	25	5.5%
Other	21	4.7%

Note. CASE = Curriculum for Agricultural Science Education; 'n' represents the subsample for which we have complete data for each item.

Instrumentation

A web-based quantitative questionnaire was used for this study to collect data from the participants. A descriptive research survey method was used to look at the effectiveness of CASE Institute and curriculum and its impact on potential teacher implementation in the classroom. The questionnaire was constructed in Qualtrics and followed Dillman's Tailored Design Method for Internet Surveys (Dillman et al., 2014). The questionnaire was distributed to all eligible participants immediately following the completion of the professional development through an electronic link to the questionnaire in Qualtrics.

The questionnaire was broken into 5 sections of questions to evaluate their CASE professional development experience. The sections included: 1) demographic information, 2) teaching background and experience, 3) assessment of the CASE professional development, 4) assessment of the lead teacher, and 5) exploration of interest in potential new CASE professional development programs. Demographic and teaching background and experience were collected so the researchers could describe and analyze the participants based on their answers. The assessment of CASE professional development and their lead teacher was used to determine the participants' opinions on the CASE Institute attended. Participants' interest in future CASE Institutes allowed researchers to see the participants' enjoyment and engagement in CASE Institutes. For the assessment of the CASE professional development and lead teacher sections,

the 5-point Likert-type scale was used with 1 representing “strongly disagree” and 5 representing “strongly agree.” The other three sections asked questions relating to demographic information, teaching background, and interest in new CASE professional development programs. As participants were all given the same questionnaire directly following the completion of their CASE Institute, the questionnaire was deemed reliable. A pilot test study was conducted with CASE-certified individuals not represented in this sample. The practice of field-testing and pilot testing is strongly recommended in order “to establish the content validity of scores on an instrument; to provide an initial evaluation of the internal consistency of the items’ and to improve questions, format and instructions” (Creswell & Creswell, 2018, p. 154). Minor adjustments to the questionnaire resulted after the completion of the pilot test study. Furthermore, an expert panel consisting of teacher educators with experience with CASE curriculum, curriculum development, and questionnaire design was utilized in order to evaluate the effectiveness of the questions (Creswell & Creswell, 2018). Their feedback was also taken into account to develop the pilot questionnaire and the finalized version of the questionnaire that was utilized in the study.

Data Collection

Immediately after their participation in the virtual CASE Institute professional development, eligible participants received an email explaining the research study along with a link to the questionnaire following the completion of their CASE Institute professional development program. Teachers’ participation was entirely voluntary. Informed consent was gathered through a single page at the beginning of the questionnaire. Any data that were missing or incomplete was removed prior to our data analysis to further control for measurement error (Creswell & Creswell, 2018). To account for non-respondents, the researchers compared early and late respondents. No statistical difference was found between early and late respondents. In this institutional review board (IRB)-approved, quantitative, survey research study, we used a researcher-created instrument to measure the effectiveness of the traditional CASE Institute professional development program using the participants’ self-perceived preparedness for implementation to determine effectiveness and ensure the collected data was controlled for measurement error (Ary et al., 2018).

Data Analysis

The data were collected through a Qualtrics quantitative questionnaire that was distributed to the participants through their email. The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) to determine the mean and standard deviation of the data related to the assessment of CASE professional development and the assessment of CASE lead teachers. These formulas were used to analyze the data to help determine the effectiveness of CASE professional development and the potential for implementation in the classroom. To analyze the demographic and teacher background, data were used to calculate the percentages of the demographic variables to highlight the varying populations that took place in the study. All the data collected and analyzed was organized and arranged into a series of tables to enhance the readability and clarity of results.

Results

Objective 1: Participants’ perceived effectiveness of virtual CASE professional development

To determine the effectiveness of the traditional CASE Institute professional development program delivered in a virtual format, participants were asked several questions that relate to the professional development’s effectiveness. The questions also were designed to specifically target two of the six effective features of professional development: 1) content focus and 2) active learning (Garet et al., 2001). Most of the participants had a strong understanding of the CASE model (Table 2), which consists of the curriculum, assessment, certification, and professional development components. Participants strongly agreed when asked if they were prepared to implement the CASE curriculum in their classroom ($\mu = 4.50$; $\sigma = 0.71$). Several of the participants agreed that the lessons and demonstrations facilitated my learning of the course content ($\mu = 4.49$; $\sigma = 0.71$), indicating that the participants learned the content material during the

professional development course. However, despite general enthusiasm and positive perspectives pertaining to their professional development experience at the CASE Institute, participants expressed less interest in having their students participate in CASE End-of-Course (EOC) assessments, formerly CASE Online ($\mu = 3.15$; $\sigma = 1.31$); these opportunities lead to the potential for students to earn additional certifications or credentials (CASE, 2024-a).

