

# **Integrating Socioscientific Issues in School-Based Agricultural Education: Teachers' Self-Efficacy, Beliefs, & Barriers**

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## **Abstract**

*The purpose of this quantitative survey research study was to describe the integration of socioscientific issues (SSI) - within school-based agricultural education (SBAE). This research was guided by the SSI-based instruction framework and the three-component model of agricultural education. The population for this study was all SBAE teachers in the U.S. during the 2019-2020 school year. A total of 136 SBAE teachers participated in the study. SBAE teachers' self-efficacy related to SSI, their perceived need to teach SSI, and barriers to teaching SSI were explored. Survey responses were analyzed using descriptive statistics. Respondents agreed that SSI are needed in agricultural education, but time to develop curriculum and integrate SSI is a barrier. Overall SBAE teachers felt supported by their administration and communities. Recommendations include integration of SSI and the SSI-based instruction framework in both pre-service agricultural teacher preparation programs and in-service teacher professional development. Aligning state and national agricultural education standards to include SSI is also recommended. Further research should be conducted to explore SBAE teachers' knowledge of SSI, how they are integrating SSI in their classes and what resources and teaching strategies they are using.*

## **Introduction and Need for the Study**

Recent estimates of global population numbers suggest projected increases of 10% to 8.5 billion people by 2030 and populations reaching 9.7 billion by 2050 (United Nations, 2019). These increases cause concerns for issues related but not limited to food security, water access, and environmental impacts. The agricultural industry is deeply entrenched in these issues as it provides nutritious food for the growing population and works to preserve natural resources.

The pervasiveness of these complex global issues and their impact on agriculture has prompted stakeholders (e.g., government agencies, world organizations, educational organizations) to voice concerns and assert research priorities to address these issues facing society. The National Institute of Food and Agriculture (NIFA) Challenge Areas list several complex global issues including food security, climate concerns, and water issues (NIFA, 2019). The most recent resolution adopted by the United Nations includes 17 goals for sustainable development through 2030. This resolution cited essential topics, including hunger and food security, water, and conservation, as well as environmental impacts and climate

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change (United Nations, 2015). According to the current Research Values of the American Association for Agricultural Education (AAAE), agricultural education research can contribute to solving these issues. (AAAE, 2023). In addition to the AAAE research agenda, National Agriculture in the Classroom's National Agricultural Literacy Outcomes (NALO) also includes the need to address complex issues within the context of agriculture and the environment, and healthy food and its availability to all (Spielmaker & Leising, 2013).

Topics or issues which are scientific in nature that impact society are known as socioscientific issues (SSI) (Sadler, 2004a). These issues are often controversial, contain multiple perspectives, and do not have simple solutions (Sadler, 2004b; Zeidler & Nichols, 2009). Some examples of SSI directly related to agriculture include climate change, genetically modified organisms (GMOs), food security, and natural resource usage. School-based agricultural education (SBAE) teachers hold a crucial role in nurturing the future generation of agricultural scientists. They are tasked with equipping their students with the skills and resources needed to recognize the intricacies of SSI and to formulate practical and sustainable solutions. This responsibility extends to cultivating global citizens who understand the interconnectedness of agricultural challenges and their broader implications. As such, SBAE is uniquely positioned as a profession to contribute to building capacity in the next generation of scientists and agriculturists to address these complex issues (Roberts et al., 2016). While research shows student benefits of SSI-based instruction (e.g., Evren-Yapicioglu, 2018; Pouliot, 2008; Sadler et al., 2007; Shoulders & Myers, 2013), it remains to be seen if SBAE teachers are intentionally integrating SSI into their curriculum. While the SSI literature is well-established in science education, research in SBAE and the integration of SSI is scarce (Cross & Kahn, 2018). If SBAE programs will contribute to the pipeline of students addressing SSI, a clearer understanding of what SBAE teachers know about SSI and their curriculum integration is essential. This study provides information as to the practice of SSI integration in SBAE. The results of this research are useful to inform the professional development needs of in-service SBAE teachers and pre-service SBAE teachers in terms of SSI integration.

### **Theoretical Framework and Literature Review**

This research was guided by the SSI-based instruction framework, which emerged through the examination of several empirical studies of SSI-based instruction by Presley et al. (2013). This framework uses themes that developed across multiple studies to inform the critical elements of successful SSI-based instruction. This framework is a flexible tool that can be used to inform curriculum development, teaching, and learning. There are three primary components to inform curriculum development including learners' experiences, curricular design elements, and teachers' characteristics or attributes. Additionally, the framework addresses classroom environment and outside/peripheral influences that guide SSI integration (Presley et al., 2013).

