Student Interest in the National Council for Agricultural Education Career Pathways

Abstract

This study describes student interest in the agricultural content pathways established by the National Council for Agricultural Education. Differences exist between male and female students concerning curriculum choices in agriculture, food, and natural resources. Male students were most interested in food products and processing systems, while females averaged the highest interest in animal systems. Females were significantly more interested in animal systems. Males were more interested in power, structural, and technical systems, biotechnology, food products and processing, and agribusiness systems. When considering the students' race and ethnic background, Native Americans or Alaska Natives reported the most interest in animal systems. Asian students reported the highest interest in natural resource systems. African American students averaged the highest interest in power, structural and technical systems. White Non-Hispanic students reported the highest interest in animal systems. White Hispanic students reported the highest average interest in natural resources. White Non-Hispanic students were significantly more interested in agribusiness systems, animal systems, food products, and processing systems than were African American students. Native American or Alaskan Native students were significantly more interested in animal systems than African American students. This study concluded that male and female students value agricultural curriculum content differently and that the differences were significant in most agricultural content pathways. Students of different races and ethnic backgrounds value agricultural content pathways differently, but most of these differences were insignificant.

Keywords: student; interest; agricultural; education; career pathways

Introduction

There are more jobs available in agriculture in the United States than there are qualified people to fill them (Daynard, 2010). Of the college graduates seeking employment in food, agriculture, renewable resources, and the environment each year in the United States, only 61% will come from degree programs in food, agriculture, renewable resources, and the environment (Fernandez et al., 2020). High school students cite the lack of interest in agriculture and having other career interests as reasons not to go into the field (Daynard, 2010; Smith & Baggett, 2012). On closer examination, it appears that part of the problem with finding enough people to fill jobs in the agriculture industry is in the industry's ability to recruit under-represented groups of people for those jobs. Agricultural education has also struggled to enhance diversity within the profession. This lack of diversity exists at every level of agricultural education, from student enrollment in secondary agricultural education programs to faculty and staff at post-secondary institutions (LaVergne et al., 2011).

One strategy to improve recruitment into agricultural careers is for agricultural education programs to gear recruiting practices toward specific content areas of interest, and not agriculture in general (Lingenfelter & Beierlein, 2006). Teachers cannot maximize this strategy until student interest in the particular content areas is better understood. Of the over 11,000 agriculture teachers in the United States, "92 percent offer agriscience; 71 percent offer advanced agriscience and biotechnology; 59 percent offer agricultural mechanics; 49 percent offer horticulture; 43 percent offer animal science; and 24 percent offer environment-related [curriculum]" (National FFA Organization, 2023). The range of offerings and their respective percentages suggest that some students may not receive a curriculum relevant to their preferred career pathway.

Participation by Females and Under-Represented Students in Agriculture

Women's career aspirations have evolved over the last 100 years, resulting in increased interest and participation in career and technical education (Domenico & Jones, 2007). Some of the earliest efforts in agricultural education made no distinction between educational opportunities for males and females. For example, the school gardens movement of the late 1800s and early 1900s placed boys and girls side by side in instructional activities designed to increase their knowledge of plants and the environment (Kohlstedt, 2008). With the National FFA Organization's official acceptance of females as members in 1969 (National FFA Organization, 2022), females have taken a more prominent role in agricultural education courses, significantly closing the gender gap in these courses (Liu & Burns, 2020). Even so, the agricultural education curriculum may not sufficiently address career opportunities for females (Bell & Fritz, 1992). While statistical trends point toward closing the gender gap in agricultural education, the gap remains.

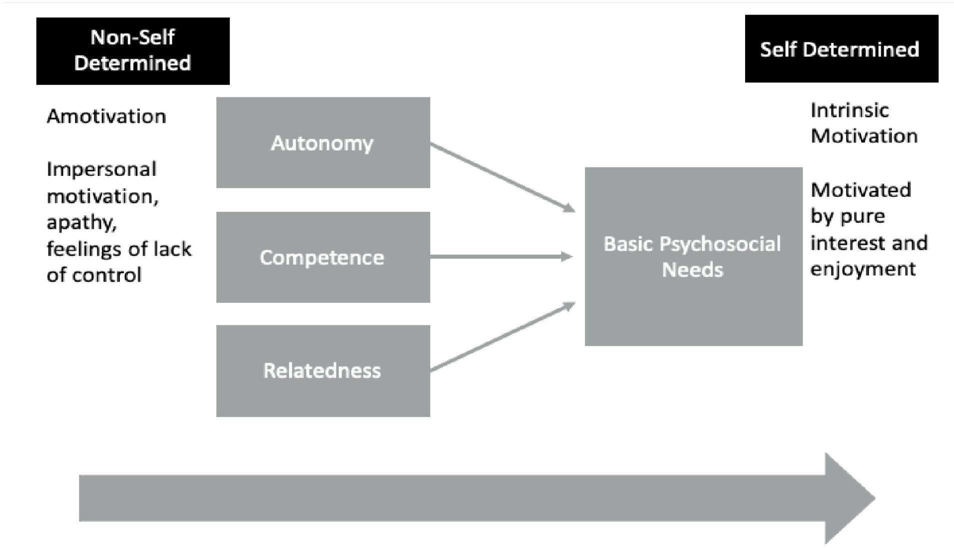
For under-represented students, having a deep understanding of the course content and an opportunity to practice skills in an authentic career-focused setting strongly influenced their decisions to pursue agricultural careers. Minority students want to experience actual working conditions, skill development, and decision-making (W. A. Jones & Larke, 2003). Until the curriculum meets these conditions, minority students may be less likely to envision themselves pursuing agricultural careers (Talbert & Larke, 1995).

Theoretical Framework

Recruiting and retaining students in agricultural education is based partly on how motivated the students are to enroll in and remain engaged in agricultural education courses. We framed our study around the Self-Determination Theory developed by Deci and Ryan (2000), as illustrated in Figure 1. The central tenet of Self-Determination Theory (SDT) is that human motivation depends on autonomy, relatedness, and competence. Autonomy is the freedom a person experiences when empowered to make their own choices. Relatedness is the desire to relate to and interact with others in activities of mutual interest. Competence is a person's preference to master a skill or concept. SDT proposed that as a person's psychosocial needs are met, they tend to be intrinsically motivated and engage in learning out of pure interest and curiosity (Cook & Artino, 2016). According to Deci and Ryan (2000), SDT "it is part of the adaptive design of the human organism to engage in interesting activities, to exercise capacities, to pursue connectedness in social groups, and to integrate intrapsychic and interpersonal experiences into a relative unity" (p. 229).

Figure 1

An Illustrated Framework Adapted from Self-Determination Theory (Ryan & Deci, 1980)



Research studies that applied SDT in school settings report optimal performance results when actions are motivated by intrinsic interests (Cook & Artino, 2016). Ryan and Deci (2009) proposed that students learn better when schools allow their natural desires to grow and flourish. Interest is a powerful component of motivation and engagement, and students need to focus on activities that interest them to nourish self-motivation (Caine & Caine, 1991; Renninger & Hidi, 2016).

