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Content Topic Development for Elementary Agricultural Education Curriculum

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Abstract

The purpose of this Delphi study was to determine perceptions of 16 stakeholders regarding what topics should be included in new elementary agricultural education curriculum for the state of Georgia. Participants consisted of elementary principals/teachers/counselors, middle school teachers, Ag in the classroom representatives, Agricultural Education State Staff, curriculum specialists, early childhood teachers, and commodity group representatives. This Delphi study resulted in 52 topics that were agreed upon by the participants; 10 topics received a 4.50 – 5.00, 16 items received a 4.25 – 4.49, 13 items received a 4.00 – 4.24, 11 items received a 3.75 – 3.99, 2 items received a 3.50 – 3.7. Participants identified the following five knowledge/skills/competencies as the most important: 1. Define agriculture and local community agriculture, 2. Agriculture industry other than farming, 3. Farm products/ag products/locally grown, 4. Careers in agriculture, 5. Resource management. These 52 knowledge/skills/competencies serve as a practical starting point for elementary agricultural education standards development. Additional research is needed to refine each knowledge/skills/competencies. The results of this study have been used to create the first set of elementary agricultural education standards for Georgia that were implemented in the Fall of 2019 by 26 pilot elementary agricultural education programs.

Keywords: elementary education; early childhood education; standards development; curriculum development

Introduction

The primary focus of most elementary education school curricula in the United States tends to be on basic academic learning and socialization skills. To date agricultural education has been absent or only a peripheral part of standardized elementary education. Because of this, what should be taught in elementary agricultural education has been interpreted differently by different people. Few public schools have focused on agriculture and/or food resulting in a society with limited understanding and/or misconceptions about agriculture and food systems (Hess & Trexler, 2011; Mabie & Baker, 1996), while the United States obesity rate continues to climb (Center for Disease Control and Prevention, 2019).

To assist in combatting the climbing obesity rates the 2017-2018 Regular Session of the Georgia Assembly passed Senate Bill 330 passed, which was signed into law by Governor Nathan Deal (Senate Bill 330, 2018). This bill established pilot programs for Elementary Agricultural Education in the state of Georgia; "so as to provide that the agricultural education program is based on a three-component model; to provide for a pilot program to develop and implement agricultural education in elementary schools; to provide for selection of pilot sites..." (GA Senate Bill 330, 2018, line 2-5).

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Twenty-six elementary schools have agreed to serve as pilot programs, which began in the Fall of 2019 (Christa Steinkamp, Personal Communication, 2019).

Society has reached a crossroads in recent years regarding how we teach children about the foods they eat. By implementing physical education programs and healthier meal plans, school systems have tried to curb the adverse effects of obesity in children (USDA, 2012). According to the Center for Disease Control and Prevention (CDC), the percentage of children affected by obesity has tripled since the 1970s (CDC, 2018). As a result, student populations have body mass indexes (BMIs) above the healthy range, additional data highlights that 1 in 5 children are obese (CDC, 2018). It is paramount that youth understand where their food comes from; leading to further analysis of complex issues later in life surrounding food such as transgenics and genetically modified organisms. Many Americans complete an education system that prepares them academically, but fails to prepare them for practical, everyday decisions surrounding food and food choices.

The US ranked 38th in math and 24th in science out of 71 developed countries (PISA, 2015). Educational professionals seek, but have not been successful in implementing more effective ways to teach students in a way to increase overall math and science knowledge. A greater emphasis has been placed on Science, Technology, Engineering, and Math (STEM) programs, specifically beginning with students at lower grade levels (Graves et al., 2016). Elementary agricultural education provides a new direction toward increasing content knowledge in food, health, math, science, and reading utilizing the context of agriculture. Therefore, the purpose for conducting this study comes from the emerging need to establish standards to guide the newly established elementary agricultural education pilot programs. Multiple researchers have addressed the technicalities of how to set educational standards (Cizek & Bunch, 2007; Hambleton & Pitoniak, 2006; Zieky et al., 2008), this study aimed to fundamentally look at the educational needs and abilities of elementary students within an agricultural context.

