

# Parents' Value of Their Children Learning about Agriculture in School

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## Abstract

*It is commonly held that parents have a profound impact on child development. Decades of research investigated the ways parents, the community, and school staff interact to foster student learning during kindergarten through twelfth grade education. Agriculture provides for daily needs through the growth, harvest, and processing of food, fiber, fuel, and forestry products. This research sought to understand the level of importance parents place on their children learning about agriculture in school. A 26-question survey was distributed to a nationally representative sample of parents having at least one child in K-12 education within the United States. Results of this study indicate parents found it important, even very important, for students to learn about many agricultural topics in school. Factors historically associated with parent perceptions and support of student learning proved to not significantly impact this indicated level of importance. Therefore, further research is needed to understand what impacts parents' value of their students learning about agricultural topics in school. The conclusions of this study are of primary importance to entities conducting agricultural education outreach such as Agriculture in the Classroom programs, Extension, Career and Technical Education, agricultural industry organizations, and others interested in agricultural literacy.*

## Introduction

Parent and child development, knowledge, and behaviors are interconnected. Theories throughout the decades have examined many aspects of this familial relationship. Uri Bronfenbrenner (1979) brought together several of these notable theories through a five-system model indicating it is the interaction of environmental changes, culture, extended family/community, immediate family, school, religion, and peers

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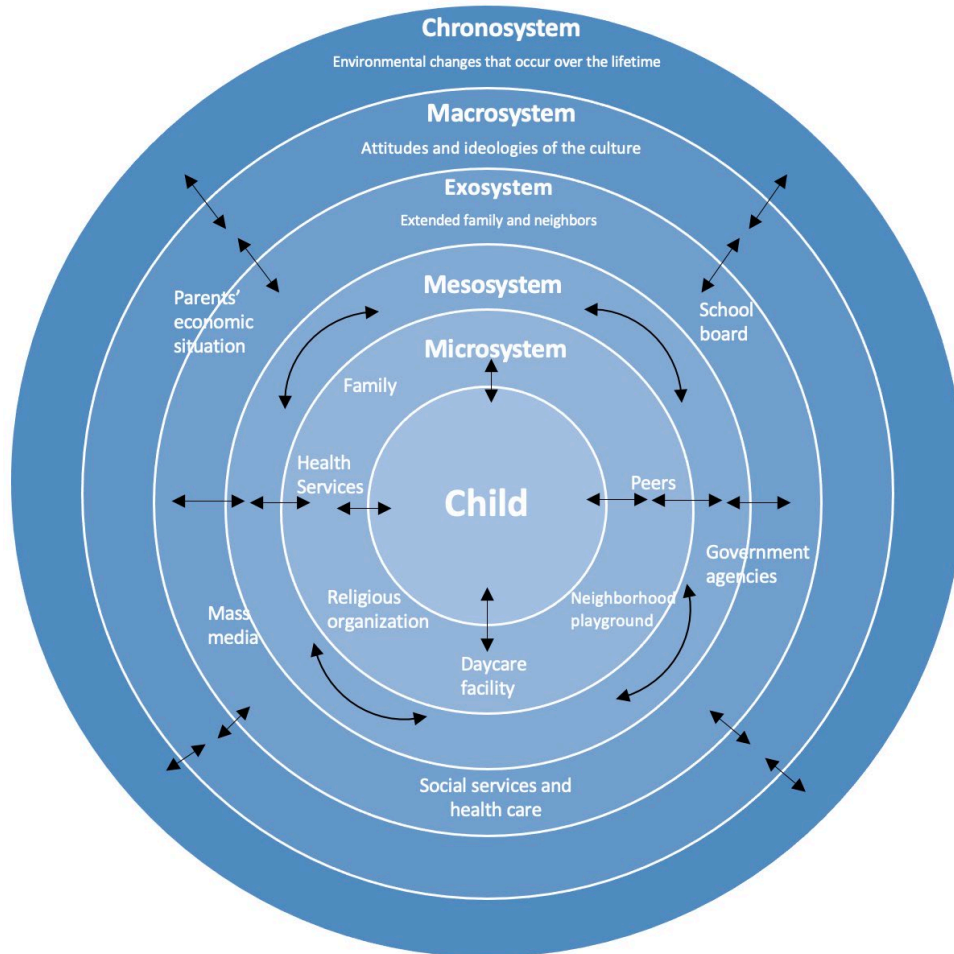
which influence child development. Parent-teacher-student relationships affect students' engagement (Schock & Jeon, 2023). Parents have long been outspoken in support of or opposition to school curriculum, teachers' choices, administrators' authority, and school board decision-making. Dating back to colonial times, parents initially refuted Thomas Jefferson's approach to public schooling, preferring their children receive the religious education of their family's choosing or stay home to work on the farm (Buell-Hiatt, 1994). From truancy laws to segregation then desegregation to addressing accommodations for disabilities, parents have argued all sides of these issues at the local, state, and federal levels (Buell-Hiatt, 1994; Library of Congress, n.d.). Although many of these curriculum debates have deep emotional ties, teachers continue to contend parents should be involved in curriculum conversations (Najarro, 2021; Seginer, 2006).

In 1988 the National Research Council stated all students, kindergarten through twelfth grade, should receive some agricultural instruction, incorporated into existing course content, outside of vocational courses at the secondary level (National Research Council, 1988). The Council indicated agriculture affects all Americans, economically, socially, and environmentally; therefore, students should have some agricultural instruction as a complement to other academic areas. The National Agriculture in the Classroom Organization's (NAITCO) programs across the United States and territories began and continue to host teacher professional development, supply standards-based lessons and resources, convene farm field trips, and other initiatives to work toward an agriculturally literate society (National Agriculture in the Classroom, 2023). The logic model for agricultural literacy provides a road map for AITC program planning, indicating human, financial, and program resources are needed to affect populations of educators of pre-kindergarten through adult students, youth activities, policymakers, and consumer information, with the end result to influence change in knowledge, skills, attitudes, behaviors, and practices relating to agriculture (Spielmaker et al., 2014). Although parents could be grouped into the consumer category of outputs in this logic model, parents are not explicitly stated as an audience of focus for agricultural literacy outreach efforts. Yet, child development and education research explicitly state parents are a key factor in what and how a child learns. This quantitative study sought to investigate the level of importance parents place on their children's understanding of agricultural concepts.

