Place-Based Learning for Elementary Science at Scale (PeBLES2)

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Place-Based Learning for Elementary Science at Scale (PeBLES2)

Place-Based Learning for Elementary Science at Scale (PeBLES^2) creates experiences that help students understand their worlds by connecting to local phenomena, communities, and cultures.
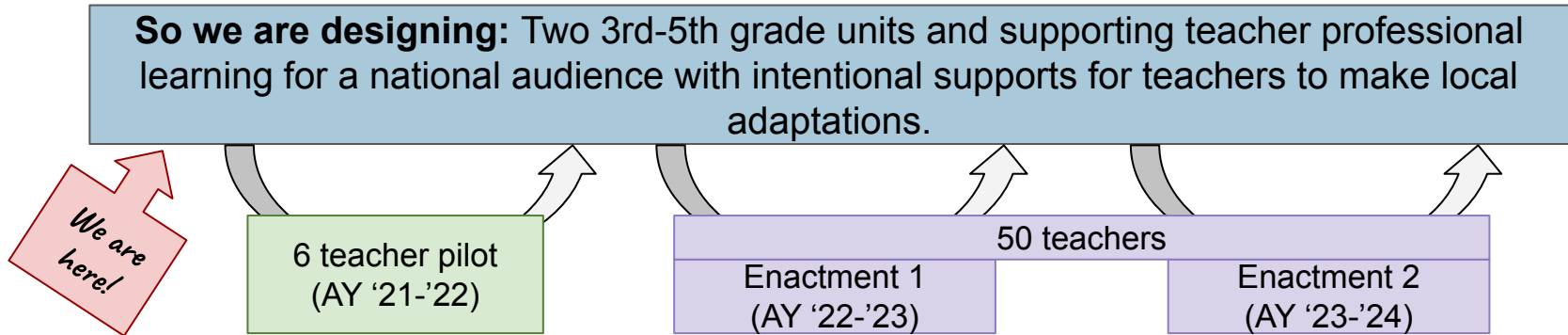
To support equitable access to place-based science learning opportunities, Maine Mathematics and Science Alliance in collaboration with BSCS Science Learning, is developing and testing a model to support 3rd-5th grade teachers in incorporating locally or culturally relevant place-based phenomena into rigorously tested curricular units that meet the expectations of the NGSS. The project team will develop two units that could be used in any region across the country with built-in opportunities and embedded supports for teachers to purposefully adapt curriculum to include local phenomena. In-person and virtual professional learning experiences will further help teachers who have limited district support for science to incorporate place-based approaches. Participating teachers will range from rural and urban settings in California, Colorado, Illinois, Nevada, and Maine to ensure the end products of this project are relevant, scalable, appropriate for a wide range of students across the country.

PROJECT DESIGN: We are testing Design-based and Outcomes-based Research Questions over a Pilot and 2 Enactments

