

Defining Fidelity in the Curriculum for Agricultural Science Education (CASE)

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Abstract

The purpose of the study was to explore the definition of fidelity in the delivery of the Curriculum for Agricultural Science Education (CASE). The conceptual framework utilized in this study was the key domains affecting curriculum fidelity. This framework has four parts focusing on (1) school context, (2) curriculum implementation systems, (3) curriculum implementers, and (4) audiences targeted. To address the research objectives of this study, a basic qualitative approach was used. Each participant represented a different state and were made up of teacher educators, high school educators, and state leaders for agricultural education. The participants were or previously had been high school agricultural educators. Several benefits of the CASE curriculum were identified by the participants of this study. The benefits identified included inquiry-based learning, resources for educators, and assistance for beginning or novice educators. Participants believed the curriculum was beneficial to agricultural educators no matter if they were beginning their careers or are established professionals. Future research should focus on how the lead teachers view the delivery of the CASE curriculum and to what level the curriculum needs to be delivered to reach teaching it with fidelity.

Introduction / Literature Review

Science, technology, engineering, and mathematics (STEM) education has seen a steady increase among the education system in the past twenty years (Kezar & Elrod, 2012). The President's Office of Science and Technology released a report in 2012 titled; *Engage to Excel: Producing One Million Additional College Graduates in Science, Technology, Engineering, and Mathematics*. This report states for the United States to reach this goal, STEM graduation rates must increase annually by 34 percent. This statistic impacts students and teachers of all subject areas. Agricultural education teachers are held accountable for meeting this goal as well. Teaching strategies, styles, and curricula must be improved, in order for this to happen.

Research has indicated that the use of inquiry-based learning techniques is linked to an increase in students' scores (Thoron & Bursleson, 2014). The findings of a study conducted by Zohar and Nemet (2002)

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added credence to this notion. The study involved the teaching of a genetics lesson to ninth-grade students. One group was taught using inquiry-based learning, while the other group was taught through a teacher-centered lesson. The results indicated the inquiry-based learning group performed higher on assessment as opposed to the traditional group. In addition, Witt & Ulmer (2010) performed an investigation of inquiry-based with middle school students and the students who received inquiry-based instruction reported a higher level of understanding as compared to their counterparts who did not receive inquiry-based instruction.

One commonly used inquiry-based curriculum, which was developed by School-based Agricultural Education (SBAE) Teachers is the Curriculum for Agricultural Science Education (CASE). CASE is a project by the National Council of Agricultural Education, managed by the National Association of Agricultural Educators, who are affiliates of the STEM Education Coalition. The mission of CASE is to “To impact student career readiness by empowering teachers with improved instructional practices and relevant curricula sustained by professional development” (CASE, n.d.). CASE is a student-directed and inquiry-based curriculum aligned to the national standards of Agriculture, Food, and Natural Resources (AFNR), science, mathematics, and English with every lesson. CASE is not a collective set of random laboratory exercises, rather the curriculum is purposely designed to spiral student learning throughout the entire course. Science and mathematics are not included in the curriculum, instead, science and mathematics are taught properly to provide true integration of core-academics. The project goal of CASE is to implement a national curriculum for agricultural education that provides a high level of educational experiences to enhance the rigor and relevance of AFNR (CASE, 2011). CASE is much more than a curriculum; it is a support system that produces students equipped for careers using professional development and certification (CASE, 2011). As this curriculum has been implemented, a new question arises; how can one say the CASE curriculum is being taught to the fullest potential? How is fidelity defined in the classroom? Moncher and Prinz (1991), Yeaton and Sechrest (1981), and de Leeuw et al. (2020) suggest fidelity of implementation is the degree to which a treatment/intervention is implemented as intended. Studies of general and special education journals have shown fidelity of implementation is not commonly documented (Swanson et al., 2011). A direct correlation between fidelity and student outcomes has been proven (Al Otaiba & Fuchs, 2006; Carroll et al., 2007; Durlak & DuPre, 2008; Kaderavek and Justice, 2010; Stein et al., 2008); however, the term is loosely defined, and measurements are varied across the field of education (Durlak, 2010; Durlak & DuPre, 2008; Green, 2001; Swanson et al., 2011). When fidelity is missing, one can only assume curriculum is not being delivered adequately with the measurements intended. Measuring fidelity has meaning when making claims of effectiveness in the classroom (Vartuli & Rohs, 2009).