While there are five primary components of the SSI-based instruction framework, this research focuses on the peripheral influences and teacher attributes as they influence SSI integration in SBAE (see Table 1). Peripheral influences include the teachers' knowledge of SSI, the support they may have from their administration and community partners, flexibility within the curriculum, connections to the learning objectives, and access to curriculum to teach about SSI (Presley, et al., 2013). Any number of these peripheral influences may determine whether a teacher integrates SSI into their classes. In addition to peripheral influences, teacher attributes may play a role in the integration of SSI. Teachers must possess knowledge of the SSI and be aware of the social considerations related to the SSI. In instances where teachers have limited knowledge of the SSI, they must recognize their own knowledge limitations (Presley, et al., 2013).

**Table 1***Primary and Secondary Components of the SSI-Based Instruction Framework*

| Primary Components of SSI-Based Instruction | Sub-component Examples  |
|---|---|
| Peripheral Influences                       | <b>Barriers to integration</b> , Knowledge of Local SSI, Support & Encouragement, Access to Materials, Curriculum Flexibility, Navigating Community Concerns, Connections to Learning Objectives        |
| Classroom Environment                       | Collaborative & Interactive, Respectful, High Participation Expectations, Safe  |
| Design Elements                             | Instruction Around a Compelling Issue, Issue Presented First, Scaffolding Provided, Culminating Experience, Use of Media, Use of Technology   |
| Teacher Attributes                          | <b>Teaching Efficacy Beliefs, Perceived Need to Integrate, Personal and Professional Characteristics</b> , Content Knowledge, Social Considerations Awareness, Acknowledgement of Knowledge Limitations |
| Learning Experiences                        | Higher Order Experiences, Use of Scientific Ideas & Theories, Analysis of Scientific Data, Navigating Social dimensions, Ethical Dimensions, Nature of Science Themes                                   |

*Note.* Based on the SSI-based Instruction Framework (Presley et al., 2013)

### Integrating SSI in SBAE

Integrating SSI in the classroom is a pedagogical approach that introduces students to a way of learning about relevant issues that are front of the mind in their communities. Students who experience SSI in an educational setting show increased feelings of responsibility and ownership of issues, critical thinking, activism, content learning, and scientific literacy (Bencze et al., 2012; Lee et al., 2013; Sadler, 2004; Sadler et al., 2016). These behavior changes are evident even through simple exposure to the SSI and the use of discourse (Lee et al., 2013). Yet, research suggests teachers struggle to implement SSI and need training (e.g., Cross, 2019; Shoulders, 2012; Walker & Zeidler, 2007; Wilcox et al., 2014). Learning about SSI in their classes is essential for students to learn about the complex issues facing society and the pertinent science of those issues (Kampourakis, 2019).

The SBAE curriculum often includes topics considered SSI. For example, it is not unusual to discuss GMOs in a plant science, food science, or biotechnology class. However, there is little research that unites SSI and SBAE explicitly together. While there is a paucity of research in this area, the first to study SSI within SBAE, Shoulders (2012), found that while teachers were excited to integrate SSI and reported familiarity with teaching methods consistent with SSI (e.g., problem-solving, inquiry-based instruction, experiential learning), teachers might not have been using them regularly in their classes. Research conducted by Cross & Kahn (2018) suggests that teachers believe SSI can help students apply the knowledge learned in classes but may need support to implement the SSI-based instruction framework.

### Self-Efficacy Beliefs and SSI

Knowing teacher self-efficacy beliefs as they relate to SSI is essential to understanding their integration of SSI in their teaching. Bandura (1995, 2009) explains that people are influenced to act or think a certain way and are motivated by their self-efficacy. Individuals' beliefs about something will also be influential in their self-efficacy (Bandura, 1995, 2009). Roath and Hay (2016) found that teachers who had

lower self-efficacy were not as committed to teaching the content and did not spend as much time teaching the material. Additionally, they found teachers used more teacher-centered approaches and attempts to motivate students were fewer (Roath & Hay, 2016).

Teachers must have content knowledge in order to teach it to their students. Even after professional development, some teachers may still lack knowledge and confidence to teach specific content. In their study of teachers who attended a professional development regarding biotechnology, Gray and Bryce (2006) found that even after attending the professional development, teachers gained knowledge in the subject and teaching techniques, but still lacked the confidence to implement them. To integrate SSI, teachers must have knowledge relative to the content of the SSI (Lee & Witz, 2009; Presley et al., 2013). In general, teachers may avoid teaching content they are less knowledgeable about (Rapoport, 2010).

