

Investigating the Use of Communities of Practice for Sustainability Instruction in Rural Agricultural Education

Subject and Problem

This paper reports the conclusions drawn from qualitative interviews of science and agricultural instructors in regards to their perceptions of sustainability and their use of instructional methods based on communities of practice. A key goal of three-dimensional science learning is to prepare students to engage in science-related debates and make scientifically-informed decisions as adult citizens (Rudolph and Horibe, 2016). This is particularly true for the topic of sustainability. However, the manner in which NGSS addresses sustainability may leave students unprepared for the non-scientific considerations of this issue, and may not fully address the realities and challenges inherent in teaching sustainability in a diverse, pluralistic society (Feinstein & Kirchgasser, 2015). While NGSS represents a shift towards an emphasis on how people use science in their own lives in order to enable socially-responsible actions, research suggests that scientific understanding alone has little impact on the decisions made as a result of civic engagement (Allum, Sturgis, Tabourazi, & Brunton-Smith, 2008). These issues around sustainability education are especially salient in rural schools and communities. Rural residents manage 97% of the US land area, and their decisions have vast consequences for sustainability (US Census Bureau, 2016). Rural areas are more likely to vote in favor of political candidates who deny the validity of anthropogenic climate change (Allred, 2014) or who advocate for environmental deregulation (Charles, 2016). As such, it will be increasingly vital for secondary science education to more effectively enable the adoption of sustainable knowledge and practice among future managers of America's land and natural resources.

This paper approaches the topic of sustainability instruction primarily using learning theories rooted in situated learning and communities of practice. Wenger (2011) defines a community of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." Lave and Wenger (1991) suggested that much of learning happens during informal interactions, and that these interactions serve as a means for the improvement of specific practices. Inclusion of instructional methods that utilize a student's sense of identity as a part of various communities may result in more informed action and decision making as a citizen (Birmingham and Calabrese Barton, 2014). Wenger (2000) also suggests a community of practice can evolve to adopt new knowledge and practice due to the involvement of individuals who are skillful in creating connections between different communities, whom Wenger termed "brokers".

While urban and suburban schools rely primarily on science teachers to teach sustainability-related goals, agricultural educators play a key role for sustainability instruction in many rural schools. Furthermore, agriscience instruction often emphasizes communities of practice through what is commonly known as the "Three Circle Model of Agricultural Education". This widely-utilized instructional model stipulates that instruction should be comprised of not only classroom and laboratory learning experiences but should also be coordinated with community-based career experiential learning and social learning opportunities through participation in organizations such as the National FFA Organization (*formerly Future Farmers of America*). Thus, agricultural education may provide a pre-existing instructional model that could be effectively adapted for the purposes of more effective sustainability instruction among potentially-resistant rural populations.

Agricultural educators represent potential brokers of sustainable knowledge and practice in rural communities of practice due to their direct connections with community members, agricultural professionals, and secondary school students. As such, it is important to understand the resources and beliefs of agricultural educators with respect to sustainability education. This study addresses two research questions:

- 1) How do agricultural educators understand issues of sustainability (particularly ecological sustainability) in rural landscapes?
- 2) What strategies do agricultural educators use and endorse for teaching about sustainability? In particular, how might they utilize a teaching model based on communities of practice to increase the adoption of sustainable knowledge and practice among rural students?

Design/Procedure

Setting and Participants: in the summer of 2017, I interviewed 11 secondary agricultural instructors and science teachers, mostly from rural regions in the United States. Teachers were interviewed on site during professional development conferences, during personal visits to their classrooms, or online through the use of a video conferencing program. All participants were professionally licensed secondary instructors in agriculture and/or science with at least two years of teaching experience. The backgrounds and political affiliation of the participants varied widely, encompassing the full range of the political spectrum. Most of the teachers had direct connections to production agriculture. All teachers interviewed utilized sustainability curriculum aligned to the National Agriculture, Food, and Natural Resources (AFNR) Academic Standards. Of the 11 participants who underwent interviews, one was a science teacher, two were science teachers who had recently obtained an agricultural add-on license, and eight were fully licensed agricultural instructors (all of whom either had a science license and/or taught courses that were aligned to science standards and counted for science credit).

Methods, Data, and Analysis: Interview study participants were contacted primarily through email list-serves maintained by educational professional organizations. Study participants were compensated for their time but were not informed that they would be compensated prior to the interview as there was not a guarantee that funding would be available for compensation.

