Journal of Agricultural Education, 66(2), Article 13
https://doi.org/10.5032/jae.v66i2.2924

Exploring Teacher Motivations and Challenges in Incorporating Agricultural Content into Elementary Grade Curricula

Kelly L. Gill[1]
Madison Hawkins[2]
Amy M. Leman[3]

Abstract

This study explores what motivates elementary school teachers to integrate agriculture into their curriculum and instruction. Additionally, it discusses the barriers teachers face to integration and what agricultural organizations can do to assist teachers. This mixed-methods study began with an online survey of teachers who had previously attended an Illinois Ag in the Classroom training. From the survey responses, interview questions were created to further understand the collected survey responses and learn more about the teachers' motivations. A portion of the respondents participated in virtual interviews. Our study found that teachers are motivated to teach agriculture because they feel a responsibility to educate students about where their food comes from, their instruction connects to agriculture, and agriculture is important to their community. Despite teachers understanding the importance of this subject, they face challenges such as time, curriculum restrictions, lack of resources, and lack of knowledge when teaching agriculture. Teachers asked for more resources and connections to agricultural professionals to combat this. Findings from this study match many previous findings related to agricultural literacy, adding that teachers desired more contact with agriculture in their own communities to create connections in their lessons.

Introduction

Agricultural literacy has been the topic of research for many years. In a broad definition, the National Research Council defines an agriculturally literate individual as someone who understands the food and fiber system, including the historical, economic, social, and environmental impacts that the system has on all individuals. (National Research Council, 1988). One study compiled responses from agricultural literacy coordinators to define agricultural literacy as the education of agriculture to youth and adult audiences, showing agriculture's role in society (Knobloch & Ball, 2003). A more recent study posited that agriculturally literate individuals should be able to analyze and assess "trade-offs" to society and individuals from agriculture enterprises (Powell et al., 2008).

Agricultural literacy is considered as having knowledge of the food system and an understanding of agricultural processes that contribute to the production of plant and animal products (Frick et al., 1991; Meischen & Trexler, 2003). Kovar and Ball (2013) discuss how, as the global population grows, agricultural knowledge is becoming increasingly necessary to meet the demand for increased food production through efficient growing practices. Therefore, the world requires an agriculturally literate population to support the agriculture industry and navigate its challenges (Kovar & Ball, 2013).

[1]Kelly L. Gill is a graduate of the Agricultural Leadership, Education and Communications Master's Degree Program at the University of Illinois at Urbana-Champaign.
[2]Madison Hawkins is a graduate of the Agricultural Leadership, Education and Communications Master's Degree Program at the University of Illinois at Urbana-Champaign.
[3]Amy M. Leman is an Assistant Professor of Agricultural Leadership, Education and Communications at the University of Illinois at Urbana-Champaign. bunselme@illinois.edu, https://orcid.org/0000-0002-7581-3116

While the definition of agricultural literacy may fluctuate, the need for an agriculturally literate society remains the same. Developing youth and adults who are agriculturally literate is not a new idea, but its importance continues to become more pressing. As agriculture advances and fewer individuals are directly connected to production agriculture, the need for an agriculturally literate society becomes even more critical to making educated and informed agricultural decisions (Kovar & Ball, 2013).

Trexler et al. (2000) found that schools and families are the primary sources from which students receive information about agriculture and the food system. Teachers in the study discussed how the information shared in a student's home will vary depending on the parent or guardian's experience with agriculture. For this reason, teachers see it as their responsibility to teach healthy eating to their students and create a place where agriculture topics can be discussed, including nutrition and environmental issues that affect the food system (Trexler et al., 2000).

Today's elementary school students often lack knowledge about the agricultural industry and food systems. For example, students may be unable to connect agriculture and its importance in everyday life (Brandt et al., 2017). Agricultural experiences and prior knowledge play a significant role in a student's level of agricultural literacy. However, many students do not have access to agricultural experience due to a variety of factors. Consequently, students demonstrate low levels of agricultural literacy (Hess & Trexler, 2011). This study will focus on understanding the benefits and challenges teachers face in including agricultural content in elementary classrooms.

Literature Review

In 1986, a study measured the agriculture knowledge of 2,000 elementary, junior, and senior high students in Kansas (Horn & Vining, 1986). Although Kansas is a significant agricultural production state, fewer than 30 percent of students in the study correctly answered basic agriculture-related questions. Significant advances in education and agriculture have occurred since 1986, but agricultural literacy remains low for several populations. A systematic review conducted in 2022 analyzed 12 studies aimed at measuring the agricultural literacy of primary and high school-aged students. The review concluded that students demonstrated low levels of agricultural literacy at both levels (Cosby et al., 2022). Clemons et al. (2018) highlighted how students' low levels of agricultural literacy could result from weak reading and writing skills.