### Perceived Need to Integrate SSI

When integrating curriculum, teachers must perceive a need for their students to learn the content before they will integrate it (Li & Linder, 2007). Teachers must have a felt need, regardless of if it is real or perceived, to teach SSI (Lee et al., 2006). In their research, Lee et al. (2006) found that although teachers expressed a need to integrate SSI, they did not due to peripheral influences that created barriers to integration.

### Barriers to Integrating SSI

The intentional inclusion of socioscientific issues into the SBAE curriculum with fidelity to the SSI framework is critical. Yet, research suggests that barriers exist when teachers integrate SSI into their curriculum. While much of this research has taken place in science education, there are studies in SBAE that suggest teachers experience barriers to integrating SSI (Cross, 2019; Shoulders, 2012). Barriers which have been identified in research outside of SBAE relate to: (a) time to develop curriculum and time within the curriculum to teach it (Lee et al., 2006); (b) teacher knowledge of the SSI and the social considerations related to them (Gray & Bryce, 2006; Lee & Witz, 2009; Presley et al., 2013); and (c) outside influences in the form of school administrative and community support (Presley et al., 2013).

If teachers are to integrate new curriculum or implement teaching strategies, they must have time to develop or gain access to the curriculum and have flexibility and time within their curriculum to integrate it. Lee et al. (2006) suggested teachers perceived time as a barrier to integrating SSI. The SSI-based instruction framework also indicates teachers must have access to materials and flexibility within the curriculum to integrate SSI with fidelity to the framework (Presley et al., 2013). The framework also identifies core design elements that must be present when integrating SSI (Presley et al., 2013). If teachers are developing their own curriculum, this may take extra time, especially if they are unfamiliar with the SSI topic and/or the teaching strategies they are using. Eastwood et al. (2012) discovered, while SSI are useful in the classroom, teachers need support to integrate them. Integrating SSI into the existing curriculum can be daunting and overwhelming for teachers who may already be taxed. Supporting teachers in their pursuit of SSI integration is necessary to ensure the SSI-based instruction framework is followed with fidelity.

Research suggests outside influences such as community and administrator support can influence teachers' tendency to integrate SSI into their curriculum (Presley et al., 2013). Additionally, if a particular SSI topic does not align with community or administration beliefs, those topics may be omitted from the curriculum. Teachers also need access to materials to assist in integration of SSI (Presley et al., 2013). Research suggests that teacher support from administration can come in two forms, specifically in *what* teachers teach and *how* teachers teach (Crookes, 1997). Support for attending outside professional development is essential for in-service teachers. This idea holds true when teachers are learning teaching strategies new to them. Supovitz et al. (2010) also found that teacher pedagogy is influenced by not only

their peers, but also administrative leadership. Many SBAE programs also have an advisory committee which is made up of community members and industry partners who collaborate with the SBAE teacher to ensure that students are learning the appropriate skills to meet the needs of industry and higher education. These community members can have an effect on what students are learning in the classroom.

### **Purpose and Objectives**

This study describes SSI integration within SBAE including the beliefs and perceived barriers of SBAE teachers about SSI integration. Research addressing how agricultural education contributes to the workforce of individuals who will have a direct hand in solving the complex challenges created by our growing global population and innovation is needed. This research contributes to the dearth of research connecting SSI and SBAE curriculum. The following research objectives guided this research:

1. Describe SBAE teachers' self-efficacy beliefs and attitudes related to SSI integration.
2. Describe SBAE teachers' integration of SSI within SBAE.
3. Describe SBAE teachers' perceived barriers to teaching SSI (i.e., time, knowledge, peripheral influences).

### **Methods/Procedures**

For this research, a descriptive survey methodology was employed. The survey instrument used in this research was designed and distributed to a simple random sample of SBAE teachers in the United States using the online survey system Qualtrics. The web-based survey was utilized for this national study because it provided low-cost data collection from a large sample and large geographical area with easy data entry and analysis options (Dillman et al., 2014). Due to online fatigue caused by COVID-19, we also distributed a paper version for those that preferred. Data collected for this study were part of a larger research project exploring various aspects of SSI integration within SBAE.

The target population for this research included all SBAE teachers in the U.S. during the school year 2019-2020, which was approximately 12,000 at the time of this research (National Association of Agricultural Educators, 2020). An SBAE teacher was defined as any middle or high school teacher who is certified to teach agricultural education courses. As SBAE teachers are registered with the National FFA Organization, we obtained contact information, specifically teacher names, school mailing addresses, and teacher emails from the National FFA Organization for 500 SBAE teachers. The tailored design method guided data collection methods (Dillman et al., 2014). The participants received their first contact through an email introducing them to the study and inviting them to participate. The email contained the link to access the survey. A follow-up email was sent approximately seven days after the first email which served as the first reminder and an opportunity for participants to request an additional paper survey if they preferred a paper survey instead of the online version. Overall, the participants were contacted five times over 3.5 weeks during the first three weeks in December of 2020.