Table 2*Participants' assessment of their CASE professional development experience*

<i>Variables</i>	<i>n</i>	<i>μ</i>	<i>σ</i>
The CASE courses and CASE Institute are programs that will benefit other teachers in my region and state.	453	4.61	0.71
I have a solid understanding of the CASE model.	453	4.57	0.71
I am prepared to begin implementing CASE curriculum in my classroom.	453	4.50	0.71
The lessons and demonstrations facilitated my learning of the course content.	453	4.49	0.71
The expectations of the participants during the CASE Institute were clearly laid out and communicated to me.	453	4.48	0.71
The sequence of the day-to-day schedule was appropriate in order to prepare me to teach this curriculum	453	4.44	0.71
The CASE Institute classrooms/laboratories were organized and well prepared for instruction and learning	453	4.43	1.41
Facilitators were able to answer my technology questions.	441	4.39	0.79
The professional development experience at this CASE Institute exceeded my expectations.	453	4.29	1.41
The curriculum download process was simple.	445	4.27	1.41
The CASE Online delivery enhanced my professional development experience.	453	3.62	1.41
The technology of CASE Online enhanced my professional development experience.	418	3.55	1.25
CASE Online was easy to navigate.	410	3.53	1.18
I am interested in implementing CASE Online (EOC) in my classroom.	428	3.15	1.31

Note. Based upon a 5-point Likert-type scale with 1= Strongly Disagree and 5= Strongly Agree. μ = Mean; σ = Standard deviation. 'n' represents the subsample for which we have complete data for each item.

Objective 2: Participants' perceived effectiveness of their virtual CASE Institute lead teacher

The second objective sought to assess the effectiveness of the CASE Institute lead teachers facilitating the professional development program in a virtual format. To assess their effectiveness, participants were asked several questions related to their lead teachers' knowledge, demeanor, and teaching ability. These questions also examined one of the six features of effective professional development, collective participation (Garet et al., 2001). When considering the data presented in Table 3, most of the participants agreed that the lead teachers demonstrated knowledge and expertise in the subject area ($\mu = 4.60$; $\sigma = 0.71$) and their teaching demeanor was deemed professional by many of the participants ($\mu = 4.57$; $\sigma = 0.71$). Regarding their teaching ability, participants agreed that they offered time outside of class for help ($\mu = 4.65$; $\sigma = 0.71$), they understood and responded to the participants' instructional needs ($\mu = 4.57$; $\sigma = 0.71$), they demonstrated how the professional development content learned fits into the CASE curriculum ($\mu = 4.56$; $\sigma = 0.71$), they provided enhancements with support materials ($\mu = 4.55$; $\sigma = 0.71$), they were organized and prepared for class ($\mu = 4.54$; $\sigma = 0.71$), they created a conducive learning

environment ($\mu = 4.54$; $\sigma = 0.71$), and they used effective modeling skills ($\mu = 4.49$; $\sigma = 0.71$). Additionally, many participants agreed to the statement, "I would take another course from this instructor."

Table 3

Participants' assessment of CASE professional development lead teacher

<i>Variables</i>	<i>n</i>	<i>μ</i>	<i>σ</i>
Offered and provided help outside of the normal class time, if requested.	453	4.65	0.71
Followed the scope and sequence (schedule).	453	4.62	0.71
Demonstrated knowledge and expertise in the course content.	453	4.60	0.71
Maintained a professional demeanor in the classroom.	453	4.57	0.71
Understood and responded appropriately to participants' instructional needs.	453	4.57	0.71
Demonstrated how individual lessons, activities, and projects that are addressed during the CASE professional development programming fit into the broader context of the course curriculum.	453	4.56	0.71
Demonstrated knowledge and expertise with the course hardware and software.	453	4.55	0.71
Provided appropriate enhancements with support materials.	453	4.55	0.71
Well organized and prepared for class.	453	4.54	0.71
Created an atmosphere that was conducive to learning (i.e., provided timely breaks, considered learner needs, minimized distractions, etc.)	453	4.54	0.71
I would take another course from this instructor.	453	4.51	0.71
Modeled effective presentation skills and content delivery methods.	453	4.49	0.71

Note. Based upon a 5-point Likert-type scale with 1 = Strongly Disagree and 5 = Strongly Agree. μ = Mean; σ = Standard deviation. 'n' represents the subsample for which we have complete data for each item.