Connecting agriculture to general education is one way to integrate these topics into the classroom. One teacher taught her students economic principles through selling molasses products made by the class. The students learned about molasses production and products, and then applied economic principles to price and sell their products (Trexler & Hikawa, 2001). Teachers utilize agriculture as a context for laboratory activities, including viewing plant cells in an onion through a microscope and using soil to study erosion (Vallera & Bodzin, 2016).

One benefit of integrating agriculture topics into general education content is connecting students to concrete examples they may be familiar with. Agriculture provides a context for students to understand how general education concepts are applied in everyday life (Knobloch, 2008; Vallera & Bodzin, 2016). In addition, integrating agriculture into general education curriculum can help students understand the connection between agriculture and science through examples that students can relate to (Mabie & Baker, 1996; Vallera & Bodzin, 2016). When students participated in an agricultural literacy unit within their general education class, interest in the material being taught increased (Knobloch & Van Tine, 2004). Another study highlighted that in teaching agricultural education, experiential learning and activities aided students' ability to observe, communicate, compare, relate, order, and infer information (Mabie & Baker, 1996).

Teachers understand the benefits of teaching agriculture and indicate a positive attitude toward incorporating it into their general education curriculum (Bellah & Dyer, 2006; Knobloch & Ball, 2003). Knobloch (2008) found that of the 689 teacher participants, 97% felt that agriculture would enhance the curriculum, and 84% believed that agriculture could be taught in any subject. Bellah and Dayer (2009) found that teachers expressed favorable attitudes and perceptions toward agricultural content. However, teachers reported a lack of time, interest, and knowledge as reasons they would not use the agricultural content.

While teachers understand the importance of agriculture and are interested in integrating it into their classrooms, they face barriers to integration. Some teachers perceive a lack of self-efficacy in teaching agricultural topics without guided resources and a lack of awareness of the resources that are available (Burrows et al., 2020). Many teachers cite not having any knowledge or experience with agriculture as a reason for not being able to create agriculture-related classroom content (Trexler & Heinze, 2001; Trexler & Hikawa, 2001). Comfortability with the material also restricts teachers' motivation to teach agriculture (Knobloch & Ball, 2003; Trexler & Suvedi, 1998).

In addition, teaching to state-mandated standardized test content may take precedence over teaching agriculture. Teachers may be more concerned with teaching the content they believe their administrators expect to be taught in their classrooms (Burrows et al., 2020; Trexler et al., 2000). Another factor that limits a teacher's ability to teach agriculture concepts is not having time to plan and implement agriculture-related activities in the classroom (Knobloch & Ball, 2003; Knobloch & Martin, 2002).

Despite the need and desire for agriculture education within elementary school settings, teacher resources and curricula incorporating agricultural topics are lacking. When agricultural topics are present within upper-elementary school standards, often no links are made between curriculum and standards (Allen & Harper, 2002). The science curriculum sometimes acknowledges the agricultural connection, but the content appears to be an individual example (Vallera & Bodzin, 2016). Teachers using the curriculum given to them often do not possess extensive agricultural knowledge to make those connections for students (Trexler & Heinze, 2001).

Theoretical Framework

To guide our study, we utilized schema theory from Piaget (1952), which describes schema as the way to organize knowledge and create understanding. When applied to education, schema theory suggests that a teacher's prior experiences and beliefs about a content area influence how they perceive and process information related to that subject. (Yang, 2023). Teachers directly influence the focus of the activities and the content taught in their classrooms (Winther et al., 2002). Teachers' schemas about agriculture will likely influence what they choose to teach. In a study conducted by Knobloch and Martin (2002), it was found that if an elementary teacher believes agriculture is relevant to specific careers and values and believes that agriculture can be integrated into various subjects and has positive perceptions of agriculture, then the teachers will be more likely to include agriculture in their curriculum. The topics and content areas teachers choose to implement in their classrooms also connect to the schemas they hold for each topic area.

Hess and Trexler (2011) used schema theory to compare urban elementary students' understanding of agriculture with nationally developed benchmarks related to agriculture literacy. A similar study used the schema theory to compare students' understanding of agricultural technology to grade-specific benchmarks for agricultural literacy, while examining the relationship to students' backgrounds and experiences (Trexler et al., 2013).

Objectives

This study aims to explore what motivates teachers to integrate agriculture into their curriculum, and what teachers need to teach agriculture in their classrooms. Three questions guided our research:

1. What motivates teachers to teach agriculture in their classrooms?
2. What barriers prevent teachers from integrating agriculture in their classrooms?
3. What can agricultural organizations and institutions do to assist teachers in teaching agriculture in their classrooms?

Methods

For our study, we used an explanatory sequential mixed methods design (Creswell & Plano Clark, 2018). We surveyed elementary teachers in Illinois who had previous experience teaching agricultural topics in their classrooms and used the findings to create an interview protocol to gain more insight into the survey answers. Online surveys enabled us to collect data from a geographically dispersed sample of participants (Burkholder et al., 2020). By conducting interviews, we could understand the personal stories of the individual experiences that influenced participants' interest in teaching and integrating agriculture into their classrooms (Burkholder et al., 2020).