Numerous studies have evaluated the fidelity of curriculum and the variability of effectiveness. Lakin and Shannon (2015) conducted a study in middle school science classes to determine the implementation variation and treatment of fidelity among educators. To understand the purpose of the study, one must understand the meaning of treatment fidelity. In educational settings, treatment fidelity is viewed as a multidimensional construct including other issues (i.e., program implementation; Shulte et al., 2009). The study involved two to four professional development workshops throughout the school year that introduced instructional methods and inquiry-based learning in science courses. The results showed teachers varied among participation in program activities and the implementation of the curriculum provided. This study provides evidence to our question regarding the percentage or guidelines needed to indicate SBAE teachers are implementing CASE curriculum to the fullest intent.

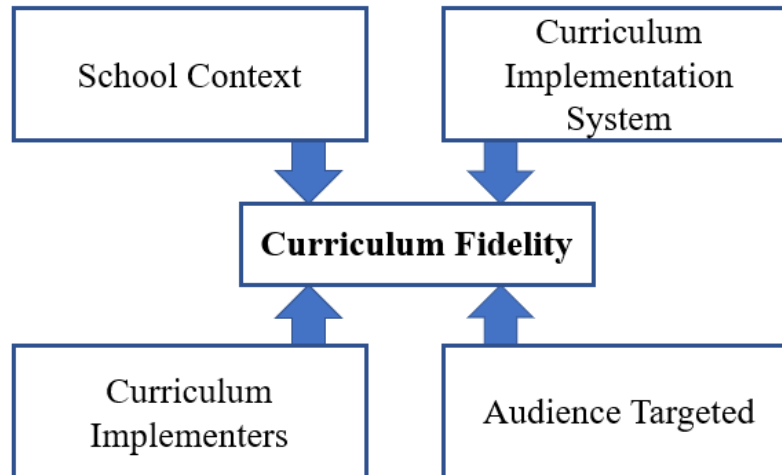
Conceptual Framework

Chen’s (1998) key domains affecting curriculum fidelity served as the conceptual framework to guide this study. This framework model has four parts, (1) school context, (2) curriculum implementation systems, (3) curriculum implementers, and (4) audiences targeted. All four parts play a role in curriculum fidelity. School context deals with the type of school (private vs public), the school size, and the school climate.

The curriculum implementation systems include the barriers to implementing the curriculum and the availability of training for educators to use the curriculum. Curriculum implementers consider the teachers' attitudes toward the curriculum. The audience targeted includes the students' interests in the curriculum (see Figure 1).

Figure 1

Key Domains Affecting Curriculum Fidelity (Chen, 1998)



When implementing CASE in a classroom, all the factors above are considered when looking at the fidelity of the curriculum. The curriculum must first be appropriate for the type of school it will be implemented. The instructor must have adequate training to attend a CASE institute to fully understand the breadth of the curriculum and the design. The instructor must feel confident when implementing the curriculum and have a positive attitude towards the implementation process and the design of the curriculum to be able to fully engage with the curriculum in the course. Finally, once the instructor has fully implemented the curriculum into their classroom, it is up to the students to buy into the curriculum the teacher is teaching. When all the factors align, the fidelity of the curriculum can be assessed.

Purpose/Research Questions

The purpose of this study was to explore the definition of fidelity in the delivery of the Curriculum for Agricultural Science Education (CASE). Specifically, three questions guided our study which also served as the objectives of the study:

1. When a teacher is delivering the CASE curriculum, how do you envision it to be delivered to say it is being delivered with fidelity?
2. If a teacher is delivering the CASE curriculum with fidelity, what percentage of the curriculum should the teacher be teaching?
3. To deliver a curriculum with fidelity, can the instructor adjust the curriculum to their local needs?

Method and Procedures

To address the research objectives for this study, a basic qualitative approach was used. Merriam (2009) defined basic qualitative research as, "the most common form of qualitative research found in education" (p. 23). The population for this study included the CASE executive committee members. The

requirement for participating in this study included serving in a leadership capacity on the executive committee. The participants were comprised of three males and two females. Each participant represents a different state and were made up of teacher educators, high school educators, and state leaders for agricultural education. All participants were or previously had been high school agricultural educators. Pseudonyms were created for each participant to aid in protecting their anonymity.

Data Collection

Qualitative methods were used based on the recommendations of Creswell (2007) and Lincoln and Guba (1985). The interview process in this study involved two interactions with each executive committee member. The first interaction was a 30–40-minute semi-structured interview which was conducted via Zoom. An interview protocol which contained three open-ended questions along with probing questions was used to guide the first interview. Specifically, the interviews focused on their definition of fidelity with the CASE curriculum and the level of curriculum needing to be delivered to be considered delivered with fidelity. Questions were also focused around if an instructor could adjust the curriculum to meet their local needs.