We are wondering: How can we support 3rd-5th grade teachers to incorporate locally or culturally relevant phenomena into science curriculum units designed for national use that meet the expectations of the science standards (Next Generation Science Standards)?
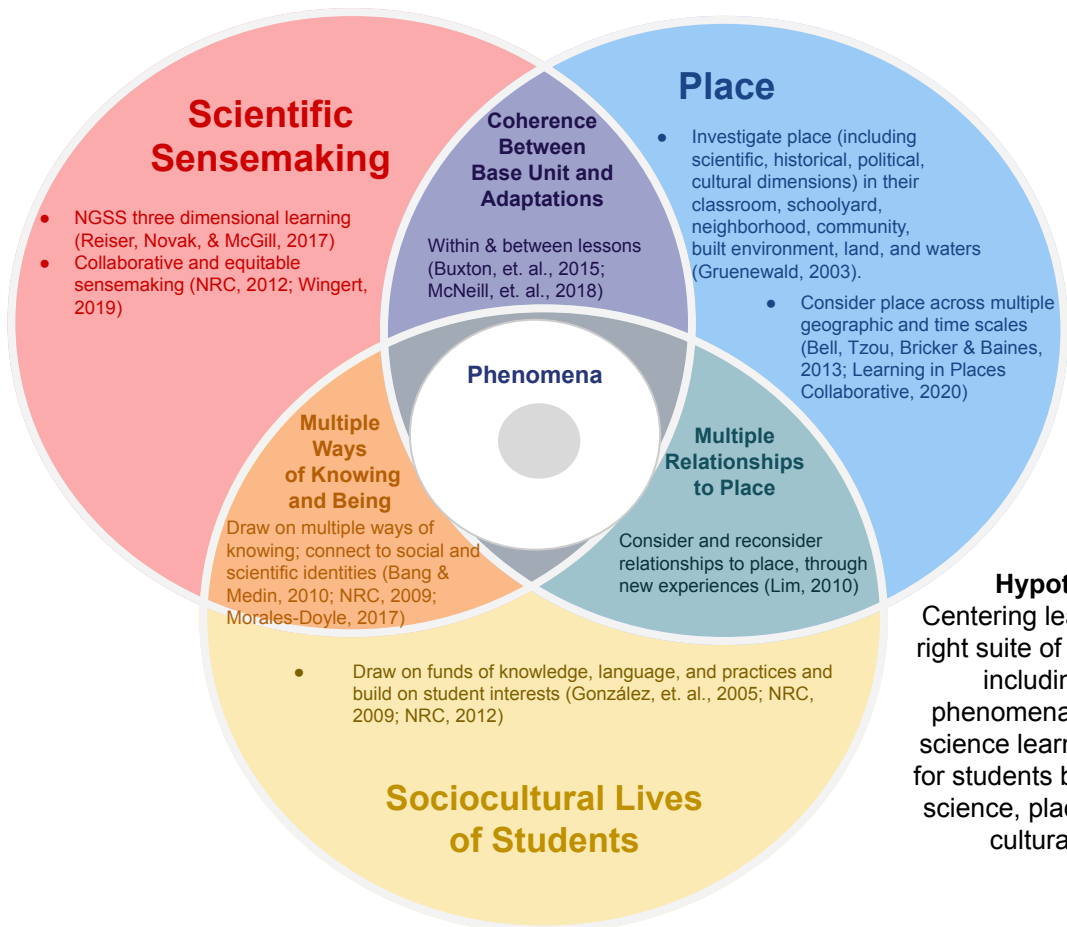
So we are designing: Two 3rd-5th grade units and supporting teacher professional learning for a national audience with intentional supports for teachers to make local adaptations.

We are here!

6 teacher pilot
(AY '21-'22)

50 teachers

Enactment 1
(AY '22-'23)

Enactment 2
(AY '23-'24)

And we are hoping to figure out:
- RQ1: How do teachers plan to teach the unit? How can this inform our design work?
- RQ2: How do teachers teach the unit? How can this inform our design work?
- RQ3: In what ways does a teacher's knowledge and skill change as they plan for and enact the unit across two rounds of enactment?
- RQ4: To what extent does engagement with the materials enhance teacher efficacy and agency?
- RQ5: To what extent does local adaptation increase student perceptions of relevance, student engagement, and student feelings of connection to place?

DESIGN INTENTIONS for the student experience

To help focus our design work, we have developed an initial set of design intentions. The **near term** purpose is to help us make difficult design decisions in the unit and professional learning. The **long term** goal is to develop a set of design principles for us, teacher/community partner co-designers, and other curriculum designers to use.

We invite you to comment on our draft design intentions. Should we be looking at particular literature? Are we missing important components?

Scientific Sensemaking

- NGSS three dimensional learning (Reiser, Novak, & McGill, 2017)
- Collaborative and equitable sensemaking (NRC, 2012; Wingert, 2019)

Coherence Between Base Unit and Adaptations

Within & between lessons (Buxton, et. al., 2015; McNeill, et. al., 2018)

Place

- Investigate place (including scientific, historical, political, cultural dimensions) in their classroom, schoolyard, neighborhood, community, built environment, land, and waters (Gruenewald, 2003).
- Consider place across multiple geographic and time scales (Bell, Tzou, Bricker & Baines, 2013; Learning in Places Collaborative, 2020)

Phenomena

Multiple Ways of Knowing and Being

Draw on multiple ways of knowing; connect to social and scientific identities (Bang & Medin, 2010; NRC, 2009; Morales-Doyle, 2017)

Multiple Relationships to Place

Consider and reconsider relationships to place, through new experiences (Lim, 2010)

Sociocultural Lives of Students

- Draw on funds of knowledge, language, and practices and build on student interests (González, et. al., 2005; NRC, 2009; NRC, 2012)

Hypothesis
Centering learning in the right suite of phenomena, including local phenomena, can make science learning relevant for students by integrating science, place, and their cultural lives.