Sample

We recruited participants to take our online survey through an email list provided by Illinois Ag in the Classroom. Individuals on the list included those who had attended a Summer Ag Institute in 2022 and 2023. We emailed the survey to 492 participants, and 114 completed surveys for a 23% response rate. Survey participants were put in a drawing for one of five $50 gift cards, funded by Illinois Agriculture in the Classroom.

The teachers who answered the survey were primarily from rural schools (71%), with only 12% from urban schools and 17% from suburban schools. Half of the survey participants (50%) had between six and 20 years of teaching experience, though teachers with both fewer and more years in the classroom were also represented. Sixty-two percent of teachers taught 1st grade through 5th grade. We did not collect information on the participant's ethnicity or sex as Illinois Agriculture in the Classroom informed us that most participants identified as female and white/Caucasian.

At the end of the survey, individuals indicated their interest in being interviewed about their experience teaching agricultural topics. We had 30 survey respondents who indicated they would be interested in participating in an interview. Of those 30, 12 survey participants responded to email requests for interviews. After the interview, each participant completed a demographic survey to collect more detailed information. The school location was asked as an open-ended question, therefore, the definition of each is from the teacher's perspective. Interview participants received agricultural-related books to use in their classroom, provided by Illinois Agriculture in the Classroom.

Table 1

Interview Participant Demographics

Pseudonym	Sex	School Location	Grade Level	Years of Teaching
Tracy	Female	Rural	3^{rd} – 5^{th} Grade	16-20
Sandra	Female	Rural	2^{nd} Grade	0-5
Connor	Male	Rural	5^{th} Grade	16-20
Ruth	Female	Rural	7^{th} – 8^{th} Grade	21-25
Abigail	Female	Rural	2^{nd} Grade	21-25
Kimberly	Female	Rural	2^{nd} Grade	0-5
Jillian	Female	Rural	K – 5^{th} Grade	16-20
Alexis	Female	Rural	Kindergarten	16-20
Tara	Female	Rural	High School	31-35
Allie	Female	Suburban	K – 4^{th} Grade	21-25
Danielle	Female	Suburban	5^{th} Grade	26-30
Jane	Female	Urban	High School	26-30

Instrumentation and Data Analysis

Survey questions were loosely based on a previous study by Knobloch and Ball (2003) addressing elementary school teachers' beliefs about teaching agriculture in their classrooms. The online survey, developed using the Qualtrics XM © online platform, was developed with the understanding that participants had already completed an agriculture education-based training through Illinois Agriculture in the Classroom. We took the results of open-ended questions in the original study and created multiple-choice questions using the themes.

The first survey question we used was from the original 2003 study that asked how frequently teachers taught different agricultural topics. Questions two through six were a series of Likert scale questions to explore the root of teachers' interest in teaching agriculture, which we chose from the original survey question on barriers. For those reasons, we selected items that were framed to assess teachers' interest in teaching agriculture, allowing us to explore their motivations for teaching the subject. Our seventh question explored teachers' perceptions about the benefits of teaching agriculture to their students. Question eight asked teachers if they encounter barriers to teaching agriculture, and then they were asked to elaborate on their answers in question nine. Our survey concluded with questions ten through thirteen, which asked for demographic information.

Surveys were sent using the email function of Qualtrics XM ©, and responses were collected anonymously. After one week, the survey was sent again to teachers who had not yet responded. The survey was closed two weeks after it was opened. s. Teachers who chose to be interviewed were taken to a separate Qualtrics XM © survey to enter their contact information and keep their survey answers anonymous. Once this was finalized, two researchers analyzed the survey data to quantify themes.

After survey collection, we reviewed the data from the survey and created an interview protocol restating questions in an open-ended format. Semi-structured interviews were conducted and recorded through a scheduled Zoom meeting. After each interview, a transcript was generated, edited to include pseudonyms, and reformatted. We uploaded the interview transcripts to a qualitative analysis platform, Dedoose, where they were analyzed by two researchers. This process used inductive coding to create themes for each research question, which provided further insight into quantitative results from the survey.

Findings

Motivations to Teach Agriculture

The first research question we asked identifies reasons that elementary teachers choose to teach about agriculture in their classrooms. Through the survey, teachers discussed various reasons that inspired them to teach their students about agriculture. Table 1 includes the number of teachers who answered the survey with Strongly Agree (5) or Slightly Agree (4) on the 5-point Likert scale.

