Locally Adaptable Instructional Materials and Professional Learning Design for Place-Based Elementary Science

Katahdin (Kate) Cook Whitt , Maine Mathematics and Science Alliance, kcook@mmsa.org
Emily Harris, BSCS Science Learning, eharris@bscs.org
Ruth Kermish-Allen, Maine Mathematics and Science Alliance, rkermishallen@mmsa.org

PeBLES2
Place-Based Learning for Elementary Science at Scale

Context

- Phenomenon driven learning happens when teachers use phenomena to motivate student learning in science.
- A growing corpus of high-quality, NGSS instructional materials designed for broad audiences and to be of high interest to students now exists.
- Incorporating locally and culturally relevant phenomena can help students connect their learning to their interests, identities, and worlds beyond the classroom (Bell, 2019; Buxton, 2010; Lee, 2020; Lee & Grapin, 2022; Lim & Calabrese Barton, 2006; Suarez & Bell, 2019).
- Designing units motivated by meaningful phenomena for broad audiences presents a challenge. What matters to students is context dependent and unique to students and their communities.

In this project, we investigate *phenomenon adaptation* as an approach to making high quality NGSS learning experiences locally and culturally relevant to students across contexts.

Phenomenon Adaptation = In planned or emergent ways, adding or swapping phenomena that are written into designed units to better connect to students' interests, identities, communities, and places.

Research Questions

How can we support elementary teachers to incorporate *phenomena adaptation* for *place and student interest and identity* into science curriculum units designed for national use that meet the expectations of the NGSS?

RQ1: What are the key design elements of educative curriculum materials and professional learning experiences designed to support phenomena adaptation that teachers