Applications of Self-Determination Theory in Agricultural Education

Studies on student motivation in agricultural education touch upon Self-Determination Theory in part or whole. Sutphin and Newsom-Stewart (1995) found that when considering academic enhancement motivators for studying agriculture in high school, satisfying interest was one of the most popular reasons given by students. Student interest in agriculture education has also been identified as a concern for agriculture educators below the high school level. Williamson et al. (2020) found that students' levels of interest and involvement were often the most concern to middle school agriculture teachers.

Beyond simply describing student interest in the content areas, agricultural education benefits from comparing the interest of students from different demographics. Agricultural education has long had a lack of diversity at nearly every level within agricultural education, from student enrollment in secondary agricultural education programs to faculty and staff at post-secondary institutions (LaVergne et al., 2011).

The Agriculture, Food & Natural Resources Career Areas

In 2015, the National Council for Agricultural Education (NCAE) created standards for delivering high-quality instruction in agriculture, food, and natural resources to increase the workforce readiness of high school graduates (Talbert et al., 2022**)**. The NCAE was established in the early 1980s as a consortium of national organizations that conduct agricultural education activities, for the purpose of providing leadership for strategic priorities mutually beneficial to the organizations and their stakeholders (National Council for Agricultural Education, 2023). The NCAE categorized standards into the following eight pathways:

1. Agribusiness Systems
2. Animal Systems
3. Biotechnology Systems
4. Environmental Service Systems
5. Food Products & Processing Systems
6. Natural Resources Systems
7. Plant Systems
8. Power, Structural & Technical Systems

(National Council for Agricultural Education, 2015)

The NCAE developed these curriculum standards and their respective pathways to reflect the most current knowledge and skills needed by students entering the modern agricultural workforce. Agricultural educators use the pathways to organize and deliver systematic instruction and structure learning experiences delivered through participation in the FFA organization and through supervised agricultural experience (National Council for Agricultural Education, 2015). We used these pathways to organize a review of the literature for this study.

Student Interest in the Agricultural Content Areas by Gender, Race, and Ethnicity

Gender can predict different content areas of agricultural interest (Bickel et al., 2015). For example, Bickel et al. (2015) found that girls were more interested in boys in the areas of animal husbandry, fruit and vegetable production, and food processing, while boys expressed more interest than girls in agricultural engineering. Of the predictors Bickel et al. (2015) analyzed, "Gender was found to be the strongest predictor of interest specificities in four of the five content areas" (p. 337).

Agribusiness Systems

In a study on the entrepreneurial interest of university agribusiness students, Higgins et al. (2018) determined that entrepreneurial-minded students were more likely to be male. Since studies in agribusiness were limited, we turned to literature about student interest in business beyond the sector of agriculture to have some idea of student interest in this content area. One study concerned with student interest in business as a major revealed male and female students had similar levels of interest (Zhou, 2013). Similarly, Devecchio et al. (2001) found that African American students and Caucasian students did not differ significantly in their interest in various business careers.

Animal Systems

Girls expressing more interest in animals than boys is a trend in the research. Several studies found that girls preferred a curriculum rich in animal science content (M. G. Jones et al., 2000; Wandersee, 1986). Desy et al. (2011) discovered that the veterinary field was reported in the top ten career interests and expected college majors of middle and high school females.

Biotechnology Systems

Weber & Custer (2005) concluded that middle school and high school students were least interested in topics related to biotechnology and further concluded that students are reluctant to expand their interest in biotechnology. Kidman (2010) found that students and teachers could not agree on the most exciting aspects of biotechnology.

Environmental Service Systems and Natural Resources Systems

Zhou (2013) found that female students were less likely to be interested in a degree in environmental and natural resources than male students. Hager et al. (2007) wrote of an interesting discrepancy in this content area. Though high school students reported an increased interest in environmental and natural resources issues, this did not translate into an interest in a career in the field (p. 97-98). Maughan et al. (2001) wrote, "we believe there is substantial interest in natural resources in the minority community, but there are limited sources from which potential students can find out about professional opportunities" (p. 922). This is one of the few possible explanations proposed in the research for the lower minority participation than their interest would reflect. Desy et al. (2011) wrote that fish and wildlife was a top ten career interest among high school boys, but this area did not make an appearance on the girls' list.

Food Products and Processing Systems

Bickel et al. (2015) found that girls were more interested in food processing than boys. Balschweid et al. (1997) found that teachers perceived students as most interested in animals and crops, followed by food processing.

Plant Systems

One study (Strgar, 2007) examined the student interest in plants at the elementary, secondary, and post-secondary levels. If given a choice between the two, students prefer animals more than plants in the curriculum (Strgar, 2007). Fifth-grade students expressed the highest interest in plants. In contrast, middle-school students rated it the least interesting of the age groups in the study. Hammann et al. (2020) wrote that student interest in plants is lacking. Pany (2014) found little significant gender difference in interest in plants, except that female students expressed more interest in ornamental plants.

Power, Structural, and Technical Systems

Desy et al. (2011) found that mechanics made it into the top ten expected college majors of male students in both middle and high school, but it does not appear among female students' top ten at either school level. Davis and Chumbley (2020) echoed the trend of male students being more interested in agricultural technology and mechanical systems than female students based on their interest in the career development events administered by the National FFA Organization.

There has been research into student interest in agriculture in general and the content areas within agriculture. However, the content areas examined in prior literature did not include data on student demographics that are of interest to this study. Further, the literature base is lacking in studies that examine student interest in the eight agricultural content pathways developed by the National Council for Agricultural Education.

Objectives of the Study and Methodology

This study assessed the interest of high school students in the eight career pathways of study outlined by the National Council for Agricultural Education (2015). This project aligns with the national research agenda of the American Association for Agricultural Education; research priority area 5-agricultural education, research question 2: What methods, models, and programs are effective in communicating with diverse audiences? (Roberts et al., 2016). The primary research objectives were to:

1. Describe student interest in each agriculture pathway.
2. Describe student interest in each agriculture pathway by gender, race, and ethnicity.

The cross-sectional design of this study intended to yield descriptive and comparative data. According to Creswell and Creswell (2017), it was best suited to a quantitative approach, specifically by designing a questionnaire. We selected a web-based questionnaire as the data collection method due to restrictions because of the COVID-19 pandemic.