Table 2

Teachers that Strongly Agreed or Agreed with Motivations to Teaching Agriculture

I'm interested in teaching about agriculture because…	*n*	%
It meets Illinois State Learning Standards. (*n*=110)	84	76%
It shifts my instruction from lower-order thinking to higher-order thinking. (*n*=111)	79	71%
There are more careers in agriculture than in any other industry in the U.S. (*n*=110)	87	79%
My past experience in agriculture. (*n*=111)	76	68%
My experience with youth development projects (4-H/FFA) in agriculture. (*n*=109)	50	46%

The topics were turned into open-ended questions to gain more information during interviews. Three themes emerged from the interviews as key motivators for teachers: the importance of agriculture, content connection, and community.

Theme 1: Importance of Agriculture

The first theme emerging from teacher interviews was the shared belief that students need to understand where their food comes from, and how food gets from the farm to the table. Several teachers specifically highlighted that their reasoning for teaching their students about agriculture was to ensure their students know the origin of their food. Similarly, teachers wanted to include agriculture in their classrooms to expose their students to the agriculture industry. Their inclusion includes the processes that exist to get food and other agricultural products from the farm to consumers, and the potential careers within the agricultural industry.

One teacher shared her reasoning for teaching agriculture in her elementary school classroom, "I think it's really important for kids to know where the things that they use come from, especially when they're young. A lot of times they think it comes from the store. That is extremely important" (Alexis, interview). A second-grade teacher told us how she makes it a goal for her students to understand where their food comes from, "I think that's a pretty big goal that I have for my second graders to expose them to as many opportunities as possible to get them interested that" (Abigail, interview).

Another reason teachers gave for choosing to teach agriculture is that agricultural products play an important role in everyday life. They emphasize that students should learn about how agriculture affects their personal lives and the world around them. During their interview, one teacher discussed that students should learn about agriculture to better understand how agriculture impacts their lives:

> There are so many avenues that it affects your life. And whether, like I said, whether your family farms or not, it's still affecting you somehow, a big proponent of the food you put on your table. Well, it took agriculture to get that. (Connor, interview)

Many teachers described the importance of the agricultural industry, and they wanted to promote agricultural careers to students beyond farming. This idea was expressed multiple times. Many teachers discussed how they hoped teaching agriculture in their classrooms would persuade students to explore a future in the agriculture industry. Several teachers shared that they teach about agriculture to show students careers in agriculture and the numerous opportunities available to them in the agricultural industry.

Theme 2: Content Connection

The second theme emerging from teacher interviews is the connection of agricultural examples to their grade-specific, state-required curricula. Teachers mentioned that they can easily fit agricultural lessons into other subjects they teach. Additionally, they can use those lessons as a means to meet state educational standards.

In an interview, a teacher commented that agricultural topics and lessons can easily fit into any subject or standard being taught:

> I really feel like we can probably make anything fit a standard. Agriculture, especially the world economy, of course that can fit in with math and how savings, spending, and the financial literacy part of that can definitely go with agriculture…But like NGSS standards, you know, they fit into anything to do with agriculture as well. So I feel like I can just weave it into all avenues of our curriculum and into our standards. (Abigail, interview)

Teachers also discussed how, when teaching common school subjects, they utilize agriculture as a way to illustrate real-world uses of the class content. Likewise, class content can be more relatable for students through examples contextualized in the agricultural industry since many students encounter agriculture daily. In a survey response, a teacher shared that agriculture could provide real-life examples for students in class content, "When students can see real-world applications of the material in class, they are more interested and invested in their learning." Another teacher wrote in a survey response that learning about agriculture can equip them with skills that will help them in the future: "Students learn real-world, transferable skills while learning about where their food, fuel, and fiber come from to become an informed consumer."

Theme 3: Community

The third motivational theme to teach agricultural content that emerged from the interviews was categorized as a connection to the community. Through the interviews, many teachers shared their previous experiences with agriculture This ranged from growing up on a farm to being a resident of a rural farming community. Each individual shared that being part of an agricultural community, either as a child or as an adult, influenced their desire to educate students about agriculture.

One teacher described how growing up on a farm gave her a passion for agriculture, and how she loves to share that part of her life with her students:

> I have always had a strong passion for agriculture. I showed beef cattle before I was even a [4-H] Cloverbud [program member]. Bringing that background into this experience with my kids. I love to do it because I know that they really enjoy it as well. And learning about things I enjoy, it makes it easier to teach. Because when you have a passion for it, then it just comes naturally. (Kimberly, interview)

Another teacher told us how she utilized living on her husband's farm to bring agriculture experiences to her students:

> I would have taught about pumpkins prior to being married to a farmer. Now, I feel like there's so much more background knowledge that I have that I can add to any of the units that I do. For example, soil, we talk about soil in second grade. I ended up during COVID creating a whole video about soil on our farm. (Allie, interview)

Other teachers commented that their school being in a rural community was a significant motivating factor in teaching agriculture in their classrooms. Many discussed how they felt it was important that their students understand what was happening in their community. One teacher shared:

> We live in a rural area, and learning about agriculture and it's importance helps the students seek careers within their communities or surroundings." In our interviews, several teachers shared reasoning similar to this teacher's, expressing that because their students live in rural farming communities, it is important to learn about agriculture so they understand what is going on around them.