The survey instrument was comprised of items that addressed the research objectives particularly items to assess SBAE teachers' knowledge, teaching self-efficacy, perceived need to integrate, perceived barriers toward SSI integration, and actual integration. Demographic information was also collected. Survey items were guided by previous research (Giliberti, 2018; Kara, 2012; Lee et al., 2006) and the SSI-based instruction framework (Presley et al., 2013). The instrument consisted of personal demographic items related to gender and political ideology. Also included were professional characteristic items related to teaching experience, and the state they currently teach in. Additional questions related to licensure were asked, specifically whether respondents had a traditional or alternative teaching credential, a science certification, and whether students received science credit for their agricultural education courses.

The four survey items that comprised the self-efficacy construct measured efficacy related to teaching strategies, teacher knowledge and understanding, and confidence in developing materials for SSI integration. Respondents were asked to rate their level of agreement with each of the items measured on a 5-point scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree*). Sample items in this construct included: "I am able to use various teaching strategies to address socioscientific issues in agricultural education classes" and "I have confidence in developing teaching and learning materials about socioscientific issues." Self-efficacy was found to be reliable (4 items; Cronbach's  $\alpha$  .83). A higher mean response for the self-efficacy construct indicated higher SBAE teacher self-efficacy toward SSI integration.

Teachers' attitude towards SSI integration was measured using items related to teachers' beliefs that SSI are appropriate and needed in SBAE. Teachers' perceptions of student background regarding SSI, increasing student interest and concern, and students' need to establish their own opinions were also measured. Teachers were asked to rate their agreement with the perceived need to integrate SSI items measured on a 5-point scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree*). Sample items include: "introducing socioscientific issues into agricultural education classes is definitely necessary" and "students need to be concerned with socioscientific issues related to agricultural science." Teachers' perceived need to integrate SSI was found to be reliable (6 items; Cronbach's  $\alpha$  .79). A higher mean response indicates a higher SBAE teacher perceived need to integrate SSI.

SBAE teachers' integration of SSI was measured by asking participants to respond to the following question: "When reflecting on the agriculture classes you teach, please identify the socioscientific issues you teach." Participants were asked to select all that applied. Nine SSI were included in the survey along with blank spaces for teachers to write in any additional SSI they integrate into their classes but were not included in the list of options. The list of SSI consisted of: "climate issues; ecosystem & biodiversity issues; energy issues; food security issues; genetic engineering issues; human population issues; natural resource issues; sustainability issues; water issues; and I do not teach any socioscientific issues."

Teachers were also provided a list of teaching strategies and asked to indicate which they use either *frequently*, *sometimes*, or *never* when teaching SSI. Participants were also asked to rank their use of resources when teaching SSI, on a 5-point Likert scale (1 = *Strongly Agree*, 2 = *Agree*, 3 = *Neutral*, 4 = *Disagree*, 5 = *Strongly Disagree*).

Barriers perceived by teachers to integrating SSI were related to time, teacher knowledge, and peripheral influences of support. These items were measured on a 5-point scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree*). Research recommends using the Spearman-Brown coefficient as a more reliable measure for two-item constructs (Eisinga et al., 2013). Thus Spearman-Brown coefficient analyses were conducted on the two-item constructs. The items comprising the construct of time barriers related to lack of time within the curriculum to integrate SSI and time to prepare SSI curriculum. Teachers' perceived barriers of time consisted of two items ( $\rho$  = .67). Knowledge barrier items entailed teachers' science content knowledge of SSI and their knowledge of social considerations of SSI. Teachers' perceived knowledge as a barrier consisted of two items ( $\rho$  = .87) and was found to be reliable. Peripheral influences contained items addressing barriers of support from teachers' administration and community. This construct included two items and was found to be reliable ( $\rho$  = .77).

Face and content validity of the instrument were evaluated by a panel of experts comprised of doctoral students and faculty in Career and Technical Education and familiar with survey research methods. Additionally, we conducted a pilot test with 25 SBAE teachers in Utah and Nevada. The teachers from the pilot were not included in the responses for the national sample. Reliability estimates for all constructs were achieved from the pilot study analysis. Additionally, the instrument's constructs were guided by published research (Aviles, 2017; Giliberti, 2018; Kara, 2012; Lee et al. 2006) using similar instruments and

constructs which have been reported along with reliability measures. Instrument development was also guided by the SSI-based instruction Framework (Presley et al., 2013). Some scholars have argued that Cronbach alpha estimates of .70 are arbitrary and results as low as .05 should be considered reliable (Field, 2018; Nunnally, 1978). Given that the reliability estimates of .67 for the time barriers measure was close to the arbitrary .70 cutoff, this variable was cautiously kept in the analysis.