Conclusions

The purpose of this study was to determine the effectiveness of the traditional CASE Institute professional development program delivered in a virtual format, using the participants' self-perceived preparedness for implementation as a measure of determining the effectiveness of the traditional CASE Institutes. The researchers evaluated the research objectives using the data collected from the participants and built upon existing literature and the theoretical framework (Garet et al., 2001) to draw conclusions. These conclusions then shaped the recommendations that were developed, both for future research and for professional practice.

Objective 1: Participants' perceived effectiveness of virtual CASE professional development

When considering the first research objective to determine the effectiveness of the traditional CASE Institute professional development program delivered in a virtual format, we found the participants' professional development experiences to be effective. This may be attributed to the professional development being designed in a way that upholds the key features of effective professional development (Garet et al., 2001) and the general best practices of designing meaningful professional development experiences as identified by Bragg et al. (2021). The participants indicated a conclusive understanding of the CASE model, self-perceived preparedness to implement the CASE curriculum, and their learning of the content material. Likewise, participants built their knowledge and ability to integrate CASE within their curriculum through building their self-efficacy (Bragg et al., 2021). However, our data is from their self-perceived analysis of their knowledge and abilities and could be considered a limitation of the study. As many of the participants agreed that the lessons and demonstrations facilitated their learning, the participants identified that learning took place. Despite this, a key outcome for effective professional

development is a change in a teacher's professional knowledge, attitude, or practice (Bragg et al., 2021; Darling-Hammond et al., 2017; Nguyen, 2018). Thus, when examining their learning and overall increase in content knowledge and practice leads to concluding that the virtual CASE Institute was an effective professional development experience for the majority of participants. An analysis was conducted between agricultural science teachers and science and other teachers who participated in the study, but no statistical significance was found when comparing these groups.

This study's findings of virtual professional development programs and training experiences being well-perceived by agricultural educators builds on existing work (Bragg et al., 2021; McKim & McKim, 2023; Smalley et al., 2023). The flexibility offered by virtual professional development (McKim & McKim, 2023) eliminates the need to travel and sacrifice additional time away from family, and also is offered to participants at a lower cost than the in-person CASE Institutes (CASE, 2024-c), while also building their own technology self-efficacy that they can then apply to their classroom teaching (Morey et al., 2023). When implemented following best practices, such as clear and easy to understand design, with opportunities for learner supports, engagement, flexibility, and application of learning, virtual professional development can be extremely effective (Bragg et al., 2021). These best practices are implemented within the CASE virtual professional development curriculum through allowing flexible delivery, engagement with an expert lead teacher, opportunity for additional learning and support beyond the time of the CASE Institute, and a clear interface to access curriculum resources and supports that they retain indefinite access to (CASE, 2024-a; CASE, 2024-c). Participants in this study indicated that their engagement in virtual professional development offered by CASE prepared them to actually implement the curriculum they received and that the experience as a whole exceeded their expectations.

In addition, two of the six effective features of professional development were identified within the first research objective: content focus and active learning (Garet et al., 2001). Content focus was examined as participants were asked to evaluate the materials and demonstrations utilized during their professional development sessions and identify if they facilitated their learning of the content (Garet et al., 2001). Many of the participants found the lessons and activities to be helpful in their learning of the CASE curriculum. Participants were also asked to rate their understanding of the CASE model and their self-perceived preparedness to implement the material in the classroom. The participants' responses identified the usage of the feature content focus because the participants expressed their understanding of the material and their ability to implement the material. When specifically looking at the feature of active learning (Garet et al., 2001), CASE Institute participants had the opportunity to engage in both active learning as their lead teachers facilitated engaging lessons, but also had the opportunity to model active teaching as part of the training. This engagement in active learning is validated as many of the participants agreed that the provided lessons and demonstrations facilitated their learning. Participants also had the ability to use the materials that are a part of the CASE curriculum, further supporting the role of active learning and active teaching.