We developed the Agricultural Content Area Interest Inventory, adapted from Walker and Stevens' (1971) Applied Biological and Agricultural Interest Inventory and Bennett's (1990) Revised Applied Biological and Agribusiness Interest Inventory, adding new items to cover a broader range of topics in the NCAE standards. There were ten questions for each content area in the inventory, totaling 80 items in the instrument, not including the demographic items. To ensure the content validity of the instrument's items, we referred directly to NCAE's standards and descriptions outlined within the pathway. The language used to create the items was pulled directly from the NCAE content standards. We consulted Dillman et al. (2014) in constructing the instrument and used the same Likert-type scale used by Walker and Stevens (1971) and Bennett (1990), ranging from "strongly dislike" to "strongly like." These questions were then randomized and input into Qualtrics. We followed these questions with those that asked students to identify gender, race and ethnicity, and community type.

We sent the agricultural interest inventory to a sample of students from a high school in Georgia for the pilot study. According to Johanson and Brooks (2010), 30 is the minimum number of participants for a preliminary survey. In total, 53 students participated in the pilot study. All content areas had a Cronbach's alpha coefficient of $\alpha = 0.817$ or above, which indicates high reliability ($\alpha = 0.70$ or above). All 80 items in the survey instrument had a Cronbach's alpha $\alpha = 0.978$, again indicating high reliability. Figure 1 illustrates the format for items on the online survey instrument and provides examples of the instrument's items.

Figure 1

Example items from the online survey instrument.


Read each statement carefully, and tell how you feel about the activity that it describes.

	Strongly Dislike	Dislike	Undecided	Like	Strongly Like
Improve forest habitats	○	○	○	○	○
Create a business plan for an agribusiness	○	○	○	○	○
Conduct taste tests on new food products	○	○	○	○	○
Learn how to identify ornamental plants	○	○	○	○	○
Learn about potential hazards in food production	○	○	○	○	○
Develop a landscape plan	○	○	○	○	○

Subject Selection and Data Collection

The population for this study was high school students enrolled in an agriculture course in Georgia schools during the spring semester of 2021. Using Cochran's (1977) formula for determining the sample of an unknown population, the researchers determined that 384 students were the recommended sample size. We selected schools from the Georgia agricultural education chapter and school directory (Georgia FFA, n.d.). In preparation for the stratified random sample selection, each school was listed alphabetically within its region and assigned a number. We randomly selected five schools from each region and requested participation from an agriculture teacher at each school.

We sent the inventory to participating agriculture teachers via a Qualtrics link, who administered it to students in their agriculture classes. Teachers were asked to return their results within 14 days. This instrument was distributed while school systems were still adjusting operations due to the COVID-19 pandemic. The school's required COVID-19 operating procedures were why most of the contacted teachers declined to participate. Five agriculture teachers (16.7% of those contacted) agreed to participate. As it became increasingly apparent that many school districts were not allowed to participate in research due to pandemic restrictions, it was determined that reaching 384 students would not be feasible. Data analysis began after collecting data from 99 high school students. Using methods recommended by Lindner et al. (2001), respondents were compared to non-respondents based on known demographic variables, and we noted no differences.

Data Analysis

The ten instrument items under each pathway construct were averaged to determine students' interest in each pathway. We calculated the standard deviations to show variability among responses within the pathways. The answers for all 80 inventory items were averaged together to determine students' interest in agriculture overall. We calculated frequencies and percentages of demographic responses. Likert scales are typically considered ordinal data. However, if the scale has more than four ordinal indicators, it can be used as continuous data (Johnson & Creech, 1983; Norman, 2010), so we used the calculated measures for each construct as continuous when analyzing collected data. Means were calculated following a reliability check using Cronbach's alpha to indicate adequate consistency of responses within constructs. Where measures of statistical significance were required, we fixed the *a priori* threshold at $p \leq .05$.

Findings

Of the participants (n=99) in this study, 45 identified as male (45.5%), and 43 identified as female (43.4%), four students preferred not to answer (4%), and seven students left this question blank (7.1%). Three participants were Native American or Alaska Native (3%), two were Asian (2%), seven were Black or African American (7.1%), 66 were White, Non-Hispanic (66.7%), nine were White, Hispanic (9.1%), two were from multiple races (2%), three preferred not to answer (3%), and seven left this question blank (7.1%).

Objective 1: Describe Student Interest in Each Agricultural Pathway

Students were asked to express their preference for 80 learning activities. These activities each aligned with one of the agricultural career pathways outlined by the National Council for Agricultural Education. There were ten items summated to develop a construct based on each pathway. Students rated their interest on a Likert scale (1 = strongly dislike to 5 = strongly like).

As shown in Table 1, The average interest of students in agribusiness systems was 3.34 (SD = 0.76). Within the pathway, students reported the highest interest in the activities, *learn how to manage a budget* (M = 3.79, SD = 1.11) and *talk with people about agriculture* (M = 3.68, SD = 0.86). They reported the slightest interest in the activities to *be a leader in agriculture* (M = 3.15, SD = 1.17) and *create a business plan for an agribusiness* (M = 3.15, SD = 1.13). Cronbach's alpha for the overall construct was α = 0.87, indicating that the items could be averaged together as they consistently measured one thing.

Table 1

The Interest of Students in the Agribusiness Systems Pathway

Item	***M1***	***SD***
Learn how to manage a budget	3.79	1.11
Talk with people about agriculture	3.68	0.86
Manage inventory at a flower shop	3.51	1.18
Design displays or exhibits about agriculture	3.40	1.04
Follow international events	3.25	1.03
Be an entrepreneur in agriculture	3.24	1.14
Sell lawn and garden equipment	3.15	1.24
Design an advertisement for an agricultural product	3.15	1.20
Be a leader in agriculture	3.15	1.17
Create a business plan for an agribusiness	3.15	1.13
Agribusiness Systems Total	3.34	0.76

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

The average interest of students in animal systems was 3.70 (*SD* = 0.61). Students indicated the highest interest in the activities *care for sick animals* (*M* = 4.24, *SD* = 0.98) and *brush an animal* (*M* = 4.19, *SD* = 1.00). They indicated the lowest interest in the activities *watch honeybees at work* (*M* = 3.38, *SD* = 1.22) and *create a nutrition plan for livestock* (*M* = 3.34, *SD* = 1.03). Cronbach's alpha for the animal systems construct was $\alpha = 0.78$ (see Table 2).

Table 2

The Interest of Students in the Animal Systems Pathway

Item	***M1***	***SD***
Care for sick animals	4.24	0.98
Brush an animal	4.19	1.00
Watch a baby chick hatch from an egg	4.12	0.92
Learn about veterinary treatments	3.83	1.01
Design an animal facility	3.73	1.00
Milk cows	3.59	1.14
Create a biosecurity plan for livestock	3.52	1.02
Attend a livestock sale	3.39	1.17
Watch honeybees at work	3.38	1.22
Create a nutritional plan for livestock	3.34	1.03

Table Continued

Animal Systems Total	3.70	0.61

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

As indicated in Table 3, the average interest of students in biotechnology systems was 3.39 (*SD* = 0.62). Students showed the most interest in the activities *design your own experiment* (*M* = 3.60, *SD* = 1.10) and *extract and purify DNA* (*M* = 3.54, *SD* = 1.10). They indicated the least interest in *learning about the history of agricultural innovations* (*M* = 2.88, *SD* = 1.20) and *use the scientific method to solve agricultural problems* (*M* = 2.88, *SD* = 1.17). Cronbach's alpha for the biotechnology construct was $\alpha = 0.814$.