Review of the Literature

Frick (1993) found that middle school agricultural education should be distinct and focus on the importance of creating a more agriculturally literate student. The Task Force on Middle School Agricultural Education determined that middle school students required unique and appropriate standards and curriculum due to their nature and maturity level (Frick, 1993). Elementary students have an equally unique nature and maturity level from middle school students, as middle school students have unique characteristics from high school students (Starratt, 2017).

Agricultural Education at the high school level began long before the Smith-Hughes National Vocational Education Act of 1917 (Moore, 1987). In much the same way middle school agricultural education was spreading long before 1988 when the National FFA Organization made a change to their constitution to allow middle school students FFA membership (FFA, 2019). A similar trend can be seen in elementary agricultural education in public schools with initiatives like Ag in the Classroom and school gardens. However, the state of Georgia is taking steps to formalize agriculture as a subject area in elementary curriculum.

Recurrent elementary education themes include prescription of standards and standardized curriculum, impacts of student activity on achievement, and the interactions between knowledge and enthusiasm when teaching agricultural topics (Atherton, 1964).

Trexler and Hikawa (2001) observed the creation of a bourgeoning elementary and middle school agricultural education program at Countryside Charter School. Teachers were given autonomy in the ways that they could teach agricultural topics in conjunction with their pre-existing expertise. The school had access to a 75-acre farm and was located in an area that was supportive of agricultural education. The three major components that led these teachers to find difficulty were lack of experience, lack of time, and lack of resources (Trexler & Hikawa, 2001). The teachers saw value in what they were teaching but were severely limited by the amount of preparation and content knowledge that they

had. This led to decreased feelings of self-efficacy and frustration, causing the program to stumble in its first two years (Trexler & Hikawa, 2001). With time the program flourished but the shaky-footing that they began upon acts as a preemptive warning to those wanting to implement an effective agricultural curriculum in an elementary school setting.

Lambert et al. (2014) found teachers to be supportive of curriculum standards in agricultural education curriculum. By looking at teachers' perceptions towards standardization, Lambert et al. were able to determine the viability of instituting a more regimented agricultural curriculum which serves as justification for this study.

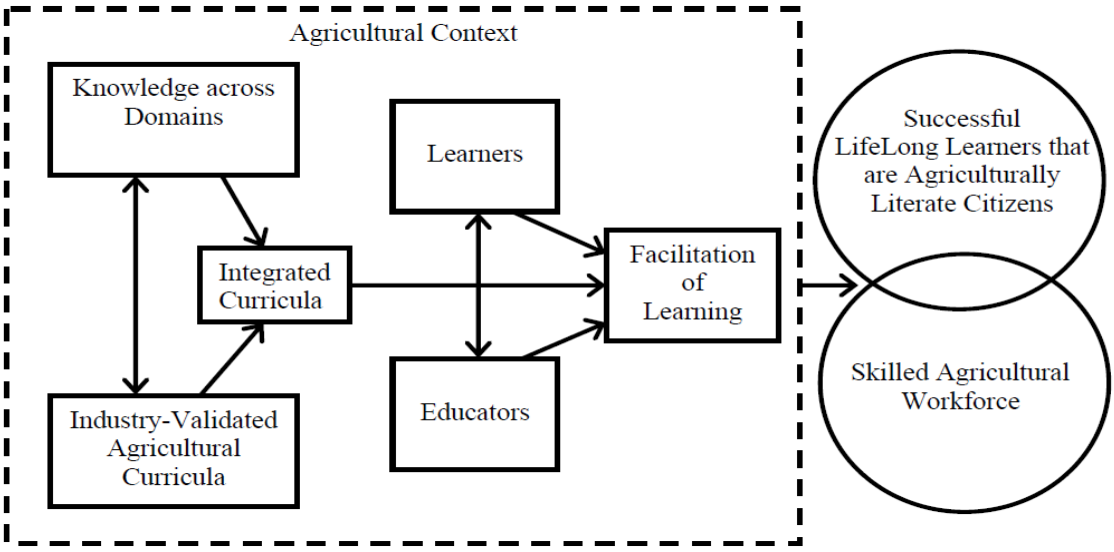
Knobloch et al. (2007) were able to describe the direct benefits of using an agricultural curriculum in an elementary/middle school setting. They concluded that by providing agricultural education as a framework for other traditional classroom topics, teachers were able to provide "situatedness, connectedness, and authenticity to teach their students" (Knobloch et al., 2007, p 32). The researchers did provide a caveat that certain topics in school coalesced with agriculture more smoothly, i.e. teaching science with a garden was easier to accomplish than teaching language arts in a garden setting. Situatedness allowed for students to view their education in relation to the context around them. For example, teaching a science lesson about plant life cycles while outside in a garden, allowed for students to see the greater context that these lessons situated. Connectedness is similar to situatedness but deviates in that where situatedness relates students back to their immediate area, connectedness places things in a global context. Finally, authenticity was achieved by demonstrating concepts that could be observed through structured practice in the classroom. Students in this study were able saw that lessons had inherent value and could be applied to various aspects of their daily lives (Knobloch et al., 2007).