Nine questions served as the basis for the semi-structured interviews. Participants were given flexibility to deviate from the prepared questions and to bring up other relevant topics as they engaged in the interview protocol. Four questions focused specifically on matters of sustainability (Research Question 1) The first two questions focused on the relationships between sustainability and production agriculture. Participants were asked to name current agricultural practices that would become impossible or unfeasible because of ecological, economic, or social reasons, followed by how they thought agricultural production would differ 100 years from now. Participants were then asked about how climate change may (or may not) impact agriculture. This was asked in part to assess how their responses might change for a more politically-charged topic in sustainability. Finally, participants were asked to describe how the average American might define sustainability and how their own definitions might differ.

The remaining five questions centered on teaching practices and the use of situated learning and socialization into communities of practice (Research Question 2). The participants were asked to summarize their own teaching experience and practice, and were asked to describe how their instructional environment was unique compared to the rest of the school. This was followed by questions regarding the learning opportunities available for students that utilized long-term group scenarios, expertise from community members, and the situated learning opportunities that occurred in authentic long-term settings outside of the classroom. Participants were prompted to provide their observations of any impact these different situations might have had on the achievement of learning objectives, on the relationships between the students and teachers, and in regards to the long-term impact on students personal, educational, and economic well-being.

The interviews were recorded, and the audio recordings of the interviews were transcribed for coding purposes. Coding was performed using computer-assisted strategies, and a summary of the conclusions were confirmed with the study participants for accuracy.

Findings

A number of patterns emerged from analysis of the interview transcripts. Most of the participants questioned the sustainability of the level of meat consumption in the United States. This was surprising given the fact that most of the participants had a direct connection to animal agriculture, including some who were currently farming in addition to teaching. Participants frequently mentioned the possibility of transitioning from meat animals to alternative sources of protein including plants, insects, fungi, and fish. The willingness of these agricultural instructors to make suggestions for future changes that would potentially result in an economic disadvantage for their own interests and/or the interests of their family and community members may suggest that agricultural instructors value and comprehend matters of ecological sustainability more than would be generally expected among rural populations. All but two participants specifically mentioned food waste as a current practice that will not be feasible in the coming decades, and specific statistics in regards to the amount of food waste that occurs were frequently cited. The specificity in which food waste was described adds additional support for the suggestion that agricultural instructors are well informed in regards to matters of sustainability.

The participants had a generally pessimistic view of the organic agriculture movement, and repeatedly suggested that this option would not be effective because increased resources are needed to sustain certified organic production. Most participants suggested that the organic label was more about attracting customer attention rather than improving the sustainability of agricultural practices. This skepticism for organic agriculture even among the certified organic producers could be reflective of some cultural biases present in agricultural production (particularly given a schism that appears to exist among organic and non-organic producers) but may also suggest a level of evidence-based skepticism among agricultural instructors in regards to the claims of organic products.

This type of skepticism was certainly evident in regards to other topics, particularly to perceived public resistance to genetically modified foods. The participants expressed a general belief that GMO's were necessary for food production to meet expected increases in demand and decreases in available land, and that GMOs could be safely used to expand food production in a more sustainable fashion. Specific statistics were also used to defend the use of genetically modified foods, and a portion of the disillusionment with organic agriculture was rooted in its broad rejection of any incorporation of genetic modification. This perhaps suggests that agricultural instructors see a disconnect between the body of research on the topics of GMOs and the practices of organic agriculture, and may value the conclusions of scientific data over other cultural values.

All but one of the participants were deeply concerned about the potential impacts of climate change on agriculture. While there were frequent concessions for the possibility that there might be gains from a lengthened growing season, all but one of the participants suggested that the losses from climate change in regards to production agriculture would exceed any gains. Most cited evidence that the most productive agricultural regions of the world would be less capable of producing food due increased rates of droughts and flooding. Multiple participants cited specific examples of their own fields (either from their own farms or from school experimental plots) that were more frequently damaged by recent extreme weather patterns. This suggests that agricultural instructors may significantly differ from their other rural counterparts in regards to their views on climate change. While many rural elected officials as well farm lobbying groups like the American Farm Bureau Federation adamantly opposes most legislative action on climate change (Filippelli, *et al.* 2010), the agricultural instructors interviewed here demonstrated a general acceptance of anthropogenic climate change, a belief that it will negatively impact agricultural production, and a sense that these effects are already causing harm to food production.