Table 3

The Interest of Students in the Biotechnology Systems Pathway

Item	***M1***	***SD***
Design your own experiment	3.60	1.06
Extract and purify DNA	3.54	1.10
Study heredity	3.51	0.93
Understand animal growth hormone effects	3.48	0.87
Study plant/animal cell structure	3.47	1.07
Conduct field trials with a genetically modified species	3.44	1.01
Grow plants from tissue cultures	3.34	0.95
Learn about genetic engineering	3.27	1.13
Learn about the history of agricultural innovations	3.08	1.20
Use the scientific method to solve agricultural problems	2.88	1.17
Biotechnology Systems Total	3.39	0.62

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Table 4 shows that the average interest of students in environmental service systems was 3.48 (*SD* = 0.72). Students indicated the highest interest in the activities *help protect our environment* (*M* = 4.30, *SD* = 0.82) and *protect lakes, streams, and rivers from pollution* (*M* = 4.08, *SD* = 0.87). Students indicated the lowest interest in the activities *learn about soil conservation* (*M* = 3.06, *SD* = 1.06) and *learn about environmental advocacy* (*M* = 2.94, *SD* = 1.04). Cronbach's alpha for the environmental service systems construct was $\alpha = 0.904$.

Table 4

The Interest of Students in the Environmental Service Systems Pathway

Item	***M1***	***SD***
Help protect our environment	4.30	0.82
Protect lakes, streams, and rivers from pollution	4.08	0.87
Work to protect biodiversity	3.62	0.93
Learn how to conserve energy use	3.46	1.07
Become involved in environmental decision-making	3.44	1.04
Prevent soil erosion	3.26	1.02
Assess the effectiveness of environmental regulation	3.21	1.00
Learn how to use environmental monitoring instruments	3.18	1.04
Learn about soil conservation	3.06	1.06
Learn about environmental advocacy	2.94	1.04
Environmental Service Systems Total	3.48	0.72

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

As shown in Table 5, the average interest of students in food products and processing was 3.49 (*SD* = 0.75). Students indicated the highest interest in the activities *learn how to make ice cream* (*M* = 4.26, *SD* = 0.96) and *conducting taste tests on new food products* (*M* = 3.98, *SD* = 1.04). Students indicated the lowest interest in the activities *learn about food packaging* (*M* = 3.18, *SD* = 1.06) and *identify different food market demands* (*M* = 3.08, *SD* = 1.09). Cronbach's alpha for the food products and processing systems construct was $\alpha = 0.891$.

Table 5

The Interest of Students in the Food Products and Processing Systems Pathway

Item	***M1***	***SD***
Learn how to make ice cream	4.26	0.96
Conduct taste tests on new food products	3.98	1.04
Learn about potential hazards in food production	3.55	1.04
Understand food labels	3.48	1.02
Cut up meat	3.36	1.22
Evaluate food products	3.34	1.05
Design new food products	3.33	1.07
Learn about consumer food preferences	3.20	1.04
Learn about food packaging	3.18	1.06

Table Continued

Identify different food market demands	3.08	1.09
Food Products and Processing Systems Total	3.49	0.75

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Table 6 shows that the average interest of students in natural resource systems was 3.60 (*SD* = 0.67). Students indicated the highest interest in the activities *manage an area for wildlife* (*M* = 4.07, *SD* = 0.92) and *improve forest habitats* (*M* = 4.03, *SD* = 0.81). They indicated the lowest interest in the activities *determine the value of a forest* (*M* = 3.14, *SD* = 1.07) and *devise a soil management plan* (*M* = 2.87, *SD* = 0.99). Cronbach's alpha for the natural resource systems construct was $\alpha = 0.873$.

Table 6

The Interest of Students in the Natural Resource Systems Pathway

Item	***M1***	***SD***
Manage an area for wildlife	4.07	0.92
Improve forest habitats	4.03	0.81
Plant a tree	4.03	0.91
Identify wildlife species of birds, mammals, and reptiles	3.81	0.99
Work to remove invasive species from an ecosystem	3.66	0.87
Assess the population of White-tailed deer in your area	3.61	1.10
Study ponds and lakes	3.45	1.13
Name the trees in the woods	3.33	1.20
Determine the value of a forest	3.14	1.07
Devise a soil management plan	2.87	0.99
Natural Resource Systems Total	3.60	0.67

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

As shown in Table 7, students' average interest in plant systems was 3.49 (*SD* = 0.81). Students indicated the highest interest in the activities *grow a vegetable garden* (*M* = 3.94, *SD* = 1.10) and *grow plants in water* (*M* = 3.92, *SD* = 1.00). They indicated the least interest in the activities *monitor a plant's growth* (*M* = 3.39, *SD* = 1.14) and *manage turf grass for a golf course* (*M* = 2.78, *SD* = 1.14). Cronbach's alpha for the plant systems construct was $\alpha = 0.908$.

Table 7

The Interest of Students in the Plant Systems Pathway

Item	M[1]	SD
Grow a vegetable garden	3.94	1.10
Grow plants in water	3.92	1.00
Arrange flowers	3.67	1.14
Work with plants and trees	3.62	1.11
Prepare soil for planting a crop	3.48	1.10
Learn how to identify ornamental plants	3.45	1.11
Identify plant disorders and diseases	3.45	1.05
Develop a landscape plan	3.44	1.13
Monitor a plant's growth	3.39	1.14
Manage turf grass for a golf course	2.78	1.14
Plant Systems Total	3.49	0.81

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Table 8 shows that the average interest of students in power, structural and technical systems was 3.37 (SD = 0.86). Students indicated the most interest in the activities *build a birdhouse* (M = 4.06, SD = 0.94) and *learn how to weld* (M = 3.77, SD = 1.31). Students indicated the least interest in the activities *draw plans for a building* (M = 3.05, SD = 1.13) and *learn about building codes* (M = 2.95, SD = 1.16). Cronbach's alpha for the power, structural, and technical systems construct was α = 0.893.

Table 8

The Interest of Students in the Power, Structural, and Technical Systems Pathway

Item	*M1*	*SD*
Build a birdhouse	4.06	0.94
Learn how to weld	3.77	1.31
Work with hand tools	3.70	1.24
Check the oil in an engine	3.56	1.23
Calculate the cost of building materials	3.29	1.23
Wire an electrical plug	3.17	1.31
Learn how to use geospatial technology (i.e., GPS, GIS)	3.15	1.09
Help repair a lawn mower engine	3.15	1.36
Draw plans for a building	3.05	1.14
Learn about building codes	2.95	1.16

Table Continued

Power, Structural, and Technical Systems Total	3.37	0.860

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Overall, students indicated the highest interest in animal systems (*M* = 3.70, *SD* = 0.61), followed by natural resource systems (*M* = 3.60, *SD* = 0.67). Students indicated the lowest interest in agribusiness systems (*M* = 3.34, *SD* = 0.76) and power, structural and technical systems (*M* = 3.37, *SD* = 0.86) (See Table 9).