5 designed-for places to incorporate local phenomena
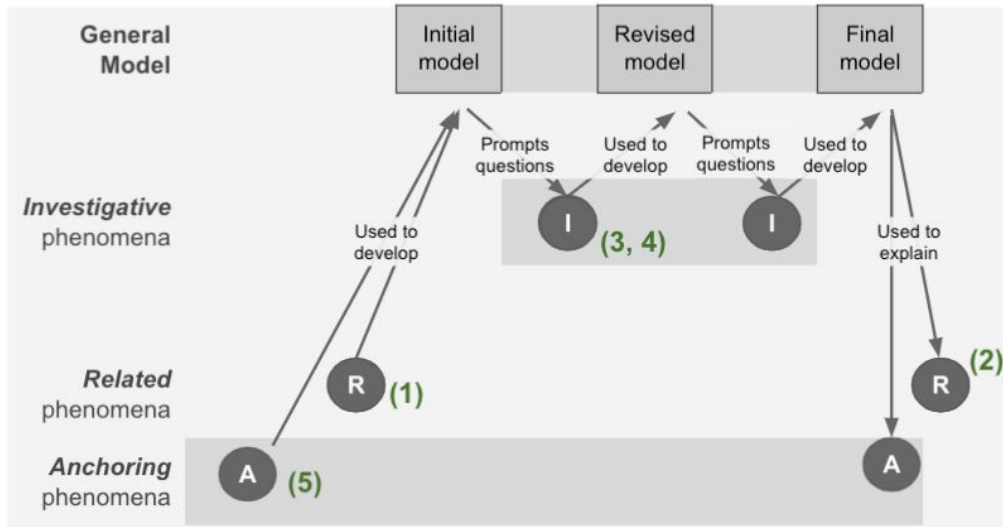
We are using model-based inquiry as an approach. This is an illustration how how and when teachers may choose to make local adaptations in the unit.

We invite you to think with us about how to support teachers in making local adaptations, both in instructional materials and professional learning.

Supplement a unit with local phenomena
1. Introduce a local related phenomenon **alongside the anchoring phenomenon** that students regularly revisit throughout the unit along with the anchor
2. Develop a **transfer task** where students use the general model to make sense of a local phenomenon or design solutions to address a community problem
3. Supplement **investigative phenomena** with local phenomena

Replace phenomena in the unit with local phenomena
4. Replace **investigative phenomena** with local phenomena
5. Replace the **anchoring phenomenon** with a closely related local phenomenon.