Upon collection, data were loaded into Qualtrics™ and analyzed using Statistical Package for Social Science (SPSS). Any surveys returned by mail were hand-entered into SPSS. Data were reviewed for abnormalities and missing entries. For research objectives one through three, we used descriptive statistics, and we reported frequencies, percentages, means and standard deviations.

## Findings

The total response rate for this study, including paper and online surveys totaled 27.2% ( $N = 136$ ; mail = 6; electronic = 130). Due to some missing data points, the responses range from 109 to 112 for some of the analyses. We analyzed early and late responses using the constructs in the survey instrument (i.e., teachers' self-efficacy beliefs, attitudes towards SSI integration, perceived barriers to integration) and teacher demographic variables (e.g., gender, teaching experience) in an independent samples *t*-test and crosstabs to compare responders and non-responders to determine the presence of nonresponse bias. No variables were found to be significant, and we concluded non-response bias was not present. Due to the relative low response rate, we acknowledge the findings are not large enough to be generalizable across all SBAE teachers in the U.S.

### Demographics and Characteristics of the Sample

The respondents in this study encompassed teachers from various AFNR pathways. Among these pathways, animal systems (74.2%), plant systems (61.9%), and power, structural, and technical systems (55.1%) were the most commonly taught. Additionally, natural resource systems (51.5%), agribusiness systems (47.8%), food products and processing systems (33.1%), environmental systems (30.9%), and biotechnology systems (22.1%) were also represented, albeit to varying degrees.

Of the respondents, 54% ( $n = 58$ ) identified as male while 46% ( $n = 49$ ) identified as female. Regarding teaching experience, respondents ranged from first-year teachers to those with 40 years of experience, with an average of 12 years. The sample included representation from all four National FFA regions.

The majority of respondents held a traditional agricultural education teaching certification (84.5%), as opposed to an alternative teaching license (15.5%). Interestingly, while more than half of the respondents (53%) did not possess a science endorsement, 52.7% indicated that their students received science credit for their agriculture classes. Furthermore, when asked about their familiarity with the term "socioscientific issues," 44% of SBAE teachers indicated they had not encountered it prior to participating in this survey.

### Objective One

Research objective one sought to describe SBAE teachers perceived self-efficacy and attitudes related to SSI integration. The survey items elicited information about teachers' self-efficacy related to their ability to employ different teaching strategies to address SSI, comprehension of SSI within the agriculture context, confidence about developing teaching materials about SSI, and having knowledge to teach about SSI. SBAE self-efficacy for SSI resulted in an overall mean of  $M = 3.96$  ( $SD = 0.55$ ) indicating teachers

agree they are efficacious with integrating SSI (see Table 2). Further, we sought to describe SBAE teachers' attitude toward teaching SSI in their agriculture courses. The survey items elicited information about teachers' perceptions related to the appropriateness of teaching SSI in an agricultural education class, the necessity of teaching SSI in agriculture classes, the adequacy of students' backgrounds, students' interests, students' concern for SSI, and students' ability to form their own opinions related to SSI. SBAE teachers' perceived need to teach SSI in their agricultural education courses resulted in an overall mean of  $M = 4.21$  ( $SD = 0.45$ ) indicating teachers overall agreed there is a need for SSI incorporation into agricultural education (see Table 2).

**Table 2**

*Descriptive Statistics for Self-efficacy Beliefs and Attitudes about SSI Integration*

| Construct                                 | <i>M</i> | <i>SD</i> |
|---|----------|-----------|
| Perceived Self-Efficacy Beliefs about SSI | 3.96     | 0.55      |
| Perceived Attitudes about Integrating SSI | 4.21     | 0.45      |

*Note.* Mean limits scaling for constructs 1 - 1.49 = *strongly disagree*, 1.50 - 2.49 = *disagree*, 2.50 - 3.49 = *neutral*, 3.50 - 4.49 = *agree*, 4.50 - 5.00 = *strongly agree*.

## Objective Two

Research objective two sought to describe teachers' integration of SSI into the SBAE curriculum. The findings indicate only 2.9% of respondents do not teach any SSI. Most respondents indicated they teach at least one SSI topic during the school year. Natural resource issues (66.9%;  $n = 91$ ), sustainability issues (66.2%;  $n = 90$ ), and water issues (64.7%;  $n = 88$ ), were the most selected SSI taught by SBAE teachers. The least selected SSI that respondents indicated they taught were climate issues (48.5%;  $n = 66$ ), ecosystem and biodiversity issues (49.3%;  $n = 67$ ), and energy issues (47.1%;  $n = 64$ ). None of the respondents used the additional space to write in other SSI they integrate into their curriculum.