All members of the research team were involved with the Zoom interview; one researcher was tasked with asking the questions and interacting with the interviewee, while the other researchers took interview handwritten notes (i.e., descriptive, and reflective) and facilitated the recording of the interviews. The interviews were recorded via Zoom recording, and we also recorded the interview with a basic audio-recording device.

Along with the initial interviews, we conducted follow-up phone interviews with all participants once the initial data was transcribed. The follow-up interview allowed us to have a second interaction with the members to allow them to reflect on the previously discussed topics and provide additional thoughts and information on the questions. Moreover, this second interview provided us with a means to conduct member checking procedures with the CASE Executive Committee members.

Procedures & Analysis

Following the data collection, we transcribed all of the interviews and the comparative method of data analysis was used to identify themes (Merriam, 2009). Data was organized into major categories of information by engaging in an open coding process (Creswell, 2014). The researchers established qualitative research practices to establish trustworthiness of the results in this study. Interviews were transcribed, data was coded, and themes were delineated to provide validation of analysis. To promote reliability and trustworthiness of the data coding, multiple researchers coded the data.

To establish confirmability and enhance the trustworthiness of this qualitative study, we implemented a bracketing technique (Merriam, 2009). Bracketing allowed us to recognize the bias and individual beliefs about the CASE (Creswell, 2013). Every member of our research team was involved in coding the data and we understand that we have differing, and converging experiences linked to the CASE. Two of us are teacher educators who lead SBAE teacher education programs. We both also formerly served as SBAE teachers in two different states. We both serve as affiliate professors for CASE and have facilitated and hosted CASE institutes. While we have been involved with CASE as teacher educators, we were not certified CASE teachers when we taught in SBAE programs.

Member checking was used to enhance the credibility of the interpretations and findings of this study. Creswell (2014) noted that member checking serves to determine the accuracy of findings by “taking the final report or specific descriptions or themes back to the participants and determining whether these participants feel that they are accurate” (p. 201). We presented the preliminary analysis and theme descriptions with the executive committee members in the follow-up interviews. Based on Creswell’s

(2013) recommendations for member checking, we asked the respondents if there were any misinterpretations with the preliminary themes.

Data Analysis

Braun and Clark (2006) thematic analysis was used in reviewing the transcripts. This process involved reducing the data down to a manageable size to develop patterns and themes (Copper & Schindler, 2003). Braun and Clark (2006) six-phase process was used to analyze the transcripts which includes: becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The researchers collected data from five participants. Jake is an SBAE teacher educator in a teacher preparation program, who has hosted pre-service and in-service teacher institutes, and is a certified teacher. Tanna serves as a state leader in agricultural education and previously taught high school agricultural education as a certified CASE teacher. Natalie is a state leader and has hosted CASE institutes. Jason is a faculty member in agricultural education. He has hosted pre-service institutes and in-service CASE institutes. Patrick is a high school agricultural educator who is certified in CASE courses and has also hosted CASE institutes.

Findings

Several benefits of CASE curriculum were identified by the participants of this study. The benefits identified included inquiry-based learning, resources for educators, and assistance for beginning or novice educators.

A heavy focus was placed on inquiry-based learning. Jake indicated, "CASE gives teachers a tool to do what agricultural education has claimed its done forever, which is hands-on problems-based teaching." This was also reiterated by Natalie who indicated, "the CASE curriculum can provide teachers with resources which involves quality inquiry-based learning." She also shared, "the concepts taught in CASE such as plant science, anyone can teach those concepts, but the key is how it is delivered." Tanna shared, "I think CASE is more of a teaching strategy of inquiry-based learning, and not so much A to Z finish of their curriculum. I think there is really good things in there, in our situation we look different from other case states." Jason shared, "quality of this resource and how inquiry-based learning is infused is valuable for no matter the age of the teacher."

Participants saw significant value in the resources CASE provided to educators. Patrick indicated, "CASE cuts down on teacher prep time and is a support for teachers. This support is from having high quality curriculum and quality professional development which can enhance the classroom experience for students." Natalie highlighted, "CASE as being turn-key, which provides young and experienced teachers with valuable resources to enhance classroom teaching." Jason indicated, "I think a big benefit of the curriculum is that it is a whole curriculum with lessons, units, activities, and reflections.... So it is a full-fledged curriculum with all of that." Patrick also indicated, "the career pathway model which we adopted, it raises some challenges. I like that CASE addressed some of those challenges by way of teacher support." Jason also shared, "the supports and connecting the curriculum to standards are helpful for any teacher when sharing the curriculum with administrators."