In our survey, one teacher wrote that since the school is in a farming community, it is a great opportunity for students from a farm family to share what they do with their peers:

> Any opportunity to expose children to something they do not normally come in contact with is great. We have many farming families in our school and this gives those kids to be the "experts" when we have these discussions in class. They can give a lot of first-hand knowledge. (anonymous survey response)

Barriers to Teaching Agriculture

Our second research question asked about the barriers that prevent teachers from integrating agriculture into their classrooms. In the survey, 44% of teachers (*n* = 111) responded that yes, they faced barriers in teaching agriculture. Teachers then answered an open-ended question to explain what the barriers were. The answers were coded into four themes, found in Table 3 below.

Table 3

Teachers' Perceived Barriers to Teaching Agricultural Topics (n = 51)

Barrier Themes	*n*	%
Time	24	46%
Curriculum Restrictions	23	44%
Lack of Resources	9	17%
Lack of Agricultural-Specific Knowledge	7	13%

Interviews delved deeper into these barriers and explored how teachers faced various challenges in teaching agricultural lessons and activities. The same four themes were found in the interview responses.

Theme 1: Time

Having enough time during the class period to add agricultural topics into lessons was the most frequently identified barrier that teachers encountered. Agriculture is not a required subject, and therefore, teachers are challenged to find available time to incorporate agricultural lessons and topics into their curriculum. In the survey, one teacher shared, "There is a lot of pressure to get through our curriculum in a short amount of time. It can fill up all of the teaching time we have and leaves very little time for teaching things not addressed in the curriculum."

Beyond just finding the time in the school day to teach agriculture lessons, teachers shared that it can be challenging to align their lesson plans with the timing of agricultural events, in order to keep the topics timely and relevant for students:

> For instance, tomorrow I'm going to be introducing the nitrogen cycle. Well, whenever I look at that, we always say, okay, in the springtime of the year, you're going to see farmers pulling these big white tanks of anhydrous ammonia in the field. What do they use that for? Well, now there's that disconnect there. Okay. Well, I'm not going to see that for another six months again. How do I get the students to relate to that after something they have seen or aren't going to see for a while, that disconnect between the timing of everything. I try to plan my units so that they are more timely. (Connor, interview)

Theme 2: Curriculum Restrictions

The second theme that emerged regarding barriers to teaching agricultural topics is that strict curricula leave little room for additional topics and activities. Teachers reported two main curriculum restrictions: the inability to connect agricultural content to existing curricula and the lack of additional time within the curriculum structure to add agriculture-related topics Some teachers shared that pressure from school administration about state-required learning standards limit their ability to teach agriculture lessons and topics:

> There's so much stress put on reading and math.… But our literacy curriculum cycles through these different science and social studies themes. And it's almost like a checked box like, oh, we're going to make this cross-curricular, but it really doesn't dive deep. I think there could be a lot more done that supports reading standards just like we're pressured to do. But using content that's relevant to ag. (Sandra, interview)

Teachers also expressed that the content area they teach influences their ability to integrate agricultural topics. Even though our sample was of teachers who participated in Ag in the Classroom professional development, one teacher stated, "I teach Math classes, so not sure how to include it into my curriculum." Another teacher said they struggle to connect agriculture to their art education class.

Theme 3: Lack of Resources

A lack of resources was another common barrier that teachers shared. Often, agriculture lessons are designed to be hands-on, requiring more materials than other curricular options. Finding and preparing the needed supplies becomes an obstacle for some teachers. As one interviewee said:

> I cannot handle gathering more things. If it was an ag lesson that required me to go out and get pipe cleaners and glitter and cut out 72 circles the size of a dime, …if there were a million supplies with it, I would not be inclined to give it a try. (Sandra, interview)

With an increase in needed materials, funding to pay for the supplies becomes a barrier within the context of a lack of resources. One teacher stated:

> It's always there's always a financial barrier because I would like to do more like I really want to do, and I've tried to order equipment, and you have to write a grant, and there is not always enough funding for everybody to receive their grant. (Tracy, interview)

Theme 4: Teacher's Lack of Agricultural-Specific Knowledge

A final theme that arose from the interviews was that teachers lack agricultural knowledge. One interviewee shared that they do not teach agriculture in their classroom due to their lack of familiarity, stating, "... what am I supposed to be teaching? What would be helpful? Yeah. I honestly don't even know where to start." (Sandra, interview)

When a teacher has little to no agricultural experience, it can be a challenge to incorporate agriculture topics and lessons into their curriculum:

> Agriculture is not something that I'm super familiar with. It does take a little longer to lesson plan. I have gone to the Ag in the Classroom summer institutes to become more aware on how to do those things. But it's not something that I think of first, it's something that I have to work a little harder at. (Jillian, interview)

Assistance for Teachers Incorporating Agricultural Education

The third research question we asked was how agricultural organizations can assist teachers in incorporating and teaching agriculture in their classrooms. Through an open-ended question, teachers were asked to suggest what agricultural organizations can do to help them incorporate agricultural topics in their classrooms. Analysis of the teachers' survey responses revealed two themes, as listed in Table 4 below. Questions related to these themes were included in the interview protocol.