Most respondents agreed or strongly agreed (61.9%) they integrate SSI into LDEs followed by CDEs (54.8%) and SAEs (46.9%). However, nearly one-third (32.7%;  $n = 37$ ) of respondents chose neutral for CDEs, and 27.4% ( $n = 31$ ) selected neutral for LDEs but respondents chose neutral most for SAEs (38.9%;  $n = 44$ ). While all respondents indicated they frequently (49.6%;  $n = 56$ ) or sometimes (50.4%;  $n = 57$ ) use lecture or direct instruction, 65% ( $n = 67$ ) indicated they never use role play when teaching SSI (see Figure 2). Most respondents also answered they sometimes use debate (70.3%;  $n = 78$ ), and the Socratic Method was never used by nearly half (49%;  $n = 50$ ).

All respondents indicated they use media frequently (59.6%;  $n = 66$ ) or sometimes (40.5%;  $n = 45$ ) when teaching SSI and the internet was the most frequently used resource by SBAE teachers (88.5%;  $n = 100$ ) (see Figure 3). Textbooks were used by SBAE teachers in this study frequently (19.6%;  $n = 22$ ) or sometimes (41.1%;  $n = 46$ ) and outside resources such as guest speakers were used sometimes (78.7%;  $n = 85$ ). Most respondents agreed (38.4%;  $n = 43$ ) or strongly agreed (52.7%;  $n = 59$ ) they use technology, but fewer agreed (55.4%;  $n = 62$ ) or strongly agreed (9.8%;  $n = 11$ ) their students analyze scientific data. In fact, 25% ( $n = 28$ ) of respondents selected neutral for using scientific data analysis when teaching SSI.

Figure 2

Teaching Strategies Used by SBAE Teachers When Incorporating SSI by Percent

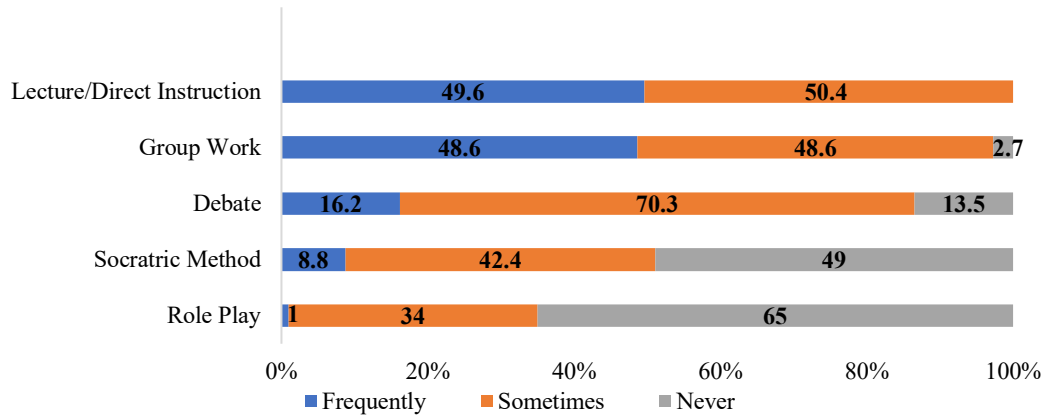
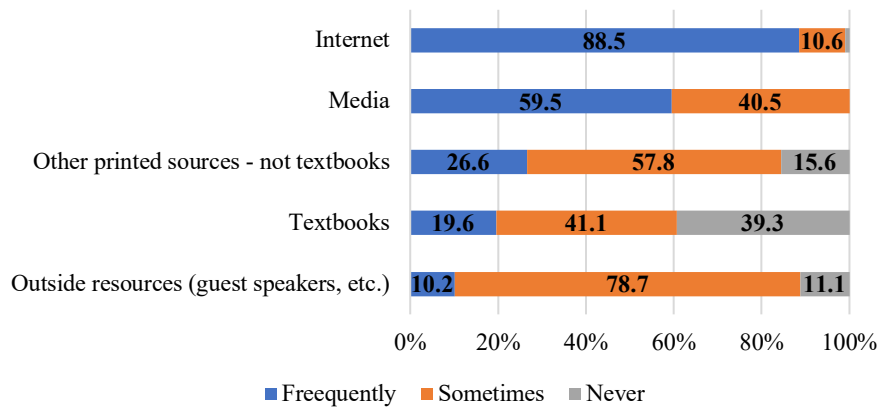


