

**Growing Minds: A Cross-Curricular STEM Professional Development Experience**

K. Dale Layfield  
Department of Agricultural Sciences  
Clemson University  
246 McAdams Hall  
Clemson, SC 29634  
864-656-5676  
[dlayfie@clemson.edu](mailto:dlayfie@clemson.edu)

Christopher J. Eck  
Department of Agricultural Education, Communications and Leadership  
Oklahoma State University  
234 Agricultural Hall  
Stillwater, Oklahoma 74078  
405-586-4655  
[chris.eck@okstate.edu](mailto:chris.eck@okstate.edu)

Joseph L. Donaldson  
Department of Agricultural and Human Sciences  
North Carolina State University  
1 Lampe Dr., 248 Ricks Hall  
Campus Box 7605  
Raleigh, NC 27695-7607  
919-515-1758  
[joseph\\_donaldson@ncsu.edu](mailto:joseph_donaldson@ncsu.edu)

Saifur Rahman  
Department of Agricultural and Human Sciences  
North Carolina State University  
1 Lampe Dr., 248 Ricks Hall  
Campus Box 7605  
Raleigh, NC 27695-7607  
919-670-8467  
[srahman9@ncsu.edu](mailto:srahman9@ncsu.edu)

Lauren Hood  
Department of Agricultural Sciences  
Clemson University  
1507 Dacusville Hwy.  
Easley, SC 29640  
864-567-8299  
[eburdin@clemson.edu](mailto:eburdin@clemson.edu)

Bohdana Vyshnivska  
Department of Agricultural Sciences  
Clemson University  
143E McAdams Hall  
Clemson, SC 29634  
864-635-1737  
[bvyshni@clemson.edu](mailto:bvyshni@clemson.edu)

Studies of Occupations, Culture, and Innovations toward Agricultural Literacy (SOCIAL): Professional Development for Integrating Agriculture and History Curricula is funded by the United States Department of Agriculture National Institute of Food and Agriculture (USDA-NIFA) Grant Number 2021-67037-34301

## **Introduction**

Just as agriculture is an ever-present aspect of our daily lives, agricultural sciences is a broad, interdisciplinary field that integrates science, technology, engineering, mathematics, and numerous social science concepts. From its prominent place in the core academic curricula stems the need to recognize the role core academic subjects, including topics such as socioscientific issues (SSIs), play in agricultural curricula (Burrows et al., 2025). This concept of blending academic components into agriculture curricula is grounded in the National Research Council's (NRC) report "Understanding Agriculture: New Directions for Education," which called for major reforms in vocational agriculture (National Research Council, 1988). The report recommended vocational education to "expand and upgrade the scientific and technical content of vocational agriculture courses," leading to years of collaboration among agriculture and science teachers (Warmbrod, 2019, p. 8).

McKim et al. (2016) discussed content area literacy and the importance for agriculture teachers to be competent in core academic areas. They noted that "teacher development in core academic integration and better position agricultural education as a powerful tool for student learning across academic boundaries" (McKim et al., 2016, p. 12). Stephenson et al. (2008) discussed in their study cross-curricular efforts with science and agriculture teachers and found that collaboration "(a) broadens school curricula, (b) reduces separation between teachers, (c) enhances student comprehension of scientific concepts, and (d) allows students to understand the relationship and importance of science and agriculture in today's society" (p. 115). However, with today's issues facing agriculture, cross-curricular issues exist beyond STEM subjects, and these topics might be addressed by social studies teachers. Burrows et al. (2025) stated, "many socioscientific issues (SSIs) impact agriculture across the world, and school-based agricultural education (SBAE) can play an important role in the education and training of individuals who can address the issues" (p. 1). At Clemson University, the issues confronting agriculture were at the center during the CASE AgXplore curriculum training with South Carolina middle school social studies and agricultural education teachers.