Table 9

The Interest of Students in Each Agricultural Pathway

Pathway	***M1***	***SD***
Animal Systems	3.70	0.61
Natural Resource Systems	3.60	0.67
Food Products and Processing Systems	3.49	0.75
Plant Systems	3.49	0.81
Environmental Systems	3.48	0.72
Biotechnology Systems	3.39	0.62
Power, Structural, and Technical Systems	3.37	0.86
Agribusiness Systems	3.34	0.76
Instrument Total	3.53	0.57

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Objective 2: Describe Student Interest in Each Agriculture Pathway by Gender, Race, and Ethnicity

Table 10 shows that students who identified as male indicated the most interest in food products and processing systems (*M* = 3.72, *SD* = 0.71) and power, structural and technical systems (*M* = 3.66, *SD* = 0.79). They indicated the least interest in plant systems (*M* = 3.54, *SD* = 0.78) and agribusiness systems (*M* = 3.52, *SD* = 0.755. Their average interest in agriculture was 3.67 (*SD* = 0.64). Students who identified as female indicated the most interest in animal systems (*M* = 3.88, *SD* = 0.45), followed by natural resource systems (*M* = 3.56, *SD* = 0.61). They indicated the least interest in biotechnology systems (*M* = 3.17, *D* = 0.59) and power, structural and technical systems (*M* = 3.06, *SD* = 0.84). Overall, their average interest in agriculture was 3.38 (*SD* = 0.47).

Table 10

The Interest of Female and Male Students in the Agricultural Pathways

	Females			***Males***		
Item	***n***	***M1***	***SD***	***n***	***M***	***SD***
Animal Systems	40	3.88	0.452	41	3.58	0.69
Natural Resource Systems	42	3.56	0.617	43	3.58	0.71
Plant Systems	40	3.37	0.827	45	3.54	0.79
Environmental Service Systems	41	3.30	0.714	42	3.57	0.67
Food Products and Processing Systems	41	3.24	0.700	42	3.72	0.71
Agribusiness Systems	43	3.17	0.707	42	3.54	0.75
Biotechnology Systems	39	3.17	0.593	44	3.58	0.55
Power, Structural, and Technical Systems	42	3.06	0.841	44	3.66	0.79
Instrument Total	33	3.38	0.477	34	3.67	0.64

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

Comparison of Student Interest in Each Agriculture Pathway by Gender

We calculated an independent-samples *T*-test to compare the interests of male and female students in the agricultural content areas, and an alpha of 0.05 was set *a priori* for this and other tests of significance. The results of these calculations are displayed in Table 11. The *T*-test revealed that when male students (M = 3.66, SD = 0.79) were compared to female students (M = 3.06, SD = 0.84), male students were significantly more interested in the power, structural, and technical systems pathway, $t(84)$=3.410, p=0.001. Male students (M = 3.52, SD = 0.75) were significantly more interested than female students (M = 3.15, SD = 0.70) in the agribusiness systems pathway, $t(83)$=2.261, p=0.026. In the biotechnology systems pathway, it was found that male students (M = 3.58, *S.D.* = 0.55) were significantly more interested than female students (M = 3.17, SD = 0.59), $t(81)$=3.250, p=0.002. Male students (M = 3.72, SD = 0.71) were also significantly more interested than female students (M = 3.24, SD = 0.70) in the food products and processing systems pathway, $t(81)$=3.127, p=0.002. Overall, male students (M = 3.67, SD = 0.64) were significantly more interested than female students (M = 3.38, SD = 0.44) in agriculture when the instrument was considered as a whole, $t(65)$=2.158, p=0.035. However, female students (M = 3.88, SD = 0.45) were significantly more interested than male students (M = 3.58, SD = 0.69) in the animal systems pathway, $t(68.75)$=2.262, p=0.027. There were no significant differences found between the interest of male and female students in the plant systems, natural resource systems, or environmental service systems pathways (Table 11).

Table 11

Independent-Samples T-test for Student Interest in Agricultural Content Areas by Gender

Gender	*n*	*M*[1]	*SD*	*df*	*t*	*p*
Male (M)	44	3.66	0.796			
PST Systems				84	3.410	0.001*
Female(F)	42	3.06	0.841			
Table Continued						
Male (M)	42	3.52	0.755			
Agribusiness Systems				83	2.261	0.026*
Female(F)	43	3.16	0.707			
Male (M)	45	3.37	0.798			
Plant Systems				83	0.949	0.345
Female(F)	40	3.37	0.827			
Male (M)	43	3.58	0.715			
Natural Resource Systems				83	0.183	0.855
Female(F)	42	3.56	0.617			
Male (M)	44	3.58	0.551			
Biotechnology Systems				81	3.250	0.002*
Female(F)	39	3.17	0.593			
Male (M)	42	3.72	0.719			
FPP Systems				81	3.127	0.002*
Female(F)	41	3.24	0.700			
Male (M)	42	3.57	0.677			
ES Systems				81	1.777	0.079
Female(F)	41	3.30	0.714			
Male (M)	41	3.58	0.697			
Animal Systems				68.76	-2.262	0.027*
Female(F)	40	3.88	0.452			
Male (M)	34	3.67	0.648			
Total				65	2.158	0.035*
Female(F)	33	3.38	0.447			

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*. * $p < .05$.

Student Interest in Each Agriculture Pathway by Race/Ethnicity

Native American or Alaskan Native students indicated the highest interest in animal systems (M = 4.10, SD = 0.10) and natural resource systems (M = 3.73, SD = 0.05). They indicated the least interest in plant systems (M = 3.40, SD = 0.10) and biotechnology systems (M = 3.07, SD = 0.60). Overall, their average interest in agriculture was 3.57 (SD = 0.18).

Asian students were most interested in natural resource systems (*M* = 4.05, *SD* = 0.21), followed by animal systems (*M* = 3.80, *SD* = 0.56). They indicated the slightest interest in food products and processing (*M* = 3.20, *SD* = 0.28) and agribusiness systems (*M* = 3.00, *SD* = 0.42). Their average interest in agriculture was 3.48 (*SD* = 0.15).

Black or African American students indicated the highest interest in power, structural and technical systems (*M* = 3.10, *SD* = 0.94), and biotechnology systems (*M* = 2.97, *SD* = 0.58). Their lowest reported interest was in agribusiness systems (*M* = 2.39, *SD* = 0.71) and food products and processing systems (*M* = 2.35, *SD* = 0.88). Overall, their average interest in agriculture was 2.50 (*SD* = 0.80).