Objective 2: Participants' perceived effectiveness of their virtual CASE Institute lead teacher

For the second research objective to assess the effectiveness of the CASE Institute lead teachers facilitating the professional development program in a virtual format, we analyzed the participants' perceptions of the lead teachers. The researchers found the participants strongly agreed that their lead teachers were highly knowledgeable and valued in their content area, responded to instructional needs, created a conducive learning environment, met with the participants outside of class, and used effective modeling skills. Coaching, modeling, and expert support are effective features of professional development (Bates & Morgan, 2018), the CASE Institute lead teachers can be considered effective based on the participants' high praise and feedback. Despite this, lead teachers do not think the virtual platform allows them to showcase their best teaching and mentorship; they admit that they would much rather offer in-person professional development experiences for teachers, and acknowledge that they would like more support from CASE if virtual professional development opportunities continue (Rice et al., 2024).

While collective participation can be implied since the curriculum was delivered to teachers focusing on agriculture, science, or STEM concepts, on a local level, collective participation cannot be explicitly described as this study did not focus on how the professional development impacted teachers within specific schools, departments or programs (Garet et al., 2001). Though the study did not specifically look at collective participation amongst the participants, there were several states and regions that had a considerable number of participants from the same areas, which could lead to greater continuity and a stronger sense of community within those geographic areas. Because many of the participants came from similar areas, there is an aspect of potential collective participation as these teachers can relate and work together as they most likely face similar challenges (Garet et al., 2001). Also, the interactions between the lead teachers and the participants could be considered collective participation as CASE Institute lead teachers are fellow educators (Garet et al., 2001).

Of the six effective features of professional development, only two of the six were implied or identified according to the research objectives for this study: 1) content focus and 2) active learning. The remaining four (collective participation, form, duration, coherence) were present but not studied explicitly (Garet et al., 2001). Unlike some of the other professional development opportunities offered by CASE, such as the more condensed BriefCASE training, the form of the professional development training for the virtual CASE Institute was a traditional form of professional development as it was a structured eight to nine full days of professional development training (CASE, 2024-c). The duration of the professional development was the same amongst all professional development sessions and was unchanged from the previous years' professional development sessions (CASE, 2024-c). Coherence is valued in CASE as they integrate Next Generation Science Standards (NGSS), AFNR Common Career and Technical Core Content Standards, Common Core Standards for High School Mathematics, and Common Core Standards for English Language Arts into their curriculum and professional development sessions (CASE, 2024-d).

High-quality, effective professional development is an integral part of teacher preparation as it can create a change in teaching practice and student outcomes (Sancar et al., 2021). Before the creation of CASE, CTE classrooms were lacking in the integration of science and agriculture as their teachers were not receiving adequate training and curriculum for this integration to occur (Castellano et al., 2003). To further illustrate the inadequacies of the CTE program, Baker et al., identified five themes that highlight the issues in CTE teacher preparation (2015). Though one professional development program cannot fully alleviate the issues brought up in the Baker et al. (2015) study, CASE professional development has provided a potential solution for a few of the barriers. For example, CASE supplies all certified participants with inquiry-based curriculum that will last for an entire year which meets the need for having more familiarity with inquiry-based instructional methods and having greater knowledge of science concepts (Baker et al., 2015). Further, CASE has provided agricultural educators with greater knowledge of inquiry-based learning methods that they can utilize to provide a positive learning experience for their students while making these rigorous connections to agricultural sciences (Baker et al., 2015; Bird & Rice, 2021). Based on the participants' self-perceived preparedness and their high praise of their lead teachers within this study, our findings build upon the existing literature and show evidence that the traditional CASE Institute professional development courses were effective and could result in potential classroom implementation.

This research study was conducted to answer the question of the effectiveness of traditional CASE Institute professional development and the CASE lead teachers. Since CASE is becoming more popular with agricultural education, CTE, and science teachers across the country, it is important to research all aspects of the CASE model to ensure its feasibility and practicality within the education system. Teachers who have positive experiences within their professional development and training at the CASE Institutes will be more likely to adopt CASE practices within their classroom (Ketelhut et al., 2019). This study specifically focused on assessing the effectiveness of the offerings of CASE by examining the ease of

implementation for participating teachers. Results can better inform CASE professional development offerings, therefore having a direct impact on teachers and ultimately, their students.