Table 4

Themes in Survey Responses to Areas Teachers Need Assistance to Incorporate Agricultural Topics (n = 51)

Themes	*n*	%
Connections	9	18%
Resources	11	22%

Theme 1: Connections

Our first emerging theme was teachers requesting connections to farmers, agriculture industry professionals, and agricultural businesses. Teachers shared how a connection to agriculture professionals would provide them with an accurate resource, while also giving their students personal connections to the topic:

> One thing I'd really like to see, this is more district-based than anything and community-based is just whenever those topics come up, what's the availability of getting that firsthand knowledge? Hey, what farm can we go to? How can we see this? Can we take a field trip? We're limited in the number of field trips we can take…We have a nice sprawling campus where we can see fields, but the interaction between the farmers and the actual people there is pretty well limited. But I think that firsthand interaction, speakers, availability of the actual industry itself, that's limiting. (Connor, interview)

Theme 2: Resources

The second theme that arose was that teachers want resources from agricultural organizations to help teach agriculture in their classrooms. Many teachers suggested that resources should be created to include readily available materials and funding should be given to support teachers incorporating agricultural lessons and projects in their curriculum.

Jillian, one of the interviewees, explained how she is hesitant to use lesson plans that require a lot of materials or hard-to-find materials:

> I guess with like hands-on activities, using things that are easy to come by. Things that we already have at school like construction paper or scissors and glue. Just easy things to get a hold of because anytime I see a lesson plan with lots of supplies, I'm going to be I don't have time to go get all those things. (Jillian, interview)

Another teacher explained that since teachers are already limited on time if agricultural organizations provided resources with accessible materials, more teachers would use them:

> Because I think that's the struggle for a lot of people, is that they feel like they don't have time to plan a whole lesson and figure out what items they need and put all of the pieces together. Those that are already there and ready-made make a world a difference for people. (Kimberly, interview)

Many of the teachers we interacted with shared that a barrier they faced in teaching agriculture was having the funds to incorporate hands-on agricultural experiences and projects into the curriculum. In our survey, one teacher wrote, "I would love to be able to do hands-on experiences more but funds are a struggle."

In an interview with Tara, she discussed how her class received a field trip grant from an agricultural organization to visit that organization's office and farms She states that she would like to take her students on similar field trips if more grants were available:

> Probably those kinds of experiences like … we're going to have an open house this date, if you can bring your kids here, or even funds that help us get kids there. I think transportation is our biggest barrier…And the school district says we can have one field trip per school year…Our school districts can't afford to pay for [multiple field trips]. (Tara, interview)

Conclusions and Recommendations

From the teachers who participated in our study, three themes emerged regarding their motivation to teach about agriculture. Teachers shared that they teach agriculture because it is important for students to understand the impact agriculture has on their lives, agriculture is related to the content they teach, and their school is a part of an agricultural community. These results parallel the existing literature that teachers understand their role in educating their students about agriculture (Trexler et al., 2000) as well as the opportunities it brings for their students' learning and skill-building for future careers (Knobloch & Martin, 2002). Additionally, agricultural concepts can be used to enhance the curriculum (Knobloch, 2008), serve as a context for class content (Mabie & Baker, 1996), and provide real-life examples for students (Vallera & Bodzin, 2016).

One theme that offered new insight was that many teachers cited their school's urban or rural location as a major factor in their decision to teach agriculture. Because of this, learning about agriculture is important for students to understand their surroundings and be informed about their community. This theme relates to our theoretical framework: teachers' experiences and beliefs influence their teaching content (Winther et al., 2002; Yang, 2023).

Results detailing barriers to teaching agriculture in elementary school are consistent with prior research. Those barriers are the time it takes to plan and teach about agriculture (Bellah & Dayer, 2009), schools' focus on standardized testing content (Trexler, 2000), the need for additional resources (Burrows et al., 2020), and low levels of teacher self-efficacy related to teaching agriculture (Knobloch, 2003).

In our interviews, teachers discussed what they suggest agricultural organizations can do to help teachers integrate agriculture into their curriculum. From this, two themes were found: increasing agricultural-related connections and providing supplemental resources. The need for more resources that teachers expressed align with the barriers found by Trexler and Heinze (2001) and Trexler and Hikawa (2001). However, the theme of wanting connections to agricultural professionals is a new request that had not been found in previous literature.

We found similar themes to Knobloch et al. (2003) that teachers are motivated to teach about agriculture because they see how it benefits their students. Our results support the themes in Knobloch et al. (2003) that agriculture easily fits into other class content, helps students connect class content to real-life examples, and is used as a context for class content. Our study found that teachers' personal experience in the agriculture industry plays a role in influencing their choice to integrate agriculture into their curriculum.