### **Conceptual Framework**

Foundational theories by Maslow, Piaget, and Vygotsky illustrate the structure of child development. Maslow explained the most basic needs are considered deficiency needs; once one is met or mostly met, the next can need can be addressed (McLeod, 2018b). Piaget's stages of cognitive development outline four stages of development denoted by age (McLeod, 2018a). He observed children all progress through these four stages at different rates of speed (McLeod, 2018a). Although Piaget did not relate his theory to the school classroom, later researchers made this connection. These researchers used Piaget's findings to define a teacher's role as a facilitator of learning, meeting each student where they are at, assessing individual needs, and realizing children could be at different points within each stage. Vygotsky's theory of cognitive development introduces the sociocultural element of human development (McLeod, 2022). Key to Vygotsky's theory is the zone of proximal development which defines ways instruction from someone with greater knowledge, such as parents and teachers, can increase children's learning.

Bronfenbrenner (1979) effectively incorporated pieces from each of these theories into his ecology of human development theory. His concentric circle model indicates those closest to the child have the most and earliest influence. As the circles expand, teachers, community members, and extended family are added as influencers of the child's development (Figure 1).

**Figure 1***Bronfenbrenner's Ecological Systems Theory*

Note: Recreated from Bronfenbrenner's Ecological Systems Theory (Guy-Evans, 2020).

If this system is supportive, nurturing, and affectionate, it will positively affect the child (Guy-Evans, 2020). It is the progression of these child development theories which builds the framework for this research. Parents and schools have a reciprocal relationship, each affecting the other to assist children in growth and learning (Guy-Evans, 2020). Therefore, understanding parents' perspectives on student learning can strengthen relationships with schools and teachers, ultimately affecting children's learning.

### Literature Review

In 1988 the National Research Council published *Understanding Agriculture New Directions for Education*. This report introduced the term *agricultural literacy*, defining an agriculturally literate person as someone whose "understanding of the food and fiber system includes its history and current economic, social, and environmental significance to all Americans" (National Research Council, 1988, p. 2). Over the course of three decades, Frick (1990), Powel, Agnew, and Trexler (2008), Kovar and Ball (2013), and the American Farm Bureau Federation (2013) have added to this original definition. Spielmaker et al. (2014) coined the most current definition, "An agriculturally literate person understands and can communicate the source and value of agriculture as it affects our quality of life" (p. 1).

In 1976, the first series of teacher-focused materials was produced by the United States Department of Agriculture. In 1981, state governors were asked to appoint a state-level task force for implementing Agriculture in the Classroom (AIRC) programming. From conception to 1997, USDA remained the national coordinating entity for AIRC programs (Adelhardt, 2006; National Agriculture in the Classroom, 2023). In the late 1990s a national consortium was established. This later became the National Agriculture in the Classroom Organization (NAICO), a standalone 501(c)(3), separate from USDA but with a memorandum of understanding to continue agricultural literacy outreach (Adelhardt, 2006; National Agriculture in the Classroom, 2023). Today, NAICO remains the managing body of state and territory AIRC programs with a board of directors comprised of state and territory program leaders (Adelhardt, 2006; National Agriculture in the Classroom, 2023). Annually, programs are requested to submit a state or territory report to NAICO (National Agriculture in the Classroom, 2023). In 2021, 43 states, one territory, and the District of Columbia reported activity (*2021 AIRC Program Report*, 2021). These programs reached 22,000 teachers and 916,000 students, supported by more than \$14,000,000 in total budgets (*2021 AIRC Program Report*, 2021).

In 2013, Kovar and Ball published a synthesis of agricultural literacy research summarizing 20 years of work since the publication of the *Understanding Agriculture New Directions for Education* book. They cited a continually growing population as well as societal interest in economic, social, and environmental issues to reaffirm the need for an agriculturally literate population. A multistate research committee was established in 2014 to aid in the support and execution of agricultural literacy outreach and research (NIMSS, 2019). As of November 2022, more than 80 publications have been documented as published by members of this committee since its inception (NIMSS, 2019). The National Center for Agricultural Literacy (NCAL) was established at Utah State University in 2015 (National Center for Agricultural Literacy, n.d.). The NCAL objectives are to provide research, learning resources, and professional development to agricultural literacy program stakeholders, including through NAICO (National Center for Agricultural Literacy, n.d.). The National Agricultural Literacy Outcomes (NALOs) were published by members of NCAL and the multistate research committee (NIMSS, 2019). These outcomes provide learning objectives organized in five themes to tie agricultural concepts to appropriate K-12 educational standards (Spielmaker & Leising, 2013). These outcomes have guided the generation of lessons and supporting resources created by AIRC programs to teach agricultural content to K-12 students (Spielmaker, 2019). The National Agricultural Literacy Curriculum Matrix houses lessons as a free-to-download database, categorized by NALOs and curriculum standards (Spielmaker, 2019).

Throughout the more than 30 years of agricultural literacy research, much effort has been put into understanding what students and teachers understand about agriculture and its application in everyday life. Researchers have worked to understand how teachers value agriculture as a means to contextualize required content standards, or measure levels of agricultural literacy of many audiences (Bennett, et al., 2022). However, no research has been recently published investigating parents' value of their children learning about agriculture in K-12 outside of Career and Technical Education courses.

In colonial America, local jurisdiction of schools was placed under the governance of townships (Buell-Hiatt, 1994). Township boards were made up of average community citizens, inevitably some parents of children attending schools (Buell-Hiatt, 1994). During this genesis of U.S. public schools, some leaders argued every child was deserving of a basic education, yet parents believed it was their right to select between private or public schools (Buell-Hiatt, 1994). Over time, parent-teacher associations formed as a result of these sorts of debates (Woynshner, 2000). Buell Hiatt argued additional legislation addressing truancy, Head Start and early childhood programs, and the Education for All Handicapped Act of 1974 would not have gained traction without widespread parent support (Buell-Hiatt, 1994).