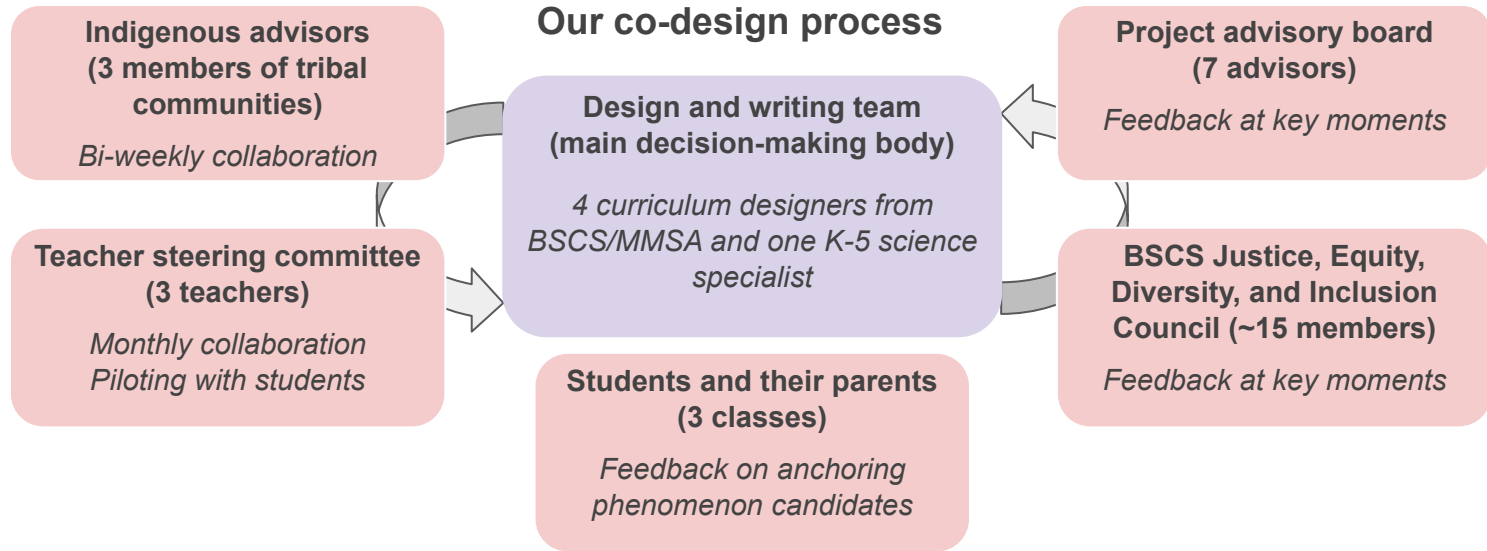# Designed-for-places to incorporate local phenomena
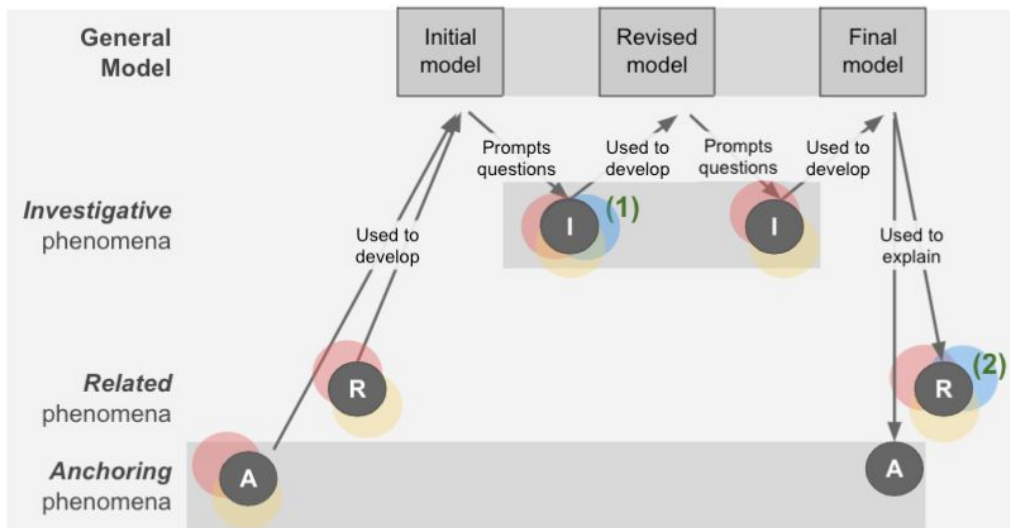
We intend to support teachers in localizing by elevating our design intentions. This is an example of how the process of localizing may play out.

We invite you to think with us about how to support teachers in making local adaptations, both in instructional materials and professional learning.

In this case, the teacher uses the anchoring phenomenon built in to the unit. The anchoring phenomenon, related phenomena, and second investigative phenomena built in to the unit are all designed to center science sensemaking (red circle) and sociocultural lives of students (red circle).

The teacher localizes with one Investigative Phenomenon (marked as 1) and in a transfer task (marked as 2) by drawing on knowledge of place (the blue circle) and the sociocultural lives of students (the yellow circle).

INITIAL UNIT DESIGN: Who are we designing with?

Our co-design process

Indigenous advisors (3 members of tribal communities)

Bi-weekly collaboration

Teacher steering committee (3 teachers)

Monthly collaboration Piloting with students

Design and writing team (main decision-making body)

4 curriculum designers from BSCS/MMSA and one K-5 science specialist

Students and their parents (3 classes)

Feedback on anchoring phenomenon candidates

Project advisory board (7 advisors)

Feedback at key moments

BSCS Justice, Equity, Diversity, and Inclusion Council (~15 members)

Feedback at key moments

What we've been doing together

- Generating candidate anchoring phenomena for Unit 1
- Selecting top candidates
- Developing anchoring lessons and final student products for two candidates
- Testing two candidates in classrooms with students
- Revising candidates so they can learn from each other
- Selecting one candidate anchoring phenomenon for Unit 1

Where we are headed

- Developing a storyline for Unit 1
- Writing individual lessons
- Developing tools and structures to invite localization of materials
- Piloting materials in Fall 2021

INITIAL UNIT DESIGN: What have been our successes and challenges?

