

Leveraging Local Phenomena: The Power of Centering Context within Place in Teacher Education

by [Rebekah Hammack](#), Purdue University West Lafayette

It is commonplace within teacher education programs to engage in discussions about the importance of adapting instruction to meet the needs of individual learners, whether that be presenting content through multiple modalities, supporting multilingual learners, or providing learners with scaffolded supports like graphic organizers or visual models. Over the span of a class period or lesson, teachers must also react in real-time to the needs of their students based on continuous informal formative assessments. A middle school science teacher, for example, who teaches six classes per day is likely to make small, or even large, changes to their instruction during each class of the day, tailoring instruction to meet the unique needs of the students in each class.

In recent years, new tools and strategies in science teacher education have further enhanced the ability of educators to adapt to diverse learner needs. Programs now increasingly emphasize experiential, phenomenon-based science learning, where teachers-in-training engage in hands-on, inquiry-based activities mirroring those they can later use in their own classrooms (Strat et al., 2023). Attention to meaningfully integrating technology like virtual simulations and digital labs prepares future educators to leverage modern tools for differentiated instruction. Professional development focusing on culturally responsive teaching practices ensures that new science teachers are equipped to meet the needs of all students, fostering an equitable learning environment (O’Leary et al., 2020).

Just as crucial for supporting diverse learner needs, but much less talked about, is the importance of adapting instruction to account for *context*. Context can incorporate many variables, *place* being an important one, and it is within these placed contexts that the lived experiences of teachers and students play out (Biddle and Azano, 2016). Few people would argue with the statement that the lived experiences and funds of knowledge of students in Manhattan, New York, are expected to be very different from those of students in Nome, Alaska. The same could be argued for any number of locale pairings. What knowledge is valued within these different locales is closely tied to the community and cultural values held within each place (NRC, 2012) and shapes the science perspectives of the people residing there. With such diversity across settings, *not* connecting classroom instruction to the local context is a missed opportunity for enacting inclusive science instruction.

As such, place-based education represents an emergent and significant innovation that connects learning to local community contexts and environments (Sobel, 2013). By incorporating local natural resources, community issues, regional history, and Indigenous epistemologies into the curriculum, teachers can make science more relevant and engaging

for students (Bang et al., 2014; Gruenewald, 2003). This approach not only enhances students' understanding of scientific concepts but also fosters a deeper connection to their community and environment. Place-based education encourages students to apply their learning to real-world problems in their own communities, positioning them as valued local experts and advocates, thereby making science education more meaningful and impactful. By integrating place-based education into teacher training programs, future educators are better prepared to create learning experiences that are both personalized and locally relevant, enriching the educational experience for all students.

Children and adults alike make sense of the world by observing natural phenomena and fitting their observations within their lived experiences. This sense-making process is not confined within the four walls of the formal classroom. As such, what is taught within the classroom should build upon outside-of-school experiences. A self-proclaimed “science geek,” David Sobel described a moment in his mid-twenties when he realized that the large flower model from his high school biology class was not just applicable to the flowers of the rainforest. “*That was a model of flowers that grew right outside the classroom door!* I said to myself in disbelief” (2013, p. 10). This example highlights the disconnect between standardized curriculum and the unique contexts in which the curriculum is enacted.

The Next Generation Science Standards brought forth an important shift towards phenomenon-based instruction. However, not all phenomena are equally effective, making the choice of which phenomena to use *within what context* an important task for teachers. When making these choices, the natural phenomena that students have first-hand experience within their *local contexts* should be leveraged. For example, consider NGSS standard 4-ESS3-2:

Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.* [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

The natural Earth process of flooding is manifested in a myriad of ways across the globe. Choosing a flooding phenomenon that is localized is one approach to helping students connect school science with their day-to-day lives. For example, because Montana has more ice jams than any other state in the continental United States, a teacher in Montana might use the phenomenon of ice-jam-related flooding to introduce a unit on natural Earth processes. Conversely, a teacher in Gulf Shores, Alabama, may focus their attention to hurricane-related flooding. These more locally focused phenomena could also serve as a point of entry for investigating socio-scientific issues experienced locally and more broadly.

As a science teacher educator tasked with preparing future teachers for the classroom, I, like others engaged in place-conscious research, wrestle with whether education programs

are “preparing [preservice teachers] for *somewhere* or *anywhere*.” (Reagan et al., 2019, p. 85). However, we do not know which communities our students will ultimately plant their feet and take root in, and it is impossible to provide them with contextualized lesson examples that will fit all school contexts. We must prepare them to be successful in a variety of contexts while also conveying the importance of connecting their teaching to the local context and their students’ lived experiences and cultures. One way to do this is to show them examples of how to take a standardized curriculum and make small changes to localize the phenomenon, which serves as the context for the science or engineering learning experiences. By moving beyond simply teaching about how to engage students in phenomenon-based learning (Saber, 2024) and instead engaging preservice teachers in conversations around choosing locally relevant phenomena, we can better prepare future science teachers to recognize the value of connecting to the local context for developing inclusive science learning experiences.

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