From science to reproductive health to religion and more, parents have negotiated to alter public school-required curriculum for decades (Cheung & Kwan, 2021; Gill & Schlossman, 2003; Hirschhoff, 1977; Kantor & Levitz, 2017). Constantine et al. (2007) surveyed parents in California about their levels of

support for several sex education topics taught in public schools. Of the 1,284 parents surveyed, they found 89% preferred a comprehensive sex education curriculum while 11% preferred an abstinence-only approach. Researchers differentiated these results by highest level of education achieved by the parent, political ideology, and geographic area of the state to look for any trends in these independent variables (Constantine et al., 2007).

Cheung and Kwan investigated more than 600 parents' perceived goals for their children's early math learning in Hong Kong (Cheung & Kwan, 2021). In this quantitative study researchers used factor analysis to narrow a list of 38 questions developed with influence from previous research to a list of 12 questions divided into three subcategories. They found the two-way interaction between parents' goals for their student and parents' highest level of education to be significant ( $F(3.34, 534.49) = 6.53, p < .001, \eta^2 = .04$ ). They found parents with at least a high school or postsecondary education indicated higher math learning goals for their students than those who had completed less education. Further, as parents' perception of the importance of their child's math reasoning skills increased, so did parents' view of their child's approach to learning math. This suggests parents' goals for their children's math learning does impact how the children learn about this subject (Cheung & Kwan, 2021).

A 2019 study about physical education curriculum evaluated parents' own experiences in physical education courses and how this related to the importance they put on the value of physical education within school curriculum for their children (Lago-Ballesteros et al., 2019). The sample included parents of more than 1,800 teenagers at 32 different secondary schools in Spain and Portugal. Using a multiple regression model, they found that parents' current activity level did not predict the value of their support for their children to take these courses. In another study, parent motivation and demonstration of perceived value in science and math resulted in their adolescent children taking more math and science courses (Harackiewicz et al., 2012). This study found school intervention providing parents with materials and guidance in how to support their teens' science and math learning did help parents be more positively influential in their children's work in these courses.

When considering private school curriculum, Freer's qualitative work discovered some influential parents had more voice than others about the direction of school curriculum (Freer, 2008). Solicited parent feedback was defined as invited parent meetings, standing committees, school-wide events, and parent-teacher organizations. This type of involvement included athletic boosters, school fundraisers, and town hall-type meetings to discuss the direction of the school. Unsolicited feedback included emails from parents to teachers, conversations with coaches at athletic events, or impromptu meetings with teachers. Initially, school administration stated parents played little role in school curriculum decisions. However, Freer found parents did have a strong impact. One example was the adjusting the grade levels offered a new Mandarin language course. Parents' indicated conflicts of timing with other courses. This significant outcry led to changes in course scheduling (Freer, 2008).

When considering how to increase the U.S. population's agricultural literacy through school-based interventions, parents' connections to food and agriculture must be considered. According to the U.S. Census Bureau and the U.S. Department of Agriculture, the Millennial generation, born between 1981 and 1996, is the largest food purchasing portion of the U.S. population as well as the largest segment caring for children under the age of 18 (Census Bureau, 2023; Kuhns & Saksena, 2017). Consumers define quality grocery items by products' freshness, minimal processing, health & nutrition, product sourcing, sustainability, and labor standards (FMI, 2023). Confusion in food labeling and marketing of food combined with a personal disconnect to food production has caused uncertainty in purchasing decisions of U.S. consumers (Powers & Roberts, 2022). In addition to purchasing decisions at the grocery store, U.S. citizens are faced with decisions about agriculture, food, and natural resources in the voting booth. Since 2000, 10 state-level bills and ballot initiatives about farm animal welfare have been brought to legislators and voters

in 12 different states (Hopkins et al., 2022). Due to the strong influence parents have over child development and school curriculum, this study narrows the focus to parents as consumers.

### **Purpose and Research Questions**

Given parents' influence on children's knowledge and development, this study sought to explain the level of importance parents of kindergarten through twelfth-grade students place on their students learning about agriculture in school. This study investigated two questions:

1. What level of importance do parents place on their students learning about agriculture in school?
2. What factors influence the level of importance parents place on their students learning about agriculture in school?

### **Methods**

This quantitative study sought to identify the level of importance parents place on their children learning about agriculture in school. Researchers developed a 26-question instrument with 19 questions based on each of the five National Agricultural Literacy Outcomes (NALO) themes, plus one question about parents' perceived importance of their children learning about agriculture in a general sense, three questions about agriculture or school involvement, and three questions about demographics. For each of the 20 questions addressing importance, respondents were required to select from a five-point Likert-scale, ranking items from *not at all important to extremely important*. Taking influence from Cheung and Kwan's (2021) work with parents' perceived importance of mathematics learning goals, the NALO themes provided groupings for the goal statements. Demographic questions addressed Research Question 2 The rural, suburban, and urban classification was assigned by reporting zip code provided by respondents in alignment with U.S. Postal Service zip codes and the United States Department of Agriculture's Economic Research Service's Rural-Urban Commuting codes (USDA ERS, 2023). This list breaks down United States zip codes into 10 categories based on measures of population density, urbanization, and daily commuting. Categories 1-3 are considered metropolitan (urban), 4-6 micropolitan (suburban), 7-9 small town, and 10 rural. For the purpose of this research, category 10 was combined with category 7-9 to create a small town/rural classification. The respondents' highest level of education achieved was asked as this is considered one of the most stable predictors of social and economic characteristics of students (Sirin, 2005). Finally, respondents were asked to categorize their field of work to control for any bias of respondents working in education or agriculture. These questions were asked at the end of the survey, following the NALO theme-based questions.

A panel of experts was used to determine the face validity of the instrument questions. These experts were faculty in agricultural education and science teacher education with previous experience teaching at the primary and secondary levels. Cronbach's alpha was calculated post-hoc to determine the reliability of the 20 ranked-item questions where values of 0.7 or higher are considered acceptable with 0.8 or higher showing very good internal consistency (Pallant, 2016). The Cronbach's alpha of these 20 questions ( $\alpha = 0.951$ ) indicated high reliability.