Successes (so far…)

- Our design stakeholders (previous slide in pink) are guiding our decision-making about our design intentions and candidate anchoring phenomena in important ways.

- We selected a PE bundle for our first and second units and an anchoring phenomenon for the first unit.
  - Unit 1: Where are animals going and why?: An exploration of animal paths/ animal movement (3rd grade environments and environmental change)
  - Unit 2: (4th grade landforms)

- We are modifying our storyline development process to include:
  - Brainstorming suites of phenomena with similar mechanistic explanations to elevate anchoring phenomenon candidates with local adaptation potential.
  - Developing final models for multiple phenomena within a suite to identify a general model that students can use to explain the anchor and local phenomena teachers might incorporate.
  - Having stakeholders across geographies consider local related phenomena and testing how teachers might incorporate those into the unit.

Challenges (so far…)

- Defining what we mean by locally relevant phenomena.
  - Is it anything relevant to students in a class?
  - Is it specific to land and waters accessible from the school?
  - Is it local to a classroom community or local to a larger region?

- Determining a balance how much do we design and how much do we leave to teachers with support to incorporate local phenomena.

- Selecting an anchoring phenomenon that has high potential for local adaptation across geographies, yet is perplexing enough to sustain interest. Balancing a phenomenon that is anchoring by design with what could emerge for teachers and students through local investigation.

- Diversifying our team (development and collaborators) to center the interests and concerns of students with diverse social identities (e.g. racial, ethnic, gender, ability) in our unit development process.
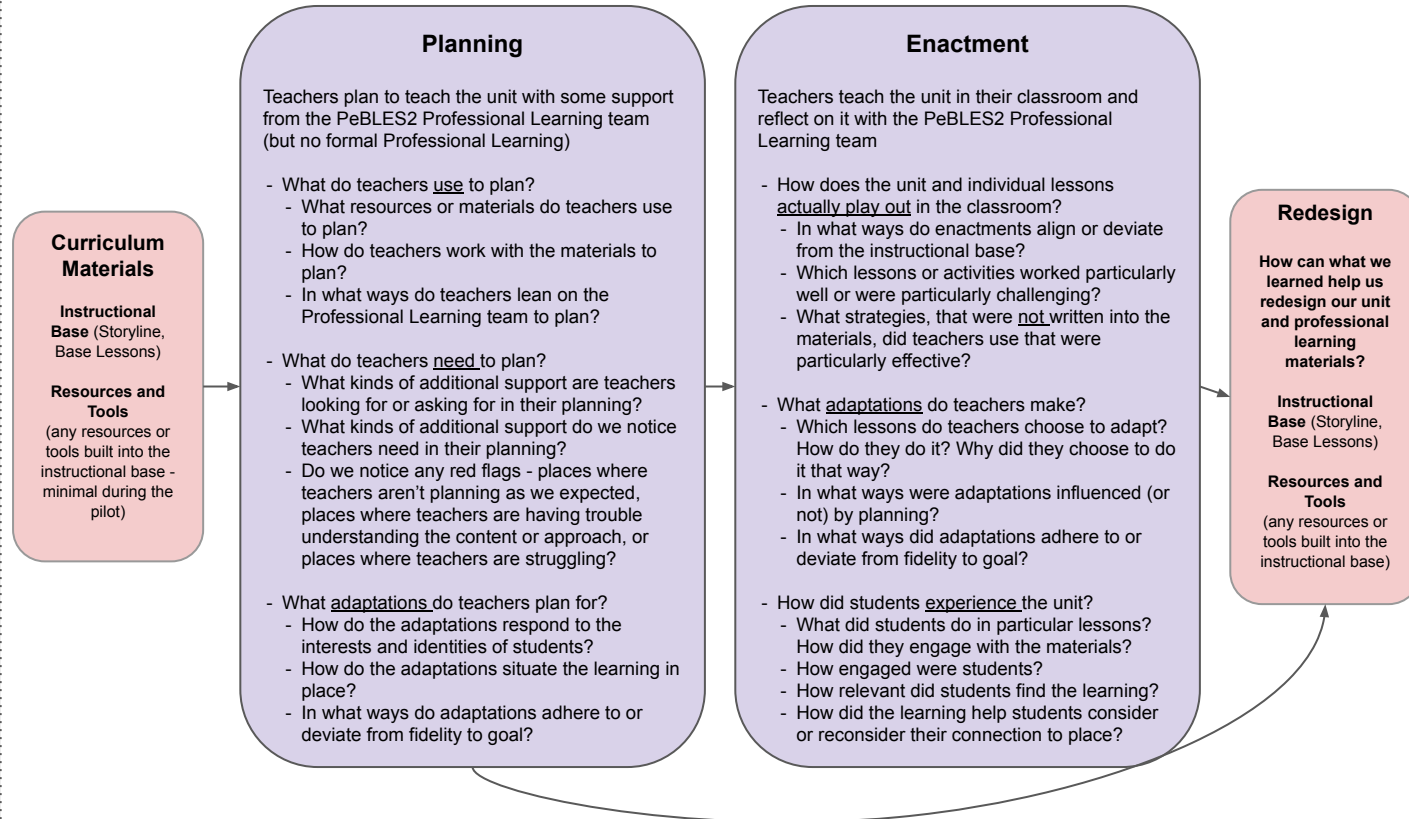
CONJECTURE MAP FOR <u>DESIGN-BASED</u> RESEARCH QUESTIONS