All of the participants demonstrated a deep appreciation for the opportunities to engage students in community-based instruction. Most cited the more meaningful relationships that they

formed with their students as a result of off-site instructional opportunities. Most cited the increased relevance and applicability of their instruction that resulted from place-based educational opportunities as key for student buy-in and incorporation of classroom instruction into their own lives. Courses that utilized community-based instruction were viewed by students as more relevant, authentic, valuable, “cool”, and impactful. Participants were often emphatic that the most effective teachers utilized off-site instruction, citing examples not only from agricultural education but also music, foreign language, and special education. They suggested that offsite instructional opportunities resulted in more significant impacts on the personal lives, identities, and trajectories of students than other forms of instruction that were much more classroom-based and focused on content. This suggests that community-based, career-oriented instruction may be a valuable means for increasing the adoption of sustainable knowledge and practice by rural students if an agricultural instructor can incorporate sustainability education into these off-site experiences.

Participants frequently cited their own observations that career- and community-based educational opportunities increased the rate at which students attended and completed a post-secondary degree. One teacher cited specific data showing increases in post-secondary degree attainment after the implementation of school-wide community internship experiences, while other participants cited personal observations and anecdotal evidence of the impact of community-based experiential learning opportunities. All participants reported observations of increased interest by students in course content as a result of connecting instructional objectives to career trajectories. This suggests that students’ adoption of sustainable knowledge and practice could be improved by demonstrating how sustainability objectives are present in the day to day decisions of professionals within potential career choices for students. This also provides a potential opportunity for addressing the growing inequality gap between rural and non-rural populations. Of counties that face persistent poverty, 85% are in rural areas, and there is a growing lag in the post-secondary degree attainment of rural students (USDA, 2016). Career-based considerations for sustainability instruction may serve as a vehicle to increase the adoption of sustainable knowledge and practice while also increasing economic opportunities and rates of degree completion for rural students.

Alternative Interpretations, Bias, Reliability, and Validity

While my background in agriculture and education provided me with a valuable perspective for this work, I also made a conscious effort to check my own conclusions against other published work to minimize bias. Because the participants were self-selected, there is an inherent bias in favor of sustainability by the participants as those with unfavorable views of sustainability would be unlikely to volunteer for an interview. While the background of the participants reflected a wide range of cultural and political viewpoints across a sizeable geographical area, it is entirely likely that these views are not fully representative of American agricultural instructors as a whole. However, these interviews suggest that there is at least a subset of agricultural instructors who value and understand sustainability, and it is very possible that these views may be representative of those most willing to adopt this approach in their own instruction. While I made a conscious effort to remain as neutral as possible on these topics, it is undeniable that my own background and viewpoints may have influenced some of the answers from the participants. The willingness of the participants to take part in the interviews was in part because of their familiarity with me via my previous work with agriscience instructors. When responses were specifically influenced by previous experience with me, these incidences were specifically noted in the interview and/or by the participant.

Contribution and General Interest

While NGSS is designed to encourage scientific decision making, it is ill-equipped to address the outcomes that occur outside of classrooms. This is particularly the case among rural populations that are critically important to America’s environmental and ecological sustainability. While rural Americans comprise less than 20% of the population, they manage 97% of America’s land and

natural resources (US Census Bureau, 2016). The findings of this work suggest that agricultural instructors do have the potential to serve as brokers of sustainable knowledge and practice among populations of rural students due a general appreciation for ecological sustainability and due to their application of experiential instructional approaches that utilize a student's sense of identity in various place-based communities of practice. The use of agricultural instructors as what Wenger (2000) might call "brokers" of sustainable knowledge and practice for communities of practice outside of the classroom may represent an effective model for merging the social and academic worlds that shape the actions and beliefs of students in a manner that leads to an increased adoption of sustainable knowledge and practice and a general shift in rural perspectives on sustainability. The use of communities of practice in rural education may be a critical means for enabling more informed and more sustainable action and decision making (Birmingham and Calabrese Barton, 2014), and may be a catalyst for the inclusion of ecological sustainability as part of a student's identity in regions of the country that are most likely to dispute anthropogenic climate change and favor environmental deregulation (Allred, 2014; Charles, 2016). Furthermore, this model could serve as a broader example for science education as a whole, enabling more extensive accomplishment of the NGSS goals of scientifically-informed decision making and citizen action by providing a means for science instructors to extend their influence beyond their classrooms and into their communities.

Since ecological sustainability is central to this work, it is being submitted in consideration for Strand 14 (Environmental Education). This paper will also be of value to members of NARST who have interest in communities of practice as a means of engaging students, who have an interest in place-based education that leads to more informed citizen decision making and action, and for those who have an interest in achieving goals specific to rural schools, including sociocultural responsiveness and the closing of achievement gaps between rural and non-rural students.

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