To reach a nationwide sample of parents of K-12 grade children, Centiment, a nationwide survey company, was contracted to distribute the questionnaire. According to the U.S. Census Bureau (2022), 63,214,000 people are parents of coresident biological, step, or adopted children under the age of 18. To obtain a statistically significant sample with a 95% confidence level and a 5% margin of error, a random sample of at least 385 parents across the United States was needed. Only one parent per household was allowed to complete the questionnaire to eliminate violating the assumption of independence. Qualtrics was used to collect survey responses. Microsoft Excel and SPSS were used to analyze data. A consent to participate letter was included and no personally identifying information was collected. Approval of research with human subjects was obtained prior to data collection.

Threats to internal and external validity were reduced by conducting a one-time survey of a random national sample of adults. However, some limitations still existed. To address a threat to external validity, this research should not be generalized to subject areas outside of agriculture or applied to a time period other than when the survey was completed. Additionally, a threat to internal validity, some participants may have more direct exposure to agriculture, food, or natural resources than others. This involvement in agriculture may be accounted for in the question about field of occupation however, it is possible the agricultural involvement is not their primary occupation therefore not disclosed. To address this issue, an ANOVA evaluating the impact occupation had on the NALO themed questions was conducted analyzing agriculture and natural resources and education occupations' responses separately from the rest of the sample. For each group of questions by NALO theme, there was no statistically significant difference between these two occupations' responses and all other responses based on  $p < .05$  (Theme 1  $p = .675$ , Theme 2  $p = .894$ , Theme 3  $p = .586$ , Theme 4  $p = .782$ , and Theme 5  $p = .907$ ). Therefore, respondents with agriculture and natural resources and education occupations remained in the dataset for analysis.

Research Question 1 was addressed by the descriptive analysis of the 20 Likert-scale questions. Because these questions produced ordinal data, median and interquartile range (IQR) were reported as measures of central tendency for these questions (Laerd, 2018). The six independent variable responses: level of education, occupation, zip code, ages of children, school participation, and agriculture participation were summarized by descriptive data. Further analysis was conducted to determine if relationships existed between independent demographic variables and the parents' value of children's agricultural understanding, addressing Research Question 2. For analysis, the 19 questions affiliated with the 5 NALO themes were categorized by theme. For each respondent, a summary score by NALO theme was calculated by obtaining the mean response to the questions within each theme. Then, multiple linear regression analysis was conducted with each theme score as the dependent variable and all six demographic factors as independent variables to determine if any of the parent demographic factors or community type (metropolitan, micropolitan, or small town/rural) affected the type of agricultural information a parent holds as important for their child to learn. Preliminary tests were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedasticity. With 6 predictor values, a sample of at least 97 respondents was needed to ensure a medium effect size ( $R^2 = .13$ ), indicating strength in the correlation between variables.

## **Results**

Centiment distributed the Qualtrics survey from July 18-31, 2023. In this 14-day period, 409 parents completed the survey; 212 identified as female (52%), 197 as male (48%) with ages ranging from 25 to 50 years old. The mean age was 38 years old ( $SD = 6.21$ ). Most respondents ( $f = 165$ , 40%) reported a high school diploma/GED as their highest level of education, followed by bachelor's degrees ( $f = 91$ , 23%), and associate degrees ( $f = 67$ , 16%). Most respondents indicated working in consumer services ( $f = 79$ , 19%) which includes occupations such as banking, utilities, retail, and hospitality (U.S. Department of Education, 2002). Manufacturing, construction, and transportation ( $f = 68$ , 17%) and health care ( $f = 63$ , 15%) followed. Forty states were represented in the respondent group, however 27 (7%) people listed invalid zip code numbers. Of the valid zip codes provided, 310 (81%) were located in metropolitan areas, 43 (11%) in micropolitan areas, and 29 (8%) in small town/rural areas.

To further understand parents' involvement with their children's schooling, respondents were asked to indicate participation in a list of nine school engagement opportunities in the last two school years. Most parents ( $f = 263$ , 64%) helped their children with homework assignments or attended a parent-teacher conference ( $f = 253$ , 62%). Only one parent indicated participation in all nine activities whereas 94 (23%) indicated participation in one activity. Similarly, parents were asked about their agricultural experience within the last year. Of the eight provided options, almost half ( $f = 198$ , 48%) visited a county or state fair or bought produce directly from a farmer while only 8% ( $f = 34$ ) indicated they personally raised livestock.

Some ( $f = 14, 3\%$ ) described participation in other agricultural activities such as attended FFA banquet, received produce from a neighbor, entered food in the county fair, sheared sheep, prepared local produce from a food bank, and cultivated other products. To gain perspective on the volume of respondents' agricultural experiences, an agricultural engagement score was calculated by adding the total number of responses per person. No respondents indicated participating in all eight activities, while 13 (3%) indicated participating in zero agricultural activities in the past year.

**Research Question One**

Twenty Likert-scale questions investigated the level of importance parents place on their students learning about agriculture in school. One question asked parents to rank the overall importance of learning about agriculture. Extremely important was the most frequently selected response ( $f = 151, 36.9\%$ ) with very little variation in opinion ( $IQR = 1$ ) (Table 1).

**Table 1**

*To What Extent is it Important that your Student Learn About Agriculture in School (n = 409)*

Not at all important	Slightly important	Moderately important	Very important	Extremely important	<i>Mdn</i>	<i>IQR</i>
<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>		
(%)	(%)	(%)	(%)	(%)		
3	21	90	144	151	4.0	1.0
(0.7)	(5.1)	(22.0)	(35.2)	(36.9)		

The remaining 19 questions were written with influence from the five NALO themes (Table 2). All questions had median responses of very important ( $Mdn \geq 4$ ) or above and some variation in opinion based on interquartile range ( $IQR \leq 2$ ).