The participants noted the value of the curriculum for beginning/novice teachers who might be struggling teacher. Jason highlighted, "teachers don't feel like they have the capabilities to teach this, but CASE allows them to feel more comfortable." He goes on to say, "once a teacher completes the professional development they feel more comfortable with the material they can return to their classroom and teach." Tanna believes, "the curriculum is more designed for new teachers." She goes on to say, "when I was in the classroom what I appreciated about it was that I had a full curriculum, which was prepared for me already, and all I had to do was preview the labs to make sure I knew what I was doing when I went through

them.” Patrick indicated, “I have seen beginning teachers excel in the classroom once they have experienced CASE because they have a quality curriculum to teach.”

Jake spoke about novice teachers at length and stated, “teachers might be more motivated and stick around longer. I have had a 30 year plus veteran, tell me they are so excited to teach another 8-10 years.” Natalie stated, “veteran teachers have used CASE to help them excel at the end of their career as it being something new to them.” Jake also said, “CASE is for teachers who are in a rut.” He went on to say, “some teachers don’t have to have CASE to be motivated and they are so awesome... their students are doing the same thing, and they don’t need CASE.”

Challenges regarding CASE curriculum were also identified by the participants of this study. The challenges identified include: science aptitude, local needs are paramount, and a focus on assessments. A focus on the theme of science aptitude focuses on the students’ academic level and teacher’s science knowledge. Patrick highlighted, “I try to follow the curriculum as stated, but children need different levels of support.” Jason stated, “our students are so use to being given four multiple choice answers on a test, that to make questions open ended and make it so they have to come up with the answer, they really struggle with that when they are first starting in CASE.” Nancy said, “science is good for students when it is infused correctly.” Jake stated, “you can’t cram ton and tons of content into CASE, because you are spending so much time teaching people how to be a scientist.” Tanna believes:

kids that are not familiar with traditional ag, I think they eat this lab experience up because they haven’t seen it in this shape or form, and its new to their eyes and new to their learning, where when you bring in your traditional ag kids that are pretty foundationally based in production ag...those kids aren’t maybe quite as motivated by this because they are like I already understand this.

On the other hand, teachers also need to have a better understanding of science. Natalie asserted, “teachers are knowledgeable, but with some of the technical science they need to be provided additional knowledge, so they understand what they are teaching.” Jake shared, “we really need to just focus on PD related to science. Science content and process knowledge is what the teachers lack. CASE does not account for the lack of their knowledge.”

The theme of local needs are paramount focuses on the school dynamics, state standards, and scaffolding. Natalie mentioned, “it can be adjusted to fit the local environment or local needs.” Tanna shared, “it is sticking to what the outline original intent, theoretical practices of a curriculum were meant to be, but as you muddy the water with different local school districts across the country, urban, rural... you get different twist on that, just by the nature of the interest of the students.” In essence, Tanna believed CASE curriculum can be adapted to the local community needs. Natalie shared, “the concepts in CASE are solid, but the delivery can be augmented to fit the needs of the program.” When working with teachers Tanna stated, “I reassure the teachers that they won’t be able to get through the CASE curriculum. You still have the ability to use it in the original form, but you can go away from the course assessment in the state.” Jake shared, “CASE was built on the assumption that everyone does pathways, and I don’t believe everyone does pathways, even when it’s where people think they are doing pathways, and teachers are still teaching the courses they want to teach.”

State standards vary from state to state depending if they are focusing on state or national standards. Jason believed, “to be used with fidelity, it is meeting the needs of the program. Whether that is state standards, towards a local graduation requirement, or if it is to get students to the level of the next course.” Based upon experiences in her state, Tanna shared:

Teachers get it stuck in their head that they can't adapt for a state or local driven curriculum that meets the students' needs using the CASE curriculum. The teachers are like we need to use this all or none, and I'm like no you don't. Is it designed to be that way, yes, but you can't forgo your state curriculum in the course, and the course assessment set up in the state.

Jake noted, "I think if it's taught with fidelity, you have got to crosswalk whatever standards you are bound to, and you need to teach everything in CASE that covers those standards. If you are looking for something to cut out of CASE, cut out what is not in a standard that your state requires." Tanna also shared, "the state courses they have doesn't 100% align with the CASE curriculum, so I get a lot of pushback from CASE teachers." Jason shared, "to teach the curriculum as it is, or with fidelity, it's probably more like teaching 75 or 80% of each lesson. If it's not to that level it is just a resource."