Similarly, Thorp and Townsend (2001) conducted an ethnographic examination of a school garden in an elementary school to investigate the instructional benefits of school gardens. They were able to show five different ways that agricultural education can aid an elementary school: 1.) shifts school culture, 2.) mediate loss of time in modern education schema, 3.) connect students via experiential learning, 4.) expression of creativity through garden, 5.) perception of agricultural shifts from commodity to a community (Thorp & Townsend, 2001). Each of these five topics, according to their research, had an ample effect on the included school. Finally, Thorp and Townsend (2001) called for the installation of a dedicated school garden volunteer (community-based or Americorp).

Conceptual Framework

Roberts and Ball's (2009) model for teaching agricultural subject matter as a content and context laid the conceptual framework for this study. The researchers recognize that this model illustrates the theoretical bases for viewing agriculture as both a content and a context for teaching agriculture at the secondary level. Roberts and Ball (2009) stated that agricultural curricula must be taught in conjunction with industry-related content and teacher knowledge in the subject area. This then would lead to a learning environment where the learner and educator were engaged in a meaningful learning environment. This learning would then assist in the creation of an agriculturally literate society and/or a skilled workforce for the agricultural industry (Roberts & Ball, 2009). As a new phase in agricultural education begins, the data collected is supported by the idea of using all resources available and the community that the school is housed in (context) as a means to inform elementary school students about agricultural concepts (content). When examining the curricular needs of elementary agricultural education students, the participants examined the current curriculum being taught in elementary classrooms to determine how the agricultural education standards could supplement the learning occurring in the other core educational areas, rather than only examining agricultural needs. Therefore, the application of this framework at the elementary level, at this time, appears to be appropriate.

Figure 1
Content and Context by Roberts and Ball (2009)



Purpose and Objectives

The purpose of this study was to establish topics needed for the development of state standards for elementary agricultural education curriculum. Beginning in August of 2019, Georgia initiated a pilot program for agricultural education to be taught at the elementary level with 26 pilot programs. Ensuring state standards exist for elementary agricultural education was one of many key components needed to ensure program success during this three-year long pilot program. Therefore, this study aimed to develop the necessary topics that should be included in elementary agricultural education curriculum, as deemed by a panel of experts.

Methods and Procedures

The RAND Corporation developed the Delphi method for experts in a particular discipline to reach a consensus on a given topic or opinion (van Zolingen & Klaassen, 2003; Okoli & Pawlowski, 2004). Furthermore, Okoli and Pawlowski (2004) postulated that the Delphi methods was an acceptable method for education research examining curriculum development or predicting future program generation. Therefore, for the purpose of this study a true Delphi method was used to assist in the generation of new curriculum topic areas needed when teaching elementary agricultural education in the state of Georgia.