**Table 2**

*Parents' Ranked Importance of Agricultural Content Taught in School (n = 409)*

	Not at all important	Slightly important	Moderately important	Very important	Extremely important	<i>Mdn</i>	<i>IQR</i>
	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>		
	(%)	(%)	(%)	(%)	(%)		
T1: Land and water use	8	23	75	161	142	4.00	1.00
	(2.0)	(5.60)	(18.3)	(39.4)	(34.7)		
T1: Environmental factors	7	32	93	150	127	4.00	2.00
	(1.7)	(7.8)	(22.7)	(36.7)	(31.1)		
T2: Cultural differences	3	27	74	171	134	4.00	2.00
	(0.7)	(6.6)	(18.1)	(41.8)	(32.8)		
T2: Renewable resources	3	22	77	153	154	4.00	1.00
	(0.7)	(5.4)	(18.8)	(37.4)	(37.7)		
T2: Differing viewpoints	9	23	94	159	124	4.00	2.00

	(2.2)	(5.6)	(23.0)	(38.9)	(30.3)		
T2: Ethics	7	29	89	164	120	4.00	2.00
	(1.7)	(7.1)	(21.8)	(40.1)	(29.3)		
T3: Basic needs	4	23	73	147	162	4.00	1.00
	(1.0)	(5.6)	(17.8)	(35.9)	(39.6)		
T3: Financial costs	7	23	80	164	135	4.00	2.00
	(1.7)	(5.6)	(19.6)	(40.1)	(33.0)		
T3: Steps of production	10	28	81	155	135	4.00	2.00
	(2.4)	(6.8)	(19.8)	(37.9)	(33.0)		
T3: Safe food prep	3	10	61	140	195	4.00	1.00
	(0.70)	(2.4)	(14.9)	(34.2)	(47.7)		
T4: Population growth	3	26	94	158	128	4.00	2.00
	(0.7)	(6.4)	(23.0)	(38.6)	(31.3)		
T4: Scientific advancements	6	24	77	176	126	4.00	2.00
	(1.5)	(5.9)	(18.8)	(43.0)	(30.8)		
T4: Biological processes	7	29	106	148	119	4.00	2.00
	(1.7)	(7.1)	(25.9)	(36.2)	(29.1)		
T4: Harmful and beneficial organisms	3	21	87	165	133	4.00	2.00
	(0.7)	(5.1)	(21.3)	(40.3)	(32.5)		
T4: Scientific discoveries	7	40	99	148	115	4.00	2.00
	(1.7)	(9.8)	(24.2)	(36.2)	(28.1)		
T5: Supply and demand	3	13	87	158	148	4.00	2.00
	(0.7)	(3.2)	(21.3)	(38.6)	(36.2)		
T5: Inventions	14	39	112	140	104	4.00	2.00
	(3.4)	(9.5)	(27.4)	(34.2)	(25.4)		
T5: Global economy	5	33	86	155	130	4.00	2.00
	(1.2)	(8.1)	(21.0)	(37.9)	(31.8)		
T5: Role of government	8	24	96	138	143	4.00	2.00
	(2.0)	(5.9)	(23.5)	(33.7)	(35.0)		

Only four questions, aligning with NALO Themes 1, 2 and 3, had little to no difference in opinion (IQR = 1). This low IQR indicates the middle 50% of respondents answered “very important” (4) or “extremely important” (5). These questions discussed students learning about content including the ways agriculture provides for human’s basic needs, how land is used by different groups such as farmers, miners, recreation, manufacturing, or the government, concepts of renewable and non-renewable resources, and safe food preparation. All other questions saw a more moderate spread of opinions within the data, with a range of 2 units on the Likert-scale (IQR = 2). This indicates the middle 50% of respondents answered “moderately important (3)”, “very important” (4), or “extremely important” (5).

### Research Question Two

The second research question investigated what factors influence the level of importance parents place on their students learning about agriculture in school. Using multiple regression models, the theme scores were the dependent variables, and the independent variables were the demographic variables including occupation, education, location (metropolitan, micropolitan, and small town/rural), school involvement, and agricultural experience. These regression models were structured as a forward entry model as previous literature indicated parents' occupation, education level, location, school involvement, and agricultural experiences all have influenced parents' view of their children's learning therefore these five factors will remain in each model for evaluation (Bronfenbrenner, 1979; Hoover-Dempsey & Sandler, 1997; Sirin, 2005; Cheung & Kwan, 2021). To investigate the relationship between these variables, correlation coefficients were calculated (Table 3). Most variables had low correlation; however, school involvement and agriculture experience indicated a strong positive relationship with  $r = .526$ . This was the strongest relationship in the model, with the correlation coefficient closest to  $\pm 1.0$  of any factor, and was statistically significant ( $t = <.01, p < .05$ ). However, the variance inflation factor (VIF), indicating the strength in relationship between predictors, for all five regression models was between 1.00 and 2.00 indicating low correlation. A VIF of 1.00 or less indicates no correlation, 1.00 to 5.00 indicates some correlation, and 5.00 to 10.00 indicates high correlation (Hayes, 2023). Therefore, it was not a strong enough relationship to indicate multicollinearity, instances of high correlation between two or more independent variables in a multiple regression, so the two factors were retained in the model.

**Table 3**

#### *Correlation Matrix*

	Level of education	Occupation	Location	School involvement	Agriculture experience
Level of education	--				
Occupation	-.060	--			
Location	.080	-.065	--		
School involvement	-.095	-.040	.036	--	
Agriculture experience	-.057	.044	.095	.526*	--

$p < .05$ \*

The first NALO theme titled "Agriculture and the Environment" focuses on teaching students the ways natural and managed ecosystems provide for everyday needs (Spielmaker & Leising, 2013). Two questions addressed this theme. Education level and school involvement were statistically significant predictors of Theme 1 responses at  $p < .05$  level. However, the  $R^2$  values for each model indicated each predictor variable was a poor predictor of any change in the dependent variable. The model with all five variables was statistically significant,  $R^2 = .025, F(5, 409) = .365, p < .05$ .

The second NALO theme "Plants and Animals for Food, Fiber and Energy" discusses the ways agriculture provides for daily life. Objectives focus on topics of animal and plant domestication, production practices, genetics, and harvest techniques to meet the needs of the global population (Spielmaker & Leising, 2013). Four questions addressed this theme. No individual factors were statistically significant in predicating any change in the dependent variable based on  $p < .05$ . The  $R^2$  values for each of the models indicate the five factors are not good predictors of Theme 2 scores. The multiple regression model for all five variables was not statistically significant,  $R^2 = .107, F(5, 409) = .097, p < .05$ .