RQ1 [DESIGN - PLANNING]: How do teachers <u>plan</u> to teach the unit? How can this inform our design work?
RQ2 [DESIGN - ENACTMENT]: How do teachers <u>teach</u> the unit? How can this inform our design work?

To help focus our research questions, we have developed two different working conjecture maps - one focusing on our design-based questions and one focusing on our outcomes-based questions. Since we are currently in our design phrase, we are sharing our map focused on our design-based research questions.

We invite you to think with us about this conjecture map. Are we paying attention to the most relevant and interesting ideas? What are we missing?

Curriculum Materials

Instructional Base (Storyline, Base Lessons)

Resources and Tools
(any resources or tools built into the instructional base - minimal during the pilot)

Planning

Teachers plan to teach the unit with some support from the PeBLES2 Professional Learning team (but no formal Professional Learning)

- What do teachers <u>use</u> to plan?
  - What resources or materials do teachers use to plan?
  - How do teachers work with the materials to plan?
  - In what ways do teachers lean on the Professional Learning team to plan?

- What do teachers <u>need</u> to plan?
  - What kinds of additional support are teachers looking for or asking for in their planning?
  - What kinds of additional support do we notice teachers need in their planning?
  - Do we notice any red flags - places where teachers aren't planning as we expected, places where teachers are having trouble understanding the content or approach, or places where teachers are struggling?

- What <u>adaptations</u> do teachers plan for?
  - How do the adaptations respond to the interests and identities of students?
  - How do the adaptations situate the learning in place?
  - In what ways do adaptations adhere to or deviate from fidelity to goal?

Enactment

Teachers teach the unit in their classroom and reflect on it with the PeBLES2 Professional Learning team

- How does the unit and individual lessons <u>actually play out</u> in the classroom?
  - In what ways do enactments align or deviate from the instructional base?
  - Which lessons or activities worked particularly well or were particularly challenging?
  - What strategies, that were <u>not</u> written into the materials, did teachers use that were particularly effective?

- What <u>adaptations</u> do teachers make?
  - Which lessons do teachers choose to adapt? How do they do it? Why did they choose to do it that way?
  - In what ways were adaptations influenced (or not) by planning?
  - In what ways did adaptations adhere to or deviate from fidelity to goal?

- How did students <u>experience</u> the unit?
  - What did students do in particular lessons? How did they engage with the materials?
  - How engaged were students?
  - How relevant did students find the learning?
  - How did the learning help students consider or reconsider their connection to place?

Redesign

How can what we learned help us redesign our unit and professional learning materials?

Instructional Base (Storyline, Base Lessons)

Resources and Tools
(any resources or tools built into the instructional base)

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