The four themes we found regarding the barriers that teachers face align with the challenges that arose in the Knobloch et al. (2003) study. Both studies reveal that teachers struggle to adjust their class schedules to accommodate agricultural lessons., They also find it challenging to focus on topics other than those included in standardized tests. Additionally, in both studies, teachers recognized their need for resources to help them with agricultural instruction and improve their knowledge of agriculture. The barrier of inadequate resources supports the creation of additional agricultural resources for teachers.

Limitations

Our study is a sample of teachers who have already expressed interest in learning more about agriculture and implementing agricultural content in their classrooms, as all had recently attended an Illinois Ag in the Classroom training. This study should not be generalized to reflect the thoughts or feelings of teachers outside the study; however, it does provide context for teachers who have already determined that they can implement agricultural topics in their classrooms while continuing to teach other subjects. Understanding how agricultural literacy has been successfully implemented in different classrooms offers valuable insights and suggestions for other teachers, specifically those who have not yet decided to integrate agriculture into their curriculum.

Recommendations

Agricultural literacy professionals should continue to promote agricultural education, provide resources for agriculture education, and connect with teachers to assist them. Teachers in our study requested a need for new and updated resources to use in their classrooms, not necessarily new curricula. Teachers discussed adapting curriculum and resources to fit their needs. If teachers can understand the agricultural content, they can add it to their existing curriculum and supplement their standards-based lessons with agricultural topic areas.

Teachers also desired additional connections to agricultural professionals within their communities. Ag literacy programs can serve as a liaison to connect local agricultural professionals to teachers, both of whom share an interest in educating students on agriculturally related topics. However, agricultural literacy programs must also consider that the local agricultural professionals may need training in youth developmental principles in order to successfully interact and connect with the youth audience. Introducing students to potential agricultural careers could be a secondary outcome of partnerships between schools and agricultural industries.

As the need to improve agricultural literacy continues to grow, perhaps the path forward is not just promoting agriculture content and curriculum but also providing teacher training on agriculture issues that encourages and empowers them to bring these topics into their classrooms. Teachers make time for what they think is important. Supporting teachers in altering their schemas around agricultural literacy and helping them understand why agricultural literacy impacts the lives of their students may provide them with the encouragement they need to add agricultural content in the classroom outside of just piloting a new curriculum.

References

Allen, C. A., & Harper, J. (2002). *Impacts of agricultural literacy programs on the perceptions of Illinois elementary and junior high school teachers towards the agriculture industry.* Illinois State Board of Education and Facilitation Coordination in Agricultural Education. https://www.agliteracy.org/research/influential/

Ball, C., Huang, K., Cotton, S. R., Rikard, R. V., & Coleman, L. O. (2016). Invaluable values: an expectancy-value theory analysis of youths' academic motivations and intentions. *Information, Communication & Society, 19*(5), 618–638. https://doi.org/10.1080/1369118X.2016.1139616

Bellah, A. K., & Dyer, J. E. (2009). Attitudes and stages of concern of elementary teachers toward agriculture as a context for teaching across grade level content area standards. *Journal of Agricultural Education, 20*(2), 12–25. https://doi.org/10.5032/jae.2009.02012

Brandt, M., Forbes, C., & Keshwani, J. (2017). Exploring elementary students' scientific knowledge of agriculture using evidence-centered design. *Journal of Agricultural Education, 58*(3), 134–149. https://doi.org/10.5032/jae.2017.03134

Burkholder, G.J., Cox, K.A. Crawford, L.M. & Hitchcock, J.H. (eds.) (2020). *Research design and methods: An applied guide for the scholar-practitioner.* Sage Publishing.

Burrows, M., Sorensen, T., & Spielmaker, D. (2020). Assessing the acceptance of incorporating agriculture into elementary school curriculum. *Journal of Agricultural Education, 61*(2), 358–370. https://doi.org/10.5032/jae.2020.02358

Clemons, C., Linder, J. R., Murray, B., Cook, M. P., Sams, B., & Williams, G. (2018). Spanning the gap: The confluence of agricultural literacy and being agriculturally literate. *Journal of Agricultural Education, 59*(4), 238–252. https://doi.org/10.5032/jae.2018.04238

Cosby, A., Manning, J., Power, D., & Harreveld, B. (2022). New decade, same concerns: A systematic review of agricultural literacy of school students. *Education Sciences, 12*(4), 235. https://doi.org/10.3390/educsci12040235

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132. https://doi.org/10.1146/annurev.psych.53.100901.135153

Frick, M. J., Miller, W. W., & Kahler, A. A. (1991). Agricultural literacy: A framework for communicating to the public sector. *Journal of Applied Communications, 75*(2), 1–9. https://doi.org/10.4148/1051-0834.1501

Hess, A. J., & Trexler, C. J. (2011). A qualitative study of agricultural literacy in urban youth: Understanding for democratic participation in renewing the agri-food system. *Journal of Agricultural Education, 52*(2), 151–162. https://doi.org/10.5032/jae.2011.02151

Horn, J. & Vining, B. (1986). *An assessment of students' knowledge of agriculture*. Kansas State University, Center for Extended Services and Studies, College of Education.