Most students who took the interest inventory identified as White and Non-Hispanic, with 66 students, 51 of whom completed the instrument entirely. They indicated the highest interest in animal systems (*M* = 3.80, *SD* = 0.52) and natural resource systems (*M* = 3.62, *SD* = 0.68). They indicated the least interest in agribusiness systems (*M* = 3.40, *SD* = 0.74) and power, structural and technical systems (*M* = 3.36, *SD* = 0.91). Overall, their average interest in agriculture was 3.59 (*SD*= 0.51).

Nine White Hispanic students took the interest inventory, with 6 completing it entirely. They indicated the most interest in natural resource systems (*M* = 3.68, *SD* = 0.42) and plant systems (*M* = 3.68, *SD* = 0.58). They indicated the least interest in power, structural and technical systems (*M* = 3.34, *SD* = 0.60) and biotechnology systems (*M* = 3.31, *SD* = 0.65). Overall, their average interest in agriculture was 3.46 (*SD* = 0.46). Only two students from two or more races took the interest inventory. They indicated the highest interest in environmental service systems (*M* = 3.50, *SD* = 0.28), followed by animal systems (*M* = 3.40, *SD* = 0.14). They indicated the least interest in biotechnology systems (*M* = 3.00, *SD* = 0.00) and power, structural, and technical systems (*M* = 3.00, *SD* = 0.70). Overall, their average interest in agriculture was 3.19 (*SD* = 0.19). Table 12 displays the interest of students in the agricultural content pathways by race and ethnicity.

Student Interest in Each Agriculture Pathway by Race/Ethnicity

The sample yielded groups of vastly unequal sizes based on differences in race/ethnicity, so Levene's Test of Homogeneity of Variances was performed. The *p*-value was greater than significance at $\alpha = .05$ for all content areas, meaning that the data met the homogeneity of variances assumption, and a one-way ANOVA could be calculated.

The one-way ANOVA revealed statistically significant differences in the interest of students from different races and ethnicities in the content areas of agribusiness systems, $F(6,82)=2.867$, $p=0.014$; animal systems ($F(6,77)=5.197$, $p=0.000$); food products and processing systems, $F(6,80)=2.304$, $p=0.042$; and in agriculture in general when considering the entire interest inventory as a whole, $F(6,63)=3.662$, $p=0.004$.

We conducted a post hoc comparison using the Tukey HSD test. In the content area of agribusiness systems, the difference in interest between White, Non-Hispanic students (*M*=3.40, *SD*=0.74) and Black or African American students (*M*=2.39, *SD*=0.71) was significant at *p*=0.010. In the content area of animal systems, the difference in interest between White, Non-Hispanic students (*M*=3.80, *SD*=0.52) and Black or African American students (*M*=2.67, *SD*=0.76) was significant at *p*=0.000. The difference in interest between Native Americans or Alaskan Native students (*M*=4.10, *SD*=0.10) and Black or African American students (*M*=2.67, *SD*=0.76) were also significant at *p*=0.005 in the content area of animal systems. In the content area of food products and processing systems, the difference in interest between White, Non-Hispanic students (*M*=3.54, *SD*=0.75) and Black or African

American students (*M*=2.35, *SD*=0.88) was significant at *p*=0.030. When the instrument was taken as a whole, the difference in interest between White Non-Hispanic students (*M*=3.59, *SD*=0.51) and Black or African American students (*M*=2.50, *SD*=0.80) was significant at *p*=0.003.

Table 12

The Interest of Students in the Agricultural Pathways by Ethnicity

	Native American or Alaskan Native Students			Asian			Black or African American			White Non-Hispanic			White Hispanic		
Item	***n***	***M1***	***SD***	**n**	**M1**	**SD**	**n**	**M1**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**
Agribusiness Systems	2	3.40	0.00	2	3	0.42	7	2.39	0.71	64	3.4	0.74	9	3.41	0.54
Animal Systems	3	4.10	0.10	2	3.8	0.56	6	2.67	0.76	59	3.8	0.52	9	3.46	0.52
Biotechnology Systems	3	3.07	0.60	2	3.4	0	6	2.97	0.58	62	3.44	0.62	8	3.31	0.65
Environmental Service Systems	3	3.60	0.26	2	3.4	0.28	6	2.87	0.82	63	3.47	0.74	8	3.61	0.61
Food Products and Processing Systems	3	3.50	0.36	2	3.2	0.28	4	2.35	0.88	65	3.54	0.75	9	3.53	0.53
Natural Resource Systems	3	3.73	0.05	2	4.05	0.21	6	2.92	0.89	65	3.62	0.68	9	3.68	0.42
Plant Systems	3	3.40	0.10	2	3.7	0.14	6	2.8	0.92	64	3.51	0.85	8	3.68	0.58
Power, Structural, and Technical Systems	3	3.50	0.26	2	3.3	0.42	6	3.1	0.94	65	3.36	0.91	9	3.34	0.60
Instrument Total	2	3.57	0.18	2	3.48	0.15	4	2.5	0.80	51	3.59	0.51	6	3.46	0.46

Note. [1]Likert Scale of 1 to 5, with 1 representing *Strongly Dislike* and 5 *Strongly Like*.

We calculated an independent-samples *T*-test comparing White and Non-Hispanic students to minority students. The *T*-test indicated White, Non-Hispanic students (*M* = 3.79, *SD* = 0.53) were significantly more interested in the animal systems pathway than were other students (*M* = 3.38, *SD* = 0.715), *t*(79)=2.750, *p*=0.007. White, Non-Hispanic students (*M* = 3.59, *SD* = 0.518) were also found to be significantly more interested in agriculture than were other students (*M* = 3.20, *SD* = 0.62) when the entire instrument was considered as a whole, *t*(65)=2.464, *p*=0.16. Though White, non-Hispanic students did indicate higher average interest in the other pathways, it was not significantly different at the alpha = 0.05 level. Table 13 provides the details on the one-way ANOVA for students of different races and ethnicities.

Table 13

One-way ANOVA for Students of Different Races and Ethnicities

Item	***df*1**	***df*2**	***F***	***p***
Power, Structural, and Technical Systems	6	83	0.83	0.544
Agribusiness Systems	6	82	2.86	0.014*
Natural Resource Systems	6	82	1.59	0.160

Table Continued

Plant Systems	6	82	1.29	0.269
Food Products and Processing Systems	6	80	2.30	0.042*
Biotechnology Systems	6	80	1.69	0.133
Environmental Service Systems	6	80	1.17	0.327
Animal Systems	6	77	5.19	0.000*
Instrument Total	6	63	3.66	0.004*

Note. [1]Degrees of freedom between groups. [2]Degrees of freedom within groups. * $p < .05$.

