Engaging With Climate Change as a Socioscientific Issue in an Informal Science Learning Environment

Kelsey Tayne, Megan K. Littrell-Baez, Erin H. Leckey, and Anne U. Gold
kelsey.tayne@colorado.edu, megan.littrellbaez@colorado.edu, erin.leckey@colorado.edu, anne.u.gold@colorado.edu
University of Colorado, Boulder

Abstract: In this study, we discuss an informal science learning environment that was designed to support student engagement with climate change as a socioscientific issue (SSI). We explore how engaging with climate change as an SSI in this context helped make student ideas more central and simultaneously strengthened students' science content learning. These research findings point to the potential value of the design of this learning environment for engaging students in meaningful learning around climate change.

Introduction

Prior research has shown that socioscientific issues, social dilemmas with links to science, "can provide a forum for working on informal reasoning and argumentation skills, [Nature of Science] conceptualizations, the evaluation of information and the development of conceptual understanding of science content" in science education (Sadler, 2004, p. 533). In this study, we discuss a learning environment that was designed to support student engagement with climate change as a socioscientific issue (SSI), exploring how student engagement with climate change as an SSI was supported and what learning opportunities were afforded to students. We found that focusing on climate change as an SSI in this learning environment helped make student ideas central and strengthened students' science content learning. In particular, we saw that discourse around social aspects of climate change, focusing on anthropogenic causes and solutions, supported students in developing their scientific understanding and that student ideas were taken up by facilitators in these instances. Our findings point to the potential value of this learning environment design for supporting meaningful learning around climate change.

This study takes the perspective that meaningful science education involves learning that holds value in students' lives by supporting and empowering students in the choices they make and the actions they take. Drawing on sociocultural theories (e.g., Lave and Wenger, 1991), research suggests that science education should be relevant for students' lives, build on student ideas and address science learning in its sociocultural context, rather than focusing *primarily* on de-contextualized scientific content knowledge which may be more removed from students' experiences (e.g., Birmingham & Calabrese Barton, 2014). Designing learning environments that explicitly support engagement with socioscientific issues (SSIs) is one such possibility for making science learning more relevant for students (Sadler, 2004). In the context of learning about climate change, providing pathways for students to engage with the sociocultural context of science is critical for meaningful student learning (Walsh & Tsurusaki, 2014). Climate change is an SSI that has far-reaching impacts on people and ecosystems across the globe (National Research Council, 2012), and we take the perspective that learning environments should support students in grappling with this complex SSI in a way that is relevant in their lives and solution focused, in contrast to ways that are more de-contextualized.

Methods and context

This research was conducted during a week-long summer program in the Western United States in which high school students worked collaboratively in small teams, with the support of a science mentor and a film mentor, to produce a film about climate change as it relates to and/or impacts participating students' lives. Students attend a short climate change workshop and then generate and develop a film topic, conduct scientific research on their topic, create a storyboard and script, interview experts, film scenes, edit their film and screen the film for an audience. Program student participants were ages 14-17 and attended the program as part of a summer science program. Participants self-identified with a wide diversity of racial backgrounds, with a majority of participants identifying as Hispanic/Latino or Native American. Many participants indicated an interest in science and/or film prior to participating in the program. Science mentors were graduate students studying chemistry or geology and the majority of mentors identified as White. All names of participants in this paper are pseudonyms. Multiple data sources were collected during the workshop including pre- and post-surveys, field notes, interviews, and artifacts. Field notes were conducted by the first author who took the role of a participant observer (Spradley, 1980). This poster presents the results of an interpretive case study (Yin, 2009) which looked at how one group of students and their science mentor engaged with climate change as an SSI while developing their film.

Findings

In presenting the case study of one climate change film group, our findings suggested this learning environment supported student engagement with climate change as an SSI, particularly by supporting student discussion about human contribution to climate change and ways that humans can address climate change. We found that this learning environment provided a way for students to engage with climate change from a scientific perspective in an authentic, purpose-driven way. Moreover, by focusing on climate change as an SSI, student ideas were made central in discussions within the film group. This film group consisted of four high school students, Lucas, Teresa, Amanda and Mateo, and their science mentor, Josh and film mentor, Amy. On day one of the week-long program, the film group quickly began discussing ideas for their film. Josh asked students to reflect on the ways that people who live in the city that the students are from are contributing to climate change, prompting the group to engage with climate change as an SSI. One student, Lucas, suggested that smoking may be a contributing factor, while another student, Teresa, suggested that her community did not contribute very much towards environmental problems because few people drive cars, there were very few factories in her city, not very much trash and people did not waste water on their yards. This conversation turned to a more general discussion of what contributes to climate change as the group continued to discuss what they wanted to present in their film, and students discussed food choices (considering the role of eating meat and the impact of packaged food vs. "healthier" options), non-renewable vs. renewable energy sources, and how trash is dealt with, whether it is littered or recycled. As students shared their ideas about environmental actions, their science mentor Josh continued to ask questions about their ideas and created a category ("Activism") on the chalkboard, listing the ideas that students were suggesting.

While discussing climate change as an SSI, the group engaged in scientific discussion that centered around or built off of the social aspects of SSI discourse. As a participant observer, the first author talked with one student, Lucas, during the research section about carbon footprints: the amount of carbon dioxide emissions associated with making something (e.g. growing a pound of strawberries) or doing something (e.g. driving a car 50 miles). She had pulled up an e-book about carbon footprints, to use as a starting point for ideas for their research. As the first author and Lucas skimmed through the book, Lucas noticed that one of the topics was the carbon footprint of sending a text message. He asked the first author and science mentor how there was a carbon footprint associated with text messages. The group had just been talking about carbon emissions of fossil fuel burning, and Lucas asked about how there was smoke associated with the text message, appearing to ask how this was connected to the carbon dioxide emissions the group had just discussed. This led to a second, more in-depth conversation about energy from power plants and burning coal and other fuels, and ultimately Josh talked with Lucas and the first author about the difference between visible smoke, made by incomplete combustion, and greenhouse gases that we cannot see, then discussed energy reflection and absorption with Lucas. Other discussion topics during and following the conversation about the anthropogenic causes and solutions to climate change included the "10% rule" (energy movement up trophic levels in an ecosystem), mechanisms by which cows emit methane and how coal is used as an energy source to generate electricity. This learning environment supported discussions of scientific content that appeared to be largely driven by student questions and ideas related to climate change as an SSI.

Conclusion

In this case study, we saw that students contributed many ideas when discussing climate change as an SSI and that these ideas, taken up by the film group science mentor, were generative of further scientific discussion which was afforded by the particular approach of this program. Supporting student engagement with climate change as an SSI appeared to create an opportunity for more meaningful learning in this informal science context. Rather than encroach on other important goals for scientific learning, these findings suggest that designing for SSI engagement with climate change can promote scientific understanding for students in a meaningful way.

References

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