Figure 3

Resources Used by SBAE Teachers When Incorporating SSI by Percent



Objective Three

Research objective three sought to describe SBAE teachers’ perceived barriers to teaching socioscientific issues, specifically as they relate to teachers’ time to prepare curriculum and integrate it, knowledge of science content and social considerations of SSI, as well as peripheral influences in the form of administration and community support. Teachers’ perceived barrier of time resulted in an overall mean of  $M = 3.62$  ( $SD = 0.84$ ), where more than half of respondents agreed or strongly agreed they lack the time to prepare curriculum (71.8%;  $n = 79$ ) and integrate SSI (60.9%;  $n = 67$ ) into their classes (Table 3). Teachers’ perceived barrier of knowledge resulted in an overall mean of  $M = 2.93$  ( $SD = 0.96$ ), and 41.9% of respondents either disagreed or strongly disagreed they lacked the knowledge of science content ( $n = 46$ ) and 40% ( $n = 44$ ) disagreed or strongly disagreed they lacked knowledge of the social considerations of SSI. Perceived barrier of support resulted in an overall mean of  $M = 3.71$  ( $SD = 0.66$ ). More than half of

the respondents felt supported by administration (64.6%;  $n = 71$ ) and their community (56.4%;  $n = 62$ ). Additionally, over one third of respondents reported being neutral regarding administrative support (33.6%;  $n = 37$ ) and community support (40.9%;  $n = 45$ ).

**Table 3**

*Descriptive Statistics for Barriers of SSI Integration*

| Construct                                  | <i>M</i> | <i>SD</i> |
|--|----------|-----------|
| Barrier of Time to Integration of SSI      | 3.62     | 0.84      |
| Barrier of Knowledge to Integration of SSI | 2.93     | 0.96      |
| Barrier of Support to Integration of SSI   | 3.71     | 0.66      |

*Note.* Mean limits scaling for constructs 1 - 1.49 = *strongly disagree*, 1.50 - 2.49 = *disagree*, 2.50 - 3.49 = *neutral*, 3.50 - 4.49 = *agree*, 4.50 - 5.00 = *strongly agree*.

### Conclusions and Recommendations

The purpose of this study was to describe SSI integration within SBAE including the beliefs and perceived barriers of SBAE teachers about SSI integration. Our findings show that SBAE teachers believe they are able to integrate SSI, that there is a need to integrate SSI into agriculture courses, and that SBAE teachers face some barriers to integrating SSI.

#### Enhancing SBAE Teacher Self-Efficacy with SSI

SBAE teachers believe they are efficacious when it comes to SSI integration. As has been suggested in previous research, individuals are motivated to act and think in a particular way by their self-efficacy (Bandura, 1995, 2009). In fact, a person's beliefs will also influence their self-efficacy (Bandura, 1995, 2009). Teachers are not immune to this phenomenon and as Roath and Hay (2016) point out, will spend less time teaching material, and use more teacher-centered strategies when their self-efficacy is lower. They also pointed out that teachers with lower self-efficacy make fewer attempts to motivate students (Roath & Hay, 2016).

The SSI-based instruction framework specifically identifies curriculum flexibility, knowledge of science content, and awareness of social considerations as key components to integrating SSI. Results of this research suggest teachers believe they have flexibility and can use various teaching strategies in their classes. They also are confident in their own ability to effectively teach SSI.

The first time SBAE teachers learn about SSI could be in their pre-service program or through professional development they participate in once they are in the classroom. Professional development can increase self-efficacy for in-service teachers. Learning about SSI, the SSI-based instruction framework, and teaching strategies to integrate SSI during professional development allows in-service teachers to learn with their peers and implement what they have learned in their classrooms, potentially improving their teaching self-efficacy for SSI as well.

#### Teaching and Integrating SSI in SBAE

Teachers in this study overwhelmingly agreed there is a need to integrate SSI into agricultural education curriculum, however the data from this research does not suggest many SBAE teachers are

actually doing it. Even though they agree SSI are needed in SBAE, teachers may not be integrating them if they do not see the alignment to their standards. The SSI-based instruction framework advises an essential element of successful SSI integration is the connection to state and national education standards (Presley et al., 2013). Although Shoulders and Myers (2013) reinforced the understanding that SSI-based instruction is useful in improving students' science content knowledge, explicitly making connections between SSI and SBAE education standards will ensure SBAE teachers have a perceived need to integrate SSI. Otherwise, teachers will not integrate what they do not need. Taking into consideration the mean for teachers' attitudes about integrating SSI was higher than the mean for perceived self-efficacy, teachers appear to know SSI is important, but their self-efficacy for teaching it is lacking. This is evidenced in the low numbers of SSI integration.