Recommendations & Future Research

Utilizing the data collected from the participants, we were able to draw conclusions and provide recommendations based on our findings regarding the effectiveness of the traditional CASE Institute professional development courses. Many of the participants strongly agreed when asked if other teachers in their region would benefit from CASE professional development. Based on these results, researchers recommend agricultural education teachers and other interested teachers to utilize CASE professional development and curriculum when desiring more educational training and classroom content along with continuing to develop virtual opportunities for teachers to engage in the professional development on a more flexible schedule.

A key limitation of this research is a lack of follow-up; we do not know if teachers implemented the learning from the CASE professional development experiences within their classroom after completing the CASE Institute. Based on the findings, we recommend further research in order to fully establish the effectiveness of CASE professional development. This research should likely occur several weeks or even months after the professional development experiences have occurred to allow time for participants to reflect on their implementation strategies, including successes and challenges. The follow-up research could be done either via a questionnaire or potentially in the form of interviews or focus groups. In this study, the researchers could discern the participants' comfort level for implementing the material, but they did not contact the participants after the initial questionnaire. Future research should verify teacher implementation and consider the methods of implementation. It would also be prudent to look at the potential issues teachers are facing when implementing the material and how CASE can adapt the curriculum or professional development sessions to address and alleviate these issues; this research could occur before and after the CASE Institute to see how their attitudes, perceptions and beliefs changed over time. Further research would allow for a complete understanding of the effectiveness of traditional CASE professional development sessions and help resolve any issues with implementation. Participants noted less interest in the CASE End of Course (EOC) assessment formerly CASE online. This should be explored more as EOC assessments serve as a measurement of student success and meet Perkins V requirements. One might suspect teachers might welcome using the EOC assessments.

When examining the professional development framework posed by Garet et al. (2001), their characteristics of professional development would also open opportunities for further inquiry across all six features of effective professional development. When examining form, future research could look at the delivery and modality of the training and if there is any difference in implementation strategies, successes, or challenges for virtual as opposed to in-person CASE Institutes. For the duration, researchers could examine how the number of contact hours affects the implementation success, seeing if shorter forms of CASE training such as the BriefCASE model increase the chance of implementation by participating teachers. In order to investigate the area of collective participation, future researchers could examine the relationships between the participants and the lead teachers, or the success had by schools or consortiums who send multiple teachers (science, agriculture, industrial technology, or any other content area) to see if there is enhanced implementation used by these individuals. To further examine the area of content focus, perhaps future research could be posed around the idea of which content area(s) result in participants feeling more prepared to implement the curriculum, and utilize those findings to make improvements to the training or curriculum to make it more accessible for teachers. Research in the area of active learning can be further addressed by evaluating participants' perceptions of how actively engaged they were in the professional development and seeing if there is a difference across different content areas or delivery styles (online or in-person), then make revisions to the training or curriculum to be more engaging for teachers. Finally, research in coherence across professional development can be conducted as a needs assessment; educators

can report the local or state standards they need assistance with meeting through their curriculum and CASE can work to integrate these needed standards or learning outcomes across the different training, curriculums and programs they offer.