Conclusions

Based on our findings, we conclude that:

1. The animal science pathway generates the most interest among agricultural education students, followed by natural resource systems. While students generally found a positive level of interest in every pathway, their strong preferences for animal science and natural resources were clear.
2. While students generally found biotechnology, power, structural, and technical systems, and agribusiness systems generally interesting, these career pathways did not engage the students as much as other content pathways.
3. Male and female students value the NCAE agricultural pathways' content differently. In most NCAE agricultural pathways, the differences between males and females were significant. Male students were most interested in food products and processing systems, while females averaged the highest interest in animal systems. Females were significantly more interested in animal systems. Males were more interested in power, structural, and technical systems, biotechnology, food products and processing, and agribusiness systems.
4. Students of different races and ethnic backgrounds also value content in the NCAE agricultural pathways differently, but most of these differences were insignificant. Where the differences were significant, White non-Hispanic students were more likely to choose the agribusiness and food products and processing curricula over Black students. White Non-Hispanic and Alaskan Native/Native American students were more likely to choose the animal science curriculum than Black students.

Because of the sample size in this study, we do not generalize our findings to the population. However, we did find some noteworthy differences between males and females in terms of how much they value the NCAE agricultural pathways. The same holds in specific instances concerning students of differing race and ethnic backgrounds and their respective values of the NCAE agricultural pathways.

Discussion and Implications

Student interest repeatedly appeared in the literature as a challenge facing agriculture teachers. The purpose of this study was to deepen the understanding of student interest in agriculture by describing and comparing student interest to help teachers better address this challenge. According to the tenets of the Self-Determination Theory (Deci & Ryan, 2012), by allowing students the freedom to participate in content areas that interest them, it should be possible to increase their engagement in agriculture. This study highlighted which content areas students reported more interest in on average. Agricultural educators wishing to bolster numbers can focus on content areas that this survey revealed to have high appeal to students, like the animal and natural resource systems pathways. Suppose agricultural educators are struggling with diversity in their programs and are struggling to recruit students of different demographics to their programs. In that case, they can try to offer courses or activities that the study indicated are of higher interest to students within those demographics.

The demands of a teacher's time and resources are intense. Single-teacher programs may not be able to offer the depth and breadth of a comprehensive curriculum that exists in multiple-teacher programs. However, almost every agriculture program could provide a foundational course in agriculture that exposes students to multiple agricultural career pathways. And the supervised agricultural experience program offers an outlet for students to explore and develop competency in the agricultural pathway that interests them the most. SAE becomes even more important as an outlet for students to explore their preferred career pathway because current course offerings by agriculture teachers nationwide do not align with the content areas most interesting to students. The National FFA Organization (National FFA Organization, 2023) reported that 59% of agriculture teachers offer agricultural mechanics and 49% offer horticulture, while only 43% offer animal science (National FFA Organization, 2023). This study revealed that the animal systems pathway was the most interesting to students, plant systems was the fourth most interesting pathway, and power, structural, and technical systems was ranked seventh out of the eight pathways. Of course, student interest cannot be the only thing dictating what course offerings teachers provide, but according to SDT it should undoubtedly factor in maximizing student performance.

Recommendations for Practice

This study's conclusions point directly to a need for agricultural educators and school administrators to offer comprehensive agricultural education programs with multiple agricultural pathways. Agricultural educators do not often have the opportunity to choose the students who enroll in their courses, nor do we recommend that they should. The agriculture industry offers plenty of options in a diverse range of careers for any student who wishes to pursue one of them. Agricultural educators and school administrators should broaden the curriculum to multiple agricultural pathways to expand the reach of their programs to students regardless of gender, race, or ethnicity. Teachers can utilize the Agricultural Content Area Interest Inventory developed for this study, or a similar instrument, to identify students' areas of interest in their school, and then decide which courses their agricultural education program offers.

Recommendations for Research

This study identified some significant differences in student interest in agriculture that aligned with students' participation levels from different demographics. This finding supports the need for research into why these groups tend to be less interested in specific subject matter and what can be done to increase their interest or motivation to participate despite a lack of intrinsic interest. Within SDT, some aspects have been found to interact with internal motivation that were not evaluated in this study, like the inclusivity of the environment, the challenge presented, the presence of cliques, or competition (Cook & Artino, 2016) or if students feel competent in the subject area. This study supports the need for further research into these topics and other aspects of SDT related to student participation in agricultural education.

References

Balschweid, M. A., Thompson, G. W., & Cole, R. L. (1997). The effects of an agricultural literacy treatment on participating k-12 teachers and their curricula. *Journal of Agricultural Education*, *39*(4), 1–10. https://doi.org/10.5032/jae.1998.04001

Bell, L. C., & Fritz, S. M. (1992). Deterrents to female enrollment in secondary agricultural education programs in Nebraska. *Journal of Agricultural Education*, *33*(4), 39–47. https://doi.org/10.5032/jae.1992.04039

Bennett, M. B. (1990). *Revision of the applied biological and agribusiness interest inventory*. Pennsylvania State University.

Bickel, M., Strack, M., & Bögeholz, S. (2015). Measuring the interest of German students in agriculture: The role of knowledge, nature experience, disgust, and gender. *Research in Science Education*, *45*(3), 325–344. https://doi.org/10.1007/s11165-014-9425-y

Caine, R. N., & Caine, G. (1991). *Making connections: Teaching and the human brain*. Association for Supervision and Curriculum Development.

Cochran, W. G. (1977). *Sampling techniques* (3d ed). Wiley. http://catdir.loc.gov/catdir/toc/onix03/77000728.html

Cook, D. A., & Artino, A. R. (2016). Motivation to learn: An overview of contemporary theories. *Medical Education*, *50*(10), 997–1014. https://doi.org/10.1111/medu.13074

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.

Davis, T., & Chumbley, S. B. (2020, May 18). *Career aspirations of the Agricultural Technology & Mechanical Systems state CDE competitors [Poster Presentation].* American Association for Agricultural Education 2020 Virtual Conference.

Daynard, K. (2010). R*ecruitment into agricultural careers: Strategies to increase enrollment in agricultural colleges and universities, in order to meet the growing number of job opportunities.* Nuffield Canada.

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Deci, E. L., & Ryan, R. M. (2012). Self-determination theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 416–436). Sage Publications Ltd. https://doi.org/10.4135/9781446249215.n21

Kruglanski, & E. T. Higgins (Eds.), H*andbook of theories of social psychology: Volume 1* (Vol. 1–1, pp. 416–437). SAGE Publications Ltd. https://doi.org/10.4135/9781446249215

Delvecchio, S., McEwen, T., & McEwen, B. C. (2001). Impact of race on business students' perceptions of business careers. *Journal of Education for Business*, *76*(4), 199–208. https://doi.org/10.1080/08832320109601311

Desy, E. A., Peterson, S. A., & Brockman, V. (2011). Gender differences in science-related attitudes and interests among middle school and high school students. *Science Educator*, *20*(2), 23–30.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method* (4th edition). Wiley.