Participants and Selection

There is not a formula to determine the exact number of experts to include on a panel for a Delphi study. Linstone (1978) suggests that "a suitable minimum panel size is seven", however a review the literature shows panel sizes have varied tremendously. The researchers' decision to invite 25 experts was empirical and pragmatic, taking into consideration factors such as time, expense, and availability. The researchers utilized the five-step process for participant selection by Okoli and Pawlowski (2004):

Step 1: Prepare a knowledge resource nomination worksheet (KRNW),
Step 2: Populating the KRNW with names,
Step 3: First-round contacts – nominations for additional experts,
Step 4: Ranking experts by qualifications, [and]
Step 5: Inviting experts to the study (pp. 20-23).

Effort was made by the researchers to include experts with an interest in elementary agricultural education, the agricultural industry, and educational program development.

In the summer of 2018, 25 stakeholders were invited to participate in this study with 16 participants actually participating. Participants included: high school agriculture teachers (1), middle school agriculture teachers (2), elementary teachers (1), elementary principals (1), middle school principals (1), Ag in the Classrooms representatives (2), Agricultural Education Faculty (2), Georgia State Staff (1), graduate students in agricultural education (1), Georgia Department of Education Food and Nutrition Representative (1), agricultural commodity group representatives (2), and the state Curriculum Director (1). These participants met in Athens, Georgia for one day to participate in this study. The group discourse took approximately seven hours to complete and assumes that group judgments are more valid than individual judgements. Most notably absent from the participants are elementary education university faculty, five were invited to attend and none chose to participate. The disproportional balance of agricultural education experts to elementary education experts is a limitation to this study.

Instrumentation, Data Collection, and Analysis

During the in-person data collection process, all participants were instructed to respond the same guiding question: What topics should be included in Elementary Agricultural Education curriculum. A trained discussion leader and two transcribers/note takers who recorded the participant's responses conducted led the Delphi. During the first round, participants were asked to respond to the question with their own thoughts and the note-takers recorded the responses exactly as the participants stated them. Other participants were asked to refrain from making comments on the topics shared and were asked to just add to the list not to reinforce any topics that were previously stated. Once all of the participant's topics were shared, the researchers administered an electronic survey with each of the topics. The participants were asked to respond to each of the items on a five-point likert scale. An *a priori* level of 3.5 was established for the retention of topics from round one to round two.

In round two, the participants were encouraged to look at the list of topics that were rated with a mean average of 3.5 or higher and to look at ways those topics could be combined, reduced, or removed from the list. Any change to the list had to be done with consensus from the entire group. Once discussion ended, the researched administered a revised electronic survey, using the same five-point Likert scale, to the participants. The participants were then presented with the reviewed list and given the option to make additional combinations, reductions, or removals. This group did not have any additional changes.

SPSS version 26 was used for data analysis. Following the final round of data collection, statistics for central tendency and variability were calculated for all items that met the 3.5 threshold for consensus. Researchers reported the mean score for each item to indicate the importance of that item to elementary agricultural education as determined by consensus of the Delphi Panel. The results of this Delphi Panel represent the collective thoughts of 16 experts participating in a Delphi at a single point of time, the results of this study should not be extended beyond this group to represent any other state, situation, or population. A total of 140 topics were considered during the course of this Delphi study and consensus was reached on 52 topics.

Findings

Data were collected in a series of two rounds with the first round being an open format for all participants to share ideas for topics resulting in 140 topics. Next, these 140 topics were loaded in Qualtrics, voted on by participants, and the participants were given the Mean and Standard Deviation for each topic with 121 standards receiving a Mean of 3.5 or higher (cutoff Mean of 3.5 was established *a priori*). The 19 topics that were removed from the study in round one are listed in Table 1. It is noteworthy that this was the first round of data collection, the group discussed and decided to remove specific curriculum packages like Project Wet, Project Wild, and Project Learning Tree and focus more on topics that would be appropriate for standards development. Some participants seemed to better differentiate between curriculum development and standard development at this juncture.