The third NALO Theme is titled “Food, Health and Lifestyle.” This theme incorporates concepts from USDA’s My Plate diagram, food safety, and food processing with agricultural production processes to build a complete farm to table picture for students (Spielmaker & Leising, 2013). Four questions addressed Theme 3. Like Theme 1, education level was a statistically significant predictor of change in NALO Theme 3 responses based on  $p < .05$ . In Theme 3, occupation was also a statistically significant indicator of change in the dependent variable. Despite this significance,  $R^2$  in each model indicate a poor fit. The multiple regression model for all five variables  $R^2 = .15$ ,  $F(5, 409) = .729$ ,  $p < .05$  was not statistically significant.

The fourth NALO Theme “Science, Technology, Engineering and Math” highlights the intersection of innovation with agriculture throughout history. From early inventions of simple machines to modern computer technologies, this theme builds understanding of the progress achieved in agricultural inventions and continued demand for technological innovations to feed the world (Spielmaker & Leising, 2013). Five questions addressed this theme in the survey instrument. Level of education remained the only statistically significant variable across all five models (Table 15). However, the  $R^2$  values were also small. The multilinear regression model for all five factors indicate  $R^2 = .144$ ,  $F(5, 409) = .161$ ,  $p < .05$  was not significant.

The final NALO Theme “Culture, Society, Economy, and Geography” focuses on social studies aspects of agricultural production. The outcomes emphasize historical inventions, agricultural practices of civilizations throughout history, and economic impacts of agriculture both in the U.S. and globally. Four questions addressed Theme 5. Again, the only statistically significant factor influencing parents’ response to the Theme 5 questions was level of education (Table 16). Though this was statistically significant,  $R^2 = .096$  indicates this factor is poor fit at predicting parents’ responses. When looking at all five factors in a multilinear regression,  $R^2 = .132$ ,  $F(5, 409) = .659$ ,  $p < .05$  was not statistically significant.

### **Discussion and Conclusions**

School learning is a large component of child development, second only to parental influence (Bronfenbrenner, 1974; McLeod, 2018a, 2022). Parent engagement in schooling is important to support child development, parent-teacher-student relationships, and the community as a whole (Epstein et al., 2019; Hoover-Dempsey & Sandler, 1997). In the 1980s the National Research Council highlighted the need to incorporate agricultural content into school lessons for all students (National Research Council, 1988). Since that time, key agricultural literacy organizations have worked to increase the U.S. population’s agricultural literacy through school-based outreach efforts. With Bronfenbrenner as the foundation, this study brought together child development and school engagement research with agricultural literacy outreach objectives to understand the level of importance parents place on their children learning about agriculture in school. His Ecology of Human Development theory depicts the bidirectional influence of parents, the community, and schools indicating these groups have influence on each other. This supports the literature indicating parents play a strong role in school curriculum decisions (Buell-Hiatt, 1994; Hoover-Dempsey & Sandler, 1997; Woyshner, 2000). Based on the findings of this study we conclude parents place high value on their children learning about agriculture in school. This conclusion aligns with Bronfenbrenner’s model. Parents want their children to learn from and learn about the world around them.

Results indicate 72% of parents believe it is very or extremely important their children learn about agriculture in school. This provides agricultural literacy program leaders with data for approaching school district leaders to implement programming. Of the 19 questions based on NALOs, four questions connected to Themes 1-3 had a very low IQR (IQR = 1) meaning most parents answered similarly to these questions, with “very important” as the median response ( $Mdn = 4$ ). The agricultural concepts within these questions do scaffold in complexity as the grade levels increase, however, at their root, these questions discuss the most basic of agricultural concepts. The Theme 1 question addressed the ways land is used by farmers,

manufacturing, recreation, and other uses. The Theme 2 question addressed evaluating the use of renewable and nonrenewable resources. The Theme 3 questions asked about teaching the ways agriculture provides for humans' most basic needs of food, water, shelter, clothing, and energy as well as safe food preparation.

It could be argued the 15 remaining questions, with more variation in respondents' answers, (IQR = 2), take on more complex topics in agriculture. The Theme 1 questions discuss environmental impacts of agriculture. The Theme 2 questions address ethics and cultural differences in food consumption. Theme 3 questions focus on financial aspects of agricultural production. Theme 4 is focused on Science, Technology, Engineering and Math (STEM). These themes directly address animal welfare and genetic modification concepts which have been sources of consumer consternation as ballot initiatives and legislation in recent years and cause consumers pause in grocery aisles (Hopkins et al., 2022; Peckman, 2020; Powers & Roberts, 2022). Theme 5 addresses the economic impact of agriculture and other social studies concepts. The U.S. Financial Literacy and Education Commission indicates Americans struggle to make the most basic decisions associated with these types of economic questions (2020). Respondents most often answered "very important" for the topics within NALO Themes 4 and 5 however, there was slightly more variation in these responses (IQR = 2). Across all questions, the median responses still indicate most parents felt each topic was either very important or extremely important for their children to learn in school.

Research question two sought to investigate what factors influence parents' response to the NALO themed questions. The factors investigated included level of education, occupation type, location (metropolitan, micropolitan, small town/rural), agricultural engagement, and school interaction. The literature indicated parents' level of education is one of the most stable predictors of characteristics of students (Sirin, 2005). Additionally, parental engagement in school influences student outcomes (Hoover-Dempsey & Sandler, 1997). One or both factors, education level and school involvement, prove to be statistically significant predictors of response for four NALO themes' questions, however, these factors are not strong predictors based on  $R^2$  values for each regression model.

Given rural communities' proximity to farms and agriculture, food, and natural resource related businesses, researchers investigated location based on metropolitan, micropolitan, and small town/rural, as defined by the USDA's Economic Research Service (USDA ERS, 2023). However, it was found location did not significantly predict how parents might respond to these NALO themed questions. Respondents were asked about agricultural involvement. Agritourism (33%), growing a home garden (42%), purchasing produce from a farmer (48%), and visiting a local fair (48%) had the highest participation, with 21% of respondents raising their own livestock or chickens. More than 60% of respondents participated in at least two of the eight agricultural activity options. Only 3% indicated having no experiences with agriculture in the past year. While attending a local fair or purchasing food from a farmers' market may not be an in-depth experience with modern agricultural practices, it is worth noting that most of this population had some specific engagement with agriculture in the past year.