## **How It Works**

The idea for this program was a collaboration between middle school social studies and agricultural education teachers from across South Carolina for an intensive one-day training on creative uses of STEM and the CASE AgXplore curriculum. The social studies teachers, identified as SOCIAL Fellows, were part of a four-year USDA-funded project that exposed them to cutting-edge agricultural innovations to foster agricultural awareness among their students. For middle school agricultural education teachers in South Carolina, the expansion of these programs has prompted a significant demand for innovative curricula to engage their young students. Both groups were provided housing for two nights, so the training began at 7:30 a.m., and lunch/dinner were provided to keep the teachers on location until 7:30 p.m. During introductions, the agriculture and social studies teachers were encouraged to share their previous engagements in curricular activities related to those outside of their subject area, if any.

The CASE AgXplore curriculum program includes hands-on activities that are designed for middle school students and focused on "plants, resources, energy, and animals we use and

consume due to agricultural technologies” (Case Learning, n.d., para. 1). Throughout the day, teacher pairings were purposefully mixed between the two groups and the CASE affiliate professor leading the training encouraged teachers to share professional perspectives during all the activities. All participating teachers received the CASE AgXplore certification through their active participation in the immersive professional development experience.

### Results to Date

Overall, the participating middle school social studies and agricultural education teachers enjoyed the opportunity and were excited about the potential of integrating CASE AgXplore in their corresponding middle school courses. In follow-up correspondence, participants discussed their impressions of the cross-curricular training:

“Students will be the ultimate beneficiaries of a program that allows experienced educators to collaborate across subject areas with an agriculture curriculum that captures students’ interest.”

“Working with the agriculture teachers during the July workshop was incredibly valuable because it showed me how cross-curricular connections can deepen student understanding.”

“The workshop with CASE training presented a great opportunity to combine the history of agriculture and its effect on the culture and economy of South Carolina with hands-on scientific experiments that will make abstract ideas real to students.”

“This collaboration deepened my understanding of how agricultural literacy intersects with themes of economics, geography, and culture, enhancing my ability to make those connections more tangible for students.”

### Future Plans

Plans are underway to engage these groups in a training session on aquaponics in the coming year, to be delivered by the state specialist in South Carolina. Both groups of teachers expressed a strong interest in hydroponics, and the concepts of aquaponics were also discussed. Currently, the cost of facilities to create a small aquaponics lab for teachers is under review, and efforts to secure funds for purchasing these materials are being discussed with related leaders for each group. Additionally, a follow-up survey will be sent to both groups of teachers at mid-year to gauge the integration of the AgXplore curriculum and assess the impact of the training.

### Costs/Resources Needed

The costs of this professional development include fees related to the cost of the CASE AgXplore curriculum (\$200 per participant for lifetime access to the curriculum materials paid to CASE), supplies purchased for the training, which included a notebook of printed materials for the training sessions and the consumables used in the hands-on activities (approximately \$30 per participant). The training was delivered by a CASE affiliate professor, who is certified in CASE AgXplore, at a cost of \$2,500 (including transportation and lodging). Additionally, the cost of refreshments for two breaks, lunch and dinner was approximately \$60 per participant.

References

- Burrows, M. S., Sorensen, T. J., & Lawver, R. G. (2025). Exploring key variables in teaching socioscientific issues in agricultural education. *Natural Sciences Education*, 54, e70027. <https://doi.org/10.1002/nse2.70027>
- CASE Learning: AgXplore Middle School (AgX)*. (n.d.). Retrieved October 24, 2025, from <https://www.case4learning.org/curriculum/agxplore-middle-school-agx/>
- McKim, A. J., Sorensen, T. J., & Velez, J. J. (2016). Exploring the role of agriculture teachers in core academic integration. *Journal of Agricultural Education*, 57(4), 1-15. <https://doi.org/10.5032/jae.2016.04001>
- National Research Council. (1988). *Understanding agriculture: New directions for education*. The National Academies Press. <https://doi.org/10.17226/766>
- Stephenson, L. G., Warnick, B. K., & Tarpley, R. S. (2008). Collaboration between science and agriculture teachers. *Journal of Agricultural Education* (49)4, 106-119. <https://doi.org/10.5032/jae.2008.04106>
- Warmbrod, J. R. (2019). The Green Book's history and legacy. *The Agricultural Education Magazine*, 91(6), 8-9.