Developing Place-Based, Climate Change Curriculum in Rural Schools

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Introduction

Despite shifts in American demographics, there remains a disproportionately small number of individuals from rural and diverse backgrounds in the field of geoscience (Bernard & Cooperdeck, 2018; Hill et al., 2011; Nguyen & Redding, 2018; Stokes et al., 2015). This is unsurprising as a multitude of schools have removed earth science from the curriculum (Lewis & Lu, 2017; Pierre-Louis, 2022). What is more, there is a continued lack of teacher preparation on topics such as climate change and geoscience (Huntoon & Baltensperger, 2012). However, teachers are willing to incorporate new curriculum if they are provided content and pedagogical training to do so effectively (Knobloch & Martin, 2000). Oftentimes, teachers like to learn new knowledge in communities (Wenger, 1998). Wenger (1998) stated a community of practice (CoP) is a group of people with a shared interest that produces communal resources and knowledge. A CoP can form organically within an organization or with targeted guidance, but regardless of how it is formed, people within the CoP share their knowledge and expertise, which leads to changes in practice, long-lasting support, and retention of knowledge and skills over time (Wenger, 1998). To provide educators with relevant geoscience and climate change curriculum and pedagogical training, we are proposing to form a CoP for teachers within a rural focus community by hosting a free, weeklong teacher institute. The institute is made possible through a Rural Confluence grant funded by EPSCoR to increase climate change literacy, capacity, and resiliency.

How it works

To increase capacity for geoscience and climate change education in rural schools, faculty at Oklahoma State University will form a CoP consisting of elementary, STEM, and agricultural education teachers. It is important to include elementary teachers as they impact students' early perceptions of STEM. Agricultural education teachers are important to the CoP because they have a considerable influence in rural communities and they prepare students for STEM careers in agriculture (Roberts & Ball, 2009). The educators in the CoP will participate in a weeklong summer institute hosted by Oklahoma State University where they will participate in professional development related to geoscience and climate change content and pedagogical methods used to effectively teach the curricula (i.e., inquiry-based learning). Participants will be introduced to various resources related to climate data and geoscience and will receive training on integrating the resources into their existing curriculum. There will also be dedicated time for teachers to collaborate and develop cross-curricular, place-based, and age-appropriate lessons based on the training they receive. After the institute concludes, the teachers will implement the lessons they designed into their curriculum using the lesson study method (LSM) to guide the process (Fernandez, 2002). LSM allows each member of the CoP to teach the lesson while the other members observe and offer feedback. After the lesson is taught, the CoP will meet to discuss the lesson and make any necessary revisions to increase its effectiveness. This cycle will

continue until each CoP member has taught the lesson, thereby allowing teachers to experience ongoing professional development (Lewis et al., 2006).

Results to date

The investigators have identified a rural focus community in the southwestern part of their state. We have pinpointed several schools from which to recruit educators for the institute. In all, four schools have been targeted. Administrators from these focus schools were contacted in the fall of 2024 and informed about the teacher institutes and were invited to attend an informational meeting hosted by Oklahoma State University in September of 2024. All the schools contacted sent representatives to discuss their specific place-based curricular needs. The teachers expressed needing lessons focused on how data changes over time, how to interpret graphs, how to contextualize and use STEM data and lessons, and resources for data related to place-based geoscience such as temperature and rainfall. In addition, the teachers expressed the need for lessons that are either aligned with state standards or could be easily adapted to fit within the existing state standards.

Future plans

As part of the funding, Oklahoma State University will form a CoP by inviting teachers to attend a weeklong institute in the summer of 2025. Over the course of the week, CoP educators will receive professional development related to geoscience and climate change content and resources, pedagogical methods, and they will participate in round table discussions to facilitate cross-curricular development of lessons and units of instruction.

Participants will be introduced to the Mesonet (1994-2024) website (a website in Oklahoma devoted to collecting weather science and environmental data related to drought and climate change), provided information on how to access the free resource, and given guidance as they actively explore the resource. Participants will receive professional development (i.e., inquiry-based instruction) on place-based climate concerns and context for its impact on their communities. Finally, teachers will participate in micro-teaching sessions, where they will model aspects of the lessons they have developed to their CoP counterparts for immediate feedback from their peers.

Investigators will collect data from the participants concerning the perceived effectiveness of the institute, increases in STEM knowledge, and perceived shifts in teaching self-efficacy. In addition, we will use a longitudinal approach to collect data from the teachers and their students once the lessons have been taught beginning in Fall 2025.

Costs

Each participant (N = ~25) will be provided with a $200.00 participation stipend and a $100.00 travel stipend. Additional costs will include meals for the participants, as well as housing and

travel for the University team during the workshop. Costs will be covered through the EPSCoR grant.

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