

Literature Citations: As part of STEM education, one of the ultimate goals of environmental education is to enable students to adopt behaviors that are increasingly sustainable and work towards the resolution of environmental problems. Most educators operate under the assumption that simply conveying knowledge will achieve this goal (Chawla, & Cushing, 2007). There are numerous publications that suggest that classroom content-based instruction alone does not motivate an individual student's transition to more sustainable behavior (Redman & Redman, 2014). Chawla and Cushing's 2007 review of four bodies of research related to this question led to their conclusion that the most effective programs in regards to motivating sustainable behaviors had extended duration of time, allowed for opportunities to learn and practice skills, and resulted in the accomplishment of a specific goal. Chawla and Cushing repeatedly highlighted the successful impact that student organizations can have on increasing the likelihood of fostering *collective* sustainable action, which they argue is the most effective outcome in regards to student adoption of sustainable action. Research by Redman & Redman (2014) also came to the conclusion that teaching about sustainability alone does not result in behavioral changes. Redman and Redman were among the first to frame their research of adoption of sustainable behaviors by considering four different domains of knowledge: declarative (factual), procedural (how-to information), effectiveness (awareness of impacts of decisions), and social (societal expectations). Their 2014 study found that the greatest influence as to whether or not students adopted sustainable behaviors was procedural and social knowledge. Redman and Redman concluded by citing research by Kaiser and Fuhrer (2003) stating that instruction that utilizes all four domains of knowledge will result in the greatest likelihood of long-term adoption of sustainable behavior.

Research Idea: Agricultural education is somewhat unique within the realm of American secondary education in that it entails a comprehensive approach to education, namely that personal development and out-of-class career preparation are as strongly emphasized as classroom and laboratory instruction. Given the findings in regards to the adoption of sustainable behaviors and identities by students, it would be reasonable to conclude that this existing model of agricultural education would be especially effective in developing students into sustainable, proactive citizens, especially considering the relationship between agriculture and ecology. However, despite almost a century of existence, little if any published research has been completed on the ability of the agricultural education model (*also known as the Three-Circle Model*) to affect the rate of adoption of sustainable behavior by students who partake in this form of education (Barrick, 2015). I hypothesize that the Three-Circle Model of education (comprised of classroom and laboratory instruction, leadership and personal development, and supervised career preparatory experiences) will be significantly more effective in engendering the adoption of sustainable behaviors and identities than traditional classroom and laboratory science instruction alone. Furthermore, this model of education may serve as a potential example for more common secondary subjects that teach sustainability, including biology, environmental science, earth science, and others. Because agricultural educators are often much more connected and cohesive as professionals than instructors of other subjects, it may be easier to enable a nationwide utilization of these practices within agricultural education first, which may catalyze adoption by other subjects if effective.

General Approach: to test this hypothesis, I will utilize existing research on effective practices on the adoption of sustainable behaviors by students in order to develop a new comprehensive curriculum that will consist of three components: 1) declarative knowledge as comprised by the new Environmental Service and Natural Resources pathways of the National AFNR Content

Standards, Revised 2015; 2) procedural & effectiveness knowledge via the new model for Supervised Agricultural Experiences (SAE) released by the National Council for Ag. Education taskforce in 2015; and 3) social knowledge as developed by personal development opportunities in the National FFA Organization's existing programs. As the lead technical writer of these academic standards, one of the designers of the new SAE model, and with a close affiliation with the National FFA Organization (including their environmental & natural resources components), I am in a unique position to be especially effective in developing this curricular option for enhanced student sustainability. This curriculum will then be offered to agricultural instructors, and the participating students will be assessed before and after the adoption of this comprehensive curriculum utilizing methodologies based on prior research. Teachers in districts with curriculum that needs to be updated to meet the new national standards and models released in 2015 will be targeted as they will have an incentive to take part in this study in order to receive a curriculum that is already aligned to national standards, thus reducing their workload. Students in courses without a student organization or career preparatory experiences will serve as the control group.

Unique resources that may be needed for accomplishing the research goal: A partnership with the National FFA Organization, whose headquarters are in the U.S. Department of Education Offices of Vocational and Adult Education, will be necessary to coordinate the elements of this curriculum and to promote this work to the nearly 8000 secondary agricultural instructors in the U.S. Additional funding will likely be needed in order to incentivize participation in this work by instructors and students (this might be achievable through industry support or elsewhere).

Potential of the research to advance knowledge and understanding within science/ Potential for broader impacts on society: Americans rank as the world's second largest national source of CO₂ emissions from fossil fuels (Boden, 2011). Despite comprising only 5% of the world's population, Americans generate 40% of the planet's garbage while consuming 20% of its energy (Semon, 2012). In light of decreasing arable land, increasing global populations, and worsening threats from climate change, the sustainability of the future average American will likely play a pivotal role in shaping the future viability of global human populations. Given we do not yet have empirical evidence regarding the adoption of sustainable behaviors (Redman & Redman, 2014), it is critical that effective curricula be developed, tested, and implemented as quickly as possible.

Works Cited:

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