References

- Advance CTE. (2021). History of Advanced CTE. *History of Advance CTE | Advance CTE*.
<https://careertech.org/100yrs>.
- Ary, D., Jacobs, L. C., & Irvine, C.K. S. (2018). Introduction to Research in Education (10th Edition). Cengage Learning US. <https://bookshelf.vitalsource.com/books/9781337671316>
- Asunda, P. A. (2012). Standards for technological literacy and STEM education delivery through career and technical education programs. *Journal of Technology Education, 23*(2).
<http://scholar.lib.vt.edu/ejournals/JTE/v23n2/asunda.html>
- Baker, M. A., Bunch, J., & Kelsey, K. D. (2015). An instrumental case study of effective science integration in a traditional agricultural education program. *Journal of Agricultural Education, 56*(1), 221–236. <https://doi.org/10.5032/jae.2015.01221>
- Bates, C.C., & Morgan, D.N. (2018). Seven elements of effective professional development. *International Literacy Association, 71*(5), 623–626. <https://doi.org/10.1002/trtr.1674>
- Bird, T. & Rice, A. (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.2021.01260>
- Bragg, L. A., Walsh, C., & Heyeres, M. (2021). Successful design and delivery of online professional development for teachers: A systematic review of the literature. *Computers & Education, 166*, 1–23. <https://doi.org/10.1016/j.compedu.2021.104158>
- Carraway, C, Ulmer, J. D., Burris, S., & Irlbeck, E. (2015). Exploring science teachers' perceptions of the Curriculum for Agricultural Science Education. *Western American Association for Agricultural Education*, Corvallis, OR, 223–267.
- CASE. (2024-a). Curriculum. *Curriculum for Agricultural Science Education*.
<https://www.case4learning.org/curriculum/courses/>
- CASE. (2024-b). Mission and vision. *Curriculum for Agricultural Science Education*.
<https://www.case4learning.org/about-case/mission-and-vision/>.
- CASE. (2024-c). Professional development. *Curriculum for Agricultural Science Education*.
<https://www.case4learning.org/about-case/professional-development/>.
- CASE. (2024-d). Standards alignment. *Curriculum for Agricultural Science Education*.
<https://www.case4learning.org/curriculum/standards-alignment/>
- Castellano, M., Stringfield, S., & Stone, J. R. (2003). Secondary career and technical education and comprehensive school reform: Implications for research and practice. *Review of Educational Research, 73*(2), 231–272. <https://doi.org/10.30102/00346543073002231>

- Center for Educational Innovation. (n.d.). Active learning. *University of Minnesota: Center for Educational Innovation*. <https://cei.umn.edu/active-learning>.
- Creswell, J. D., & Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications, Inc.
- Darling-Hammond, L., Hyler, M. E., Gardner, M. (2017). Effective teacher professional development. Palo Alto, CA: *Learning Policy Institute*. <https://doi.org/10.54300/122.311>.
- Desimone, L. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181–199. <https://doi.org/10.3102/0013189X08331140>
- 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 Inc.
- Figland, W., Blackburn, D. J., Stair, D. K., & Smith, D. E. (2019). What do they need? Determining differences in the professional development needs of Louisiana agriculture teachers by years of teaching experience. *Journal of Agricultural Education*, 60(2), 173–189. <https://doi.org/10.5032/jae.2019.02173>
- Frontline Education. (2021, January 14). Timeline: History of professional learning: Education and technology. *Frontline Education*. <https://www.frontlineeducation.com/solutions/professional-growth/insights/professional-learning-timeline/>.
- Garet, M., Porter, A., Desimone, L., Birman, B., Yoon, K. (2001). What makes professional development effective? Results from a National Sample of Teachers. *American Education Research Journal*, 38(4), 915–945. <https://doi.org/10.3102/00028312038004915>
- Ketelhut, D.J., Mills, K., Hestness, E., Cabrera, L., Plane, J., & McGinnis, J.R. (2019). Teacher change following a professional development experience in integrating computational thinking into elementary science. *Journal of Science Education and Technology*, 29(1), 173–187. <https://doi.org/10.1007/s10956-019-09798-4>
- Lambert, M.D., Velez, J.J., & Elliott, K.M. (2014). What are the teachers' experiences when implementing the Curriculum for Agricultural Science Education? *Journal of Agricultural Education*, 55(4), 100–115. <https://doi.org/10.5032/jae.2014.04100>
- McKim, A., & McKim, L. K. (2023). Enhancing professional development by increasing agricultural educator margin. *Journal of Agricultural Education*, 64(3), 16–25. <https://doi.org/10.5032/jae.v64i3.48>
- Mizell, H. (2010). Why professional development matters. *Learning Forward*. ISBN 978-0-9800393-9-9.
- Morey, T., Foster, D., & Ewing, J. (2023). Virtual mentoring in agricultural education: Describing digital literacy, technology self-efficacy, and attitudes toward technology of secondary agricultural educators. *Journal of Agricultural Education*, 64(1), 12–27. <https://doi.org/10.5032/jae.v64i1.27>
- National Association of Agricultural Educators. (2021). What is agricultural education? *National Association of Agricultural Educators*. <https://www.naae.org/whatisaged/>.