All together the five demographic factors considered, as possible factors affecting parents' value of their children learning about agriculture in school, proved to not be statistically significant influences on any NALO theme response. Education level was individually significant for four themes, and school involvement and occupation were each individually significant for one theme. Based on  $R^2$  values, none of these factors were strong predictors of parents' responses. Unlike school subjects evaluated in previous research, the value parents' place on their children learning about agricultural topics in school is not strongly influenced by parents' level of education, occupation, location, school involvement, or agricultural experience.

### **Recommendations**

Further research is needed to understand what sources of information about agriculture parents see as credible and how this information is impacting their decision making. An initial next step might be to

ask parents where they are receiving their information about the agricultural topics. Knowing about sourcing information could clarify what factors influence the level of importance indicated in this study. Based on the literature, parents' level of education, occupation, location, involvement in school activities, and agricultural exposure all were evaluated in this research, yet none proved to strongly influence parents' indicated level of importance of their students learning about agriculture. So, if not these factors, then what factors do influence the level of importance parents place on their children learning about agriculture in school?

Repeating this study using specific, more controversial terms such as GMO, animal welfare, and autonomous equipment, in a similar context to the questions asked in this study might provide insight into specific support or disapproval of agricultural practices. Would parents place the same high level of importance on their students learning about genetic modification, livestock antibiotic use, or autonomous tractors in school? Changing the vernacular describing agricultural practices in a study such as this might influence the level of importance parents place on certain topics. It also could add to the body of science literacy research by using more specific terms directly related to advancements in plant and animal science.

Additional research could also investigate ways agricultural literacy interventions are reaching parents as well as school children. Major entities conducting this type of outreach report hosting events where parents attend as chaperones or families come to public events, yet little research has been conducted with the parents at these events. Agricultural literacy program staff could capitalize on the school involvement factor, as discussed in this research, by seeking out support of parent teacher associations. It would seem a partnership with these organizations would surface some of the most involved parents which could garner support for further agricultural literacy interventions in the school.

A final recommendation would be to conduct an agricultural literacy assessment of a sample of the adult population in a similar manner to the way this study's population was sourced. The Logic Model for Agricultural Literacy indicates the long-term result of agricultural literacy programming is to create an agriculturally literate population (Spielmaker et al., 2014). While the literature suggests we have not reached this state of societal literacy, until such an assessment is provided to a sample of the adult population, the society's current level of agricultural literacy is unknown.

## References

- 2021 AITC Program Report. (2021, June). <https://www.jotform.com/report/22048559108405518>
- Adelhardt, L. (2006). *Agriculture in the Classroom 1981-2006*. National Agriculture in the Classroom Organization. [https://cdn.agclassroom.org/nat/data/get/25th\\_book.pdf](https://cdn.agclassroom.org/nat/data/get/25th_book.pdf)
- Bronfenbrenner, U. (1974). Developmental research, public policy, and the ecology of childhood. *Child Development*, 45(1), 1–5. <https://doi.org/10.2307/1127743>
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press. <http://ebookcentral.proquest.com/lib/usu/detail.action?docID=3300702>
- Buell-Hiatt, D. (1994). Parent involvement in American public schools: An historical perspective 1642-1994. *The School Community Journal*, 4(2), 27–38.
- Cheung, S. K., & Kwan, J. L. Y. (2021). Parents' perceived goals for early mathematics learning and their relations with children's motivation to learn mathematics. *Early Childhood Research Quarterly*, 56, 90–102. <https://doi.org/10.1016/j.ecresq.2021.03.003>

- Constantine, N. A., Jerman, P., & Huang, A. X. (2007). California parents' preferences and beliefs regarding school-based sex education policy. *Perspectives on Sexual and Reproductive Health*, 39(3), 167–175. <https://doi.org/10.1363/3916707>
- Epstein, J. L., Sanders, M. G., Sheldon, S. B., Simon, B. S., Clark-Salinas, K., Rodriguez-Jansorn, N., Van Voorhis, F. L., Martin, C. S., Thomas, B. G., Greenfeld, M. D., Hutchins, D. J., & Williams, K. J. (2019). *School, family, and community partnerships: Your handbook for action* (Fourth Edition). Corwin.
- FMI. (2023). *U.S. Grocery Shopper Trends*. [www.fmi.org/Grocerytrends](http://www.fmi.org/Grocerytrends).  
[https://www.fmi.org/images/default-source/2023-trends/trends-tracker-2023-infographic-q.png?sfvrsn=deb2d23d\\_1](https://www.fmi.org/images/default-source/2023-trends/trends-tracker-2023-infographic-q.png?sfvrsn=deb2d23d_1)
- Gill, B. P., & Schlossman, S. L. (2003). Parents and the politics of homework: Some historical perspectives. *Teachers College Record*, 105(5), 846–871. <https://doi.org/10.1111/1467-9620.00270>
- Guy-Evans, O. (2020). Bronfenbrenner's ecological systems theory.  
<https://www.simplypsychology.org/Bronfenbrenner.html>  
<https://www.simplypsychology.org/Bronfenbrenner.html>
- Harackiewicz, J. M., Rozek, C. S., Hulleman, C. S., & Hyde, J. S. (2012). Helping parents to motivate adolescents in mathematics and science: An experimental test of a utility-value intervention. *Psychological Science*, 23(8), 899–906. <https://doi.org/10.1177/0956797611435530>
- Hayes, A. (2023, February 25). *Multicollinearity: Meaning, examples, and FAQs*. Investopedia.  
<https://www.investopedia.com/terms/m/multicollinearity.asp>
- Hirschoff, M.-M. U. (1977). Parents and the public school curriculum: Is there a right to have one's child excused from objectionable instruction. *Southern California Law Review*, 50(5), 871–960.
- Hoover-Dempsey, K. V., & Sandler, H. M. (1997). Why do parents become involved in their children's education? *Review of Educational Research*, 67(1), 3–42.  
<https://doi.org/10.3102/00346543067001003>
- Hopkins, K. A., McKendree, M. G. S., & Schaefer, K. A. (2022). Resolving the reality gap in farm regulation voting models. *Food Policy*, 112, 102357.  
<https://doi.org/10.1016/j.foodpol.2022.102357>
- Kantor, L., & Levitz, N. (2017). Parents' views on sex education in schools: How much do Democrats and Republicans agree? *PLoS ONE*, 12(7), e0180250.  
<https://doi.org/10.1371/journal.pone.0180250>
- Kovar, K. A., & Ball, A. L. (2013). Two decades of agricultural literacy research: A synthesis of the literature. *Journal of Agricultural Education*, 54(1), 167–178.  
<https://doi.org/10.5032/jae.2013.01167>
- Kuhns, A., & Saksena, M. (2017). *Food purchase decisions of millennial households compared to other generations* (EIB-186). U.S. Department of Agriculture, Economics Research Service.