Table 1
Elementary Agricultural Education Topics Removed at the End of Round 1

No.	Topic	Mean	SD
1	Loans	2.67	0.83
2	Environmental education - Scat	3.07	1.15
3	Project wild	3.14	0.99
4	Project wet	3.14	0.99
5	Graphing	3.14	0.83
6	Project learning tree	3.20	1.06
7	Input Costs	3.27	0.77
8	Risk Management	3.27	0.86
9	Herbicide/pesticide	3.27	1.20
10	Research	3.27	1.25
11	Hunter safety	3.33	0.95
12	Installation	3.20	0.99
13	Farm business management	3.47	1.03
14	Bean in a bag	3.53	1.18
15	Grass Fed	3.33	0.79
16	Coordinate mapping	3.47	0.89
17	Risk	3.40	0.81
18	Plant macro nutrients	3.32	1.22
19	GPS	3.47	1.10
20	lawn care	3.47	0.82
21	Fertilizer	3.47	1.03

Next participants were given the opportunity to discuss, condense, create, or remove any topics presented during round one and achieved a mean score of 3.5 or higher. Researchers facilitated this discussion to aid in reaching group consensus, ensure clarity, and ensure everyone's participation. For any of these actions to occur a majority vote by the participants was required. By the end of this process the participants had condensed the list of elementary agricultural education standards topics from 121 to 80. These 80 topics were then loaded in Qualtrics for online voting and the participants were again allowed to vote for each topic individually and privately. Standards receiving mean level of 3.5 or higher (set *a priori*) were deemed to be essential and were accepted by the group resulting in 52 standards listed in Table 2.

Table 2
Elementary Agricultural Education Topics Retained After Round 2

No.	Topic	M	SD
1	Define agriculture and local community agriculture	5.00	0.00
2	Agriculture industry other than farming	4.81	0.40

Table 2
Elementary Agricultural Education Topics Retained After Round 2, Continued…

3	Farm products/ag products/locally grown	4.81	0.40
4	Careers in agriculture	4.75	0.45
5	Resource management	4.69	0.60
6	Soils - what is soil and what is living in it	4.69	0.48
7	Leadership - character building and citizenship	4.63	0.62
8	natural resources	4.63	0.62
9	Agricultural animal welfare/care	4.56	0.73
10	food animals	4.56	0.51
11	fertilizers/plant basic needs/sun	4.44	0.73
12	flower/plant parts	4.44	0.63
13	Animal identification	4.38	0.62
14	Animal safety	4.38	0.50
15	Edible plant, parts of plants/roots and shoots	4.38	0.62
16	Forestry products	4.38	0.81
17	Plant benefits - green space, energy cycle, photosynthesis, etc.	4.38	0.62
18	renewable/nonrenewable resources	4.38	0.62
19	Agricultural byproducts	4.31	0.60
20	Georgia habitats	4.31	0.60
21	Plant growth	4.31	0.60
22	Agricultural mechanics - tool identification and use	4.25	0.86
26	Measuring – using measuring tapes, rulers, etc.	4.25	0.77
24	Agricultural and Natural Resource sustainability	4.25	0.93
25	Tree ID	4.25	0.68
26	Urban agriculture	4.25	0.77
27	Geography/Georgia regions – Agricultural regions	4.19	0.98
28	Insects - pests/beneficial/pollinators	4.19	0.54
29	Ag Technology – global positioning systems, inventions, history, people	4.13	0.89
30	Animal breeds	4.13	0.89
31	Animal nutrition	4.13	0.62
32	Food preparation/measuring/preservation/processing/taste testing/safety	4.13	0.81
33	Recycling	4.13	0.81
34	Small/companion animals/pets	4.13	1.02
35	Ecosystems/food webs	4.06	0.68
36	Human nutrition/health - labeling, GMO's, grocery, organic	4.00	0.89
37	Problem solving and the scientific method	4.00	0.89
38	Streams, rivers, and watersheds	4.00	0.63
39	Water quality/management - water cycle, macro invertebrates	4.00	0.63
40	Plant classification	3.94	0.77
41	Succession/deforestation/reforestation	3.94	0.85

Table 2
Elementary Agricultural Education Topics Retained After Round 2, Continued…

42	Wildlife management - why people hunt	3.94	1.12
43	Agritourism/marketing/agricultural business	3.88	0.81
44	Erosion	3.81	0.75
45	Fiber processing	3.81	0.83
46	Ag sales/marketing/public relations	3.75	0.93
47	Landscape - plantings	3.75	0.86
48	Natural disasters/weather/seasons	3.75	0.86
49	Perennials/annuals/plant life cycles	3.75	0.86
50	When to plant	3.75	0.77
51	Equipment safety - lawnmower, all-terrain vehicles, tractors	3.63	0.92
52	Air quality	3.50	0.73

*All wording is according to panel suggestions

Next participants were given the opportunity to proceed with a third round of the review process, but the group consensus was that this list did not need further review.