- NC State University. (n.d.). Curriculum for agricultural science education (CASE). *Agricultural and Human Sciences*. <https://cals.ncsu.edu/agricultural-and-human-sciences/professional-development/curriculum-for-agricultural-science-case/#:~:text=The%20goal%20is%20to%20implement,mathematics%2C%20and%20English%20language%20understanding>.
- Nguyen, H. C. (2018). An investigation of professional development among educational policymakers, institutional leaders and teachers. *Management in Education*, 33(1), 32–36. <https://doi.org/10.1177/0892020618781678>
- Pauley, C.M., & McKim, A.J. (2019). Interdisciplinary Connections; Evaluating Collaboration between AFNR and Leadership, Mathematics, and Science Educators. *Journal of Interdisciplinary Studies in Education*, 8(1), 30–44. <https://doi.org/10.32674/jise.v7i2.1084>
- Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). Handbook on agricultural education in public schools (6th ed.). Thompson Delmar Learning.
- Rice, A., Hasselquist, L., & Smalley, S. (2024). Lead teacher perspectives of virtual CASE Institute professional development. *Journal of Agricultural Education*, 65(3), 322–338. <https://doi.org/10.5032/jae.v65i3.104>
- Sancar, R., Atal., D., & Deryakulu D., (2021). A new framework for teachers' professional development. *Teaching and Teacher Education*. 101(1), 1–12. <https://doi.org/10.1016/j.tate.2021.103305>
- Shoulders, C. & Myers, B. (2014). Effective professional development in agriscience education: An examination of core features. *Journal of Agricultural Education*. 55(1), 167–185. doi: 10.5032/jae.2014.01167
- Smalley, S., Hainline, M., & Sands, K. (2019). School-based agricultural education teachers' perceived professional development needs associated with teaching, classroom management, and technical agriculture. *Journal of Agricultural Education*. 60(2), 85–98. doi:10.5032/jae.2019.02085
- Smalley, S., Rice, A., & Hasselquist, L. (2023). The effectiveness of virtual CASE institute professional development: A participant perspective. *Journal of Agricultural Education*. 64(2), 85–97. <https://doi.org/10.5032/jae.v64i2.89>
- Smalley, S. W., & Smith, A. R. (2017). Professional development needs of mid-career agriculture teachers. *Journal of Agricultural Education*, 58(4), 282–290. <https://doi.org/10.5032/jae.2017.04283>
- The National Council for Agricultural Education (2023). *AFNR standards*. <https://thecouncil.ffa.org/afnr/>
- Thoron, A. C., Myers, B. E., & Barrick, R. K. (2016). Research priority 5: Efficient and effective agricultural education programs. In T. G. Roberts, A. Harder, & M. T. Brashears. (Eds.), *American Association for Agricultural Education national research agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.
- Thornton, K. M., Coleman, B. M., Bunch, J., & Roberts, T. G. (2020). Professional life phases: Identifying professional development needs for Florida agriscience teachers. *Journal of Agricultural Education*, 61(4), 283–295. <https://doi.org/10.5032/jae.2020.04283>

- Touchstone, A. J. L. (2015). Professional development needs of beginning agricultural education teachers in Idaho. *Journal of Agricultural Education, 56*(2), 170–187.
<https://doi.org/10.5032/jae.2015.02170>
- Tummons, J., Hasselquist, L., & Smalley, S. (2020). Exploring content, pedagogy, and literacy strategies among preservice teachers in CASE institutes. *Journal of Agricultural Education, 61*(2), 289–306. <https://doi.org/10.5032/jae/2020/02289>
- U.S. Department of Education, Office of the Under Secretary. (2006). The study of professional development and teacher change: Building on national, cross-sectional finding with longitudinal data. *The Journal for Vocational Special Needs Education, 28*(2), 19–24.
- Wood, M., Sorensen, T., & Rubenstein, E. (2024). Assessing the pedagogical content knowledge of school-based agricultural education teachers and determining their individualized need for professional development by licensure type. *Journal of Agricultural Education, 65*(2), 54–70.
<https://doi.org/10.5032/jae.v65i2.119>
- Yopp, A. M., Edgar, D., & Croom, D. B. (2020). Technical in-service needs of agriculture teachers in Georgia by career pathway. *Journal of Agricultural Education, 61*(2), 1–19.
<https://doi.org/10.5032/jae.2020.02001>