The participants believed the CASE curriculum can be delivered in several ways, but an important aspect of the curriculum is the spiraling and scaffolding. Patrick stated, "I think that when you are delivering that APP are you doing it in the spirit that is student directed." Jason shared, "I think it is realistic for teachers to use parts of it, as long as they are cognizant of the scaffolding that has occurred prior to that lesson or unit." Natalie mentioned, "It is important that the CASE courses are taught in sequence and there are no gaps in the sequence. The foundational courses should serve as a prerequisite to the advanced courses." Jason noted, "It is often used for the lesson or a unit or an activity that has been pulled out, but I always, always give caution that because it spirals so much and it scaffolds so much material, if you use one unit or one lesson, you will need to make sure that you have addressed any pre-knowledge that could have been in previous units."

A final theme identified by participants focused on the assessment and the high expectation by CASE for the curriculum. Natalie shared, "I believe it is an expectation of each lead teacher to deliver that info and it is the expectation of the participants to know that when they go to that training that they will experience the entire course." As a teacher when delivering CASE, Patrick mentioned, "CASE is not saying that every single APP, is the absolute best way to teach everything, but it's a solid place to start." In addition, Patrick shared, "if someone could get through half the curriculum, but if they are delivering the curriculum as intended, I view that as being done with fidelity." Natalie believed the true assessment is the end of course assessment and states, "they are delivering the lessons in the course sequentially, as its been designed in the program, they have the appropriate equipment and supplies... and the teacher is properly trained or certified...they are assessing the students at the end of the course, so we have data." Patrick shared, "If you want them to perform well on the end of course assessments, they have to have a high percentage of the lessons." Natalie also mentioned, "It should be 100 percent... if the assessments are based on the course, and the students take the assessment, if they don't finish the course, they are certainly not going to score well on the assessments at the end of the course."

Conclusions/Recommendations/Implications

The premise of this study was to explore the definition of fidelity in the delivery of the Curriculum for Agricultural Science Education (CASE). This study helps to shed some light on defining fidelity for CASE as it presents some unique benefits and challenges of delivery that could affect fidelity. The intent was not to generalize the results to CASE entirely, but rather to provide a description of the participants who participated in this study. Caution should be taken to not generalize the results to all who have participated in CASE.

Overall, participants believed the curriculum was beneficial to agricultural educators no matter if they were beginning their career or are established professionals. This aligns with Chen's (1998) key domains affecting curriculum development because the curriculum implementer's attitudes towards CASE

are positive allowing for the delivery to be with fidelity. By having a yearlong curriculum developed and professional development provided in delivering the curriculum, the participants believed it reduces the preparation time in developing curriculum for a teacher and develops supports for the teacher. The professional development events provided allow the curriculum implementation systems to play a part to ensure the curriculum has fidelity (Chen, 1998). Participants specifically stressed the significant value that was placed on the curriculum to help beginning teachers. They believed the same value was placed on the curriculum for novice teachers as it enhanced their excitement to stick around and teach longer in the profession.

With a heavy focus within the curriculum being directed towards inquiry-based instruction, the participants believed the curriculum was beneficial for students in the agricultural education class. As highlighted in Zohar and Nemet (2002) study, inquiry-based learning groups performed higher on assessments as opposed to the traditional group. The same was true for the study conducted by Witt & Ulmer (2010) with middle school students indicating a higher level of understanding from inquiry-based instruction. When inquiry-based instruction is used in the classroom, students gain a higher level of understanding of the material being taught in the classroom and allows for practice of the scientific inquiry (Skelton et al., 2018; Witt & Ulmer, 2010). This higher understanding also increased students' critical thinking skills when taught through inquiry-based instruction (Lundy et al., 2002). Critical thinking is used alongside inquiry-based instruction to help facilitate the problem-solving process (Friedel et al., 2008), which the CASE curriculum is modeled after.

Among participants, there was a coherent agreement to use the curriculum with fidelity, but it was not clear if a teacher could pick and choose which lesson they delivered or if the curriculum would need to be presented from the beginning to end. The variation largely could be due to the standards that are adapted by each state, as some states do not follow specific state standards. As there was not one simple definition of fidelity, one can assume the CASE curriculum is being delivered adequately with how it is intended to be delivered. Fidelity can be measured by the effectiveness of the curriculum in the classroom (Vartuli & Rohs, 2009).

Future research should focus on how the lead teachers view the delivery of the CASE curriculum and to what level the curriculum needs to be delivered to reach teaching it with fidelity. Additional research should focus on the level the curriculum is being adopted by teachers across the country. The present study generated additional questions on the most effective way to deliver the curriculum. As leaders of SBAE, we must understand the needs of teachers and work to provide the highest quality of professional development possible.

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