- Lago-Ballesteros, J., Martins, J., González-Valeiro, M. Á., & Fernández-Villarino, M. A. (2019). Parental assessment of physical education in the school curriculum: A brief report on the influence of past experiences as students. *PLoS ONE*, *14*(7), e0219544. <https://doi.org/10.1371/journal.pone.0219544>
- Library of Congress. (n.d.). *School segregation and integration* [Web page]. Library of Congress. Retrieved February 27, 2023, from <https://www.loc.gov/collections/civil-rights-history-project/articles-and-essays/school-segregation-and-integration/>
- McLeod, S. A. (2018a). Jean Piaget's Theory of Cognitive Development. *Simply Psychology*. <https://www.simplypsychology.org/piaget.html>
- McLeod, S. A. (2018b). Maslow's Hierarchy of Needs. *Simply Psychology*.
- McLeod, S. A. (2022). Lev Vygotsky's Sociocultural Theory. *Simply Psychology*. <https://www.simplypsychology.org/vygotsky.html>
- Najarro, I. (2021, December 17). Majority of educators believe parents should be involved in curriculum choices. *Education Week*. <https://www.edweek.org/teaching-learning/majority-of-educators-believe-parents-should-be-involved-in-curriculum-choices/2021/12>
- National Agriculture in the Classroom. (2023). *About*. About. <https://agclassroom.org/get/about/>
- National Center for Agricultural Literacy. (n.d.). *About*. About. <https://www.agliteracy.org/about/>
- National Research Council. (1988). *Understanding agriculture: New directions for education*. National Academy Press. [http://www.nap.edu/catalog.php?record\\_id=766](http://www.nap.edu/catalog.php?record_id=766)
- NIMSS. (2019). *Multistate Agricultural Literacy Research Project (W3006)*. National Institute of Food and Agriculture. <https://www.nimss.org/projects/view/mrp/outline/18611>
- Pallant, J. (2016). *SPSS survival manual* (6th ed.). Open University Press.
- Peckman, J. Y. (2020). *Exploring the influence of the "gluten-free" label claim on parents' food purchasing decisions* [Thesis]. <https://ttu-ir.tdl.org/handle/2346/85798>
- Powers, R., Li, N., Gibson, C., & Irlbeck, E. (2020). Consumers' Evaluation of Animal Welfare Labels on Poultry Products. *Journal of Applied Communications*, *104*(1). <https://doi.org/10.4148/1051-0834.2310>
- Powers, R., & Roberts, R. (2022). A historical examination of food labeling policies and practices in the United States: Implications for agricultural communications. *Journal of Agricultural Education*, *63*(4), 168–187. <https://doi.org/10.5032/jae.2022.04168>
- Schock, N., & Jeon, L. (2023). Like your students, like their families? Teacher perceptions and children's socio-emotional-behavioral functioning. *Journal of Applied Developmental Psychology*, *84*, 101479. <https://doi.org/10.1016/j.appdev.2022.101479>
- Seginer, R. (2006). Parents' educational involvement: A developmental ecology perspective. *Parenting*, *6*(1), 1–48. [https://doi.org/10.1207/s15327922par0601\\_1](https://doi.org/10.1207/s15327922par0601_1)

- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417–453. <https://doi.org/10.3102/00346543075003417>
- Southwell, B. G., & White, K. (2022). *Science and Technology: Public Perceptions, Awareness, and Information Sources* (NSB-2022-7). National Science Board. <https://nces.nsf.gov/pubs/nsb20227/information-sources-and-involvement>
- Spielmaker, D. M. (2019, June). The green book: Chapter 2—Agricultural literacy. *The Agricultural Education Magazine, 91*(6), 22–25.
- Spielmaker, D. M., & Leising, J. G. (2013). *National agricultural literacy outcomes*. <https://www.agliteracy.org/resources/outcomes/>
- Spielmaker, D. M., Pastor, M., & Stewardson, D. M. (2014). *A logic model for agricultural literacy programming*. American Association for Agricultural Education, Snowbird, UT. <https://www.agliteracy.org/research/logic/>
- U.S. Census Bureau. (2022). *America's families and living arrangements: 2022* (Table A3). <https://www.census.gov/data/tables/2022/demo/families/cps-2022.html>
- U.S. Census Bureau. (2023). *Family households with own children under 18 years of age by type of family, 2000 to 2021, and by age of householder*. <https://statabs-proquest-com.dist.lib.usu.edu/sa/docview.html?table-no=66&acc-no=C7095-1.1&year=2023&z=032E7E988287FE41214A5E79F7A9322755069A84&rc=1&seq=65&accountid=14761&y=current>
- U.S. Financial Literacy and Education Commission. (2020). *U.S. national strategy for financial literacy*. U.S. Department of the Treasury. <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://home.treasury.gov/system/files/136/US-National-Strategy-Financial-Literacy-2020.pdf>
- USDA ERS. (2023, March 22). *Rural-Urban commuting area codes*. USDA Economic Research Service. <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>
- Woyshner, C. (2000). *Black Parent-Teacher Associations and the origins of the National Congress of Colored Parents and Teachers, 1896–1926*.