Conclusions, Recommendations, and Implications

The results of this study have been used to create the first set of elementary agricultural education standards for Georgia that will be utilized in the fall of 2019 by 26 pilot elementary agricultural education programs. In addition to the research agenda that is currently being conducted, teacher preparation faculty have worked with the Georgia Professional Standards Commission Education Specialist, to develop Elementary Agricultural Education Teacher Certification Requirements. The Elementary Agricultural Education Teacher Certification Task Force met in September of 2018 and created a proposal for how Elementary Agricultural Education Teachers will be certified to teach in the state of Georgia. In conjunction with this new certification route the Agricultural Education Teacher Preparation Faculty are designing a post-secondary curriculum that will provide students with the tools needed to succeed in the teaching elementary agricultural science.

From this study, 52 topics for elementary agricultural education standards were developed. These topics included all seven of the Agricultural Food and Natural Resources Career Clusters (The Council, 2020). Furthermore, these topics can be cross walked with current topics being taught through the core academic curriculum to ensure that the agricultural education curriculum can supplement as an application for science, mathematics, and technology standards already being taught. This reinforces the work of Roberts and Ball's (2009) model for teaching agricultural subject matter as a content and context.

While these 52 topics serve as a valuable starting point for elementary agricultural education standard development additional research is needed as pilot programs utilize the standards developed from this study and are able to better determine which standards are appropriate to retain and which standards should be removed. Several of the recommended topics that resulted from this study are regionally or state specific. These regional differences may have been increased or decreased by the absence or presence of specific Georgia commodity groups.

The state of Georgia does no currently test elementary students in science, elementary students are tested in math and reading. While many agricultural education teacher educators consider high school agriculture courses the context within which to teach math and science, it may be more appropriate to consider elementary agriculture courses the context within which to teach math and reading. Furthermore, the planned pilot program for elementary agricultural education does not provide extended day or extended year funding for elementary agricultural education pilot program teachers so

these teachers fall outside of the prevue of the State Director of Agricultural Education, instead they fall under the prevue of the school principal. As such it is not clear how to best integrate the leadership component and individualized learning component at the elementary level, it may not be practical or possible to utilize FFA and Supervised Agricultural Experiences as middle school and high school programs do.

The following recommendations for further research were proposed:

1. Refining the elementary agricultural education standards,
2. Examination of elementary principal perceptions,
3. Examining existing Georgia agriculture teacher mobility towards elementary education programs,
4. Investigate barriers to success of elementary agricultural education programs, and best practices for elementary agricultural education programs,
5. Follow up studies are required to examine the standards developed from the proposed topics to determine their fit into the curriculum being taught in elementary classrooms.

The following recommendations for practitioners were proposed:

1. Work to develop working relationships with each of the grade level teachers to find ways to connect the agricultural education standards to the curriculum being taught in each of the core academic areas to enhance student knowledge retention.
2. Develop relationships with the county extension personnel to build collaboration between the education programing provided in school and the extracurricular programing through 4-H.
3. Develop relationships with local agricultural industry representatives to provide students with hands-on learning opportunities to apply the knowledge they are learning in their core content areas and in their agricultural education curriculum.

The following recommendations for teacher educators were proposed:

1. Work with elementary education faculty to look at possible collaboration methods to ensure that certified elementary agricultural education teachers become well versed in elementary and agricultural education pedagogical methods.
2. Work to develop pedagogical content knowledge courses to help certified agricultural education teachers learn new methods to connect agricultural content to elementary aged students.

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