Knobloch, N. A. (2008). Factors of teacher beliefs related to integrating agriculture into elementary school classrooms. *Journal of Agriculture, Food, and Human Values Society*, *25,* 529–539. https://doi.org/10.1007/s10460-008-9135-z

Knobloch, N. A., & Ball, A. (2003). *An examination of elementary teachers' and agricultural literacy coordinators' beliefs related to the integration of agriculture.* Illinois State Board of Education

Knobloch, N. A., Ball, A. L., & Allen, C. (2007). The benefits of teaching and learning about agriculture in elementary and junior high schools. *Journal of Agricultural Education, 48*(3), 25–36. https://doi.org/10.5032/jae.2007.03025

Knobloch, N. A., & Martin, R. A. (2002). Factors influencing the integration of agriculture into the elementary school curriculum: Relevance, value, fit, and perceptions. *Proceedings of the annual meeting of the AAAE Central Region Agricultural Education Research Conference*, 219–230.

Knobloch, N. A. & Van Tine, J. L. (2004). *Elementary students outcomes of a year-long agricultural and environmental literacy unit.* Illinois State Board of Education and Facilitating Coordination in Agricultural Education. https://www.agliteracy.org/research/influential/

Kovar, A. K. & Ball, A. L. (2013). Two decades of agriculture literacy research: A synthesis of the literature. *Journal of Agricultural Education, 54*(1), 167–178. https://doi.org/10.5032/jae.2013.01167

Kuhn, C., Hagenauer, G., & Groschner, A. (2022). Because you always learn something new yourself! An expectancy-value-theory perspective on mentor teachers' initial motivations. *Teaching and Teacher Education, 113,* https://doi.org/10.1016/j.tate.2022.103659

Mabie, R. & Baker, M. (1996). A comparison of experiential instructional strategies upon the science process skills of urban elementary students. *Journal of Agriculture Education, 37*(2), 1–7. https://doi.org/10.5032/jae.1996.02001

Meischen, D. L. & Trexler, C. J. (2003). Rural elementary student's understandings of science and agricultural education benchmarks related to meat and livestock. *Journal of Agricultural Education, 44*(1), 43–55. https://doi.org/10.5032/jae.2003.01043

National Research Council. (1986). *Understanding agriculture: New directions for education.* The National Academies Press.

Piaget, J. (1952). *The origins of intelligence in children.* (M. T. Cook, Ed.). International University Press. https://doi.org/10.1037/11494-000

Powell, D., Agnew, D., & Trexler, C. (2008). Agriculture literacy: Clarifying a vision for practical application, *Journal of Agricultural Education, 49*(1), 85–98. https://doi.org/10.5032/jae.2008.01085

Trexler, C. J., Hess, A. J., & Haynes, K. N. (2013). Urban elementary students' conceptions of learning goals for agriculture science and technology. *Natural Sciences Education, 42*(1), 49–59. https://doi.org/10.4195/nse.2013.0001

Trexler, C. J., Johnson, T., & Heinze, K. (2000). Elementary and middle school teacher ideas about the agri-food system and their evaluation of the agri-system stakeholders' suggestions for education. *Journal of Agricultural Education, 41*(1), 30–38. https://doi.org/10.5032/jae.2000.01030

Trexler, C. J. & Hikawa, H. (2001). Elementary and middle school agriculture curriculum development: An account of teacher struggle at countryside charter school. *Journal of Agricultural Education, 42*(3), 53–63. https://doi.org/10.5032/jae.2001.03053

Trexler, C. J. & Suvedi, M. (1998). Perception of agriculture as a context for elementary science teaching: A case of change in Sanilac County, Michigan. *Journal of Agricultural Education, 39*(4), 28–36. https://doi.org/10.5032/jae.1998.04028

Winther, A. A., Volk, T. L., & Shrock, S. A. (2002). Teacher decision making in the 1st year of implementing an issues-based environmental education program: A qualitative study. *The Journal of Environmental Education, 33*(3), 27–33. https://doi.org/10.1080/00958960209600812

Vallera, F. L. & Bodzin, A. M. (2016). Knowledge, skills, or attitudes/beliefs: The contexts of agricultural literacy in upper-elementary science curricula. *Journal of Agricultural Education, 57*(4), 101–117. https://doi.org/10.5032/jae.2016.04101

Yang, J. (2023). The use of schema theory in the teaching of reading comprehension. *Journal of Education and Educational Research, 4*(1), 59–61. https://doi.org/10.54097/jeer.v4i1.10032