SBAE teachers in this study indicated they were using media frequently (59.5%) or sometimes (40.5%) and most teachers agreed their students use technology and analyze scientific data when learning about SSI, which is in line with the SSI-based framework. However, nearly 40% of the SBAE teachers in this study indicated they never use a textbook and 25% selected neutral when it came to their students analyzing scientific data. Previous research suggests a neutral selection could indicate the respondents do not know the answer or they selected the answer believed to be the social norm for that response (Chyung et al., 2017). Several queries should be considered from these results. Perhaps SBAE teachers never use textbooks because they are outdated or expensive, creating additional barriers to integrating SSI. They may also be using more current online resources instead of textbooks. Finally, SSI are often controversial and can lead to what some might consider disruptions in classroom management and students feeling uncomfortable. Thus, teachers maintain a degree of control over the classroom environment and the content learned when using lecture or direction instruction. Teachers may also be using teaching methods they learned by, teaching the way they were taught (Lortie, 1975/2002).

### **Navigating SSI Integration**

Teachers can be apprehensive when it comes to integrating unfamiliar content or new teaching strategies. Thus, the SSI-based instruction framework asserts that teachers need support and encouragement when implementing SSI into their curriculum (Presley et al., 2013). This support may be in the form of professional development to learn about the SSI content, curriculum design, or teaching strategies. Administrators and community members should also be supportive when teachers integrate often-controversial SSI, so teachers are not concerned about potential repercussions or criticism when tackling these difficult topics. Our findings indicate that the majority of SBAE teachers felt supported by their administration and community.

### **Recommendations**

Based on this research, we have recommendations for both practice and further study. In practice, agricultural teacher educators should incorporate the SSI-based instruction framework into pre-service agricultural education courses. This will provide future agriculture teachers with a deeper understanding of societal issues relevant to agriculture, empowering them to educate their students effectively. By introducing pre-service teachers to SSI topics, particularly those connected to agriculture, they can prepare to guide their students in understanding these issues and their potential impact on the agricultural industry. The focus of pre-service exposure to SSI should be on teaching methodologies for these topics.

Additionally, in-service professional development should be provided to SBAE teachers to familiarize them with SSI and the instructional framework. This knowledge will enable SBAE teachers to create contextual learning experiences for their students, fostering independent thinking and engagement with societal issues. Updating national and state SBAE content standards to include SSI is also crucial to ensure that these topics are appropriately integrated into the curriculum.

Future research should expand beyond the scope of this study to delve deeper into the teaching methods and materials utilized by SBAE teachers when addressing SSI. Specifically, research should concentrate on examining the curriculum design aspects and the learners' experiences within the framework of SSI-based instruction. Adopting an observational, qualitative approach would be beneficial for this research endeavor as it would not only help in identifying the strategies and resources employed but also in observing their implementation within SBAE classrooms.

Additionally, it is crucial to investigate the effects of integrating SSI and the SSI-based instruction framework into pre-service agriculture teacher preparation programs and in-service professional development. Exploring impacts on the self-efficacy of pre-service and in-service SBAE teachers related to SSI and their integration into agricultural education curriculum is important to furthering the connection between SSI and SBAE. Researchers should conduct further studies to explore barriers related to SSI experienced by teachers at different stages in their careers, as well as possible barriers influenced by the location of the SBAE program. This research would be beneficial to inform teacher preparation programs and professional development opportunities in the areas most needed. Research should also be conducted to discover the self-efficacy and knowledge of pre-service agriculture teacher educators related to SSI and the SSI-based instruction framework. Ensuring that teacher educators are positioned to integrate SSI and the SSI-based instruction framework into pre-service agricultural teacher education programs is essential.

Although the response rate for this research was not large enough to be generalizable to the SBAE teacher population the research provides important information related to SBAE teachers' beliefs, attitudes, and integration of SSI. Previous research exploring SSI and SBAE focused primarily on curriculum and instruction of SSI topics (Cross, 2019; Shoulders 2012), the field of agricultural education must know where SBAE teachers are in terms of their own knowledge and self-efficacy of teaching SSI before teachers can be expected to teach SSI in their classes. Understanding SBAE teachers' knowledge and beliefs about SSI is essential to furthering the integration of SSI into SBAE curriculum. This research helps provide a better understanding of SBAE teachers' knowledge, beliefs, and perceived barriers related to SSI and contributes to the research began by Shoulders (2012) and Cross (2019).

The complex challenges facing society are a priority for many stakeholders in education and in agriculture. SBAE students, have the potential to be change makers and instrumental in ensuring that agriculture and education play an active part in solving these complex issues. Advancing our understanding of SSI and ensuring students are agriculturally and scientifically literate will establish SBAE's seat at the table when it comes to impacting solutions of significant and complex SSI.

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