Domenico, D. M., & Jones, K. H. (2007). Career aspirations of women in the 20th century. *Journal of Career and Technical Education*, *22*(2). https://doi.org/10.21061/jcte.v22i2.430

Fernandez, J. M., Goecker, A. D., Smith, E., Moran, E. R., & Wilson, C. A. (2020). E*mployment opportunities for college graduates in food, agriculture, renewable natural resources, and the environment; 2020-2025*. USDA 2020-2025 Employment Opportunities. https://www.purdue.edu/usda/employment

Hager, S., Straka, T., & Irwin, H. (2007). What do teenagers think of environmental issues and natural resources management careers? *Journal of Forestry*, *105*(2), 95–98. https://doi.org/10.1093/jof/105.2.95

Hammann, M., Jordens, J., & Buschgens, D. (2020). Students' situation interest in cultivated plants: The importance of contextualization and topic selection. *International Journal of Science Education*, *42*(16), 2765–2799. https://doi.org/10.1080/09500693.2020.1836430

Higgins, L. M., Schroeter, C., & Wright, C. (2018). Lighting the flame of entrepreneurship among agribusiness students. *International Food and Agribusiness Management Review*, *21*(1), 121–132. https://doi.org/10.22004/ag.econ.266453

Johnson, D. R., & Creech, J. C. (1983). Ordinal Measures in multiple indicator models: A simulation study of categorization error. *American Sociological Review*, *48*(3), 398–407. https://doi.org/10.2307/2095231

Jones, M. G., Howe, A., & Rua, M. J. (2000). Gender differences in students' experiences, interests, and attitudes toward science and scientists. *Science Education*, *84*(2), 180–192. https://doi.org/10.1002/(SICI)1098-237X(200003)84:2<180::AID-SCE3>3.0.CO;2-X

Jones, W. A., & Larke, A. (2003). Factors influencing career choices of ethnic minorities in agrjculture. *NACTA Journal*, *47*(3), 11–17. https://www.nactateachers.org/index.php/international-committee/58-issues/volume-47-number-3-september-2003/477-factors-influencing-career-choices-of-ethnic-minorities-in-agriculture

Kidman, G. (2010). What is an 'interesting curriculum' for biotechnology education? Students and teachers opposing views. *Research in Science Education, 40*, 353–373. https://doi.org/10.1007/s11165-009-9125-1

Kohlstedt, S. G. (2008). “A better crop of boys and girls”: The school gardening movement, 1890–1920. *History of Education Quarterly*, *48*(1), 58–93. https://doi.org/10.1111/j.1748-5959.2008.00126.x

LaVergne, D. D., Larke, A., Elbert, C. D., & Jones, W. A. (2011). The benefits and barriers toward diversity inclusion regarding agricultural science teachers in Texas secondary agricultural education programs. *Journal of Agricultural Education*, *52*(2), 140–150. http://dx.doi.org/10.5032/jae.2011.02140

Lingenfelter, K. M., & Beierlein, J. G. (2006). Recruitment into the college of agricultural sciences: Factors related to student major choices. In Proceedings of 2006 American Association of Agricultural Education National Research Conference (Vol. 33). *Proceedings of 2006 American Association of Agricultural Education National Research Conference*, *33*.

Liu, A. Y., & Burns, L. (2020). *Public high school students' career and technical education coursetaking: 1992 to 2013* (NCES 2020-010; Statistics in Brief). National Center for Education Statistics.

Maughan, O. E., Bounds, D. L., Morales, S. M., & Villegas, S. V. (2001). A successful educational program for minority students in natural resources. *Wildlife Society Bulletin*, *29*(3), 917–928.

National Council for Agricultural Education. (2015). A*griculture, food and natural resources (AFNR) career cluster content standards*. National Council for Agricultural Education.

National Council for Agricultural Education. (2023). *The Council: about us*. https://thecouncil.ffa.org/about-us/

National FFA Organization. (2022). *2022-23 Official FFA manual*. National FFA Organization.

National FFA Organization. (2023). *FFA statistics*. https://www.ffa.org/statistics/

Norman, G. (2010). Likert scales, levels of measurement and the “laws” of statistics. *Advances in Health Sciences Education*, *15*(5), 625–632. https://doi.org/10.1007/s10459-010-9222y

Pany, P. (2014). Students' interest in useful plants: A potential key to counteract plant blindness. *Plant Science Bulletin*, *60*(1), 18–27. https://doi.org/10.3732/psb.1300006

Renninger, K. A., & Hidi, S. E. (2016). *The power of interest for motivation and engagement.* Routledge.

Roberts, T. G., Harder, A., & Brashears, T. (2016). *American Association for Agricultural Education national research agenda: 2016-2020.* University of Florida Department of Agricultural Education and Communication.

Smith, B. S., & Baggett, C. D. (2012). Perceptions of agriculture and perceived enrollment barriers to agricultural programs of select southern New Jersey high school students. *NACTA Journal*, *56*(1), 48–56.

Strgar, J. (2007). Increasing the interest of students in plants. *Journal of Biological Education*, *42*(1), 19–23. https://doi.org/10.1080/00219266.2007.9656102

Sutphin, H. D., & Newsom-Stewart, M. (1995). Student's rationale for selection of agriculturally related courses in high school by gender and ethnicity. *Journal of Agricultural Education*, *36*(2), 54–61. https://doi.org/10.5032/jae.1995.02054

Talbert, B. A., Croom, B., LaRose, S., Vaughn, R., & Lee, J. S. (2022). *Foundations of agricultural education* (4th edition). Purdue University Press.

Talbert, B. A., & Larke, A. (1995). Factors influencing minority and non-minority students to enroll in an introductory agriscience course in Texas. *Journal of Agricultural Education*, *36*(1), 38–45. https://doi.org/10.5032/jae.1995.01038

Walker, R. W., & Stevens, G. Z. (1971). *The applied biological and agribusiness interest inventory.* The Interstate Printers and Publishers, Inc.

Wandersee, J. H. (1986). Plants or animals—Which do junior high school students prefer to study? *Journal of Research in Science Teaching*, *23*(5), 415–426. https://doi.org/doi.org/10.1002/tea.3660230504

Weber, K., & Custer, R. (2005). Gender-based preferences toward technology, education content, activities, and instructional methods. *Journal of Technology Education*, *16*(2), 55–71. https://vtechworks.lib.vt.edu/bitstream/handle/10919/8339/weber.pdf?sequence=1

Williamson, A., Hock, G., Ulmer, J., & Goodson, L. (2020, May 18). *Teacher perceptions of the impact and challenges of middle school agricultural education experiences in Kansas* [Poster Presentation]. American Association for Agricultural Education 2020 Virtual Conference.

Zhou, H. (2013). *Analysis of South Carolina high school students' interest in selected majors: Agriculture, business, economics, and environmental and natural resources* [Master's thesis, Clemson University]. https://tigerprints.clemson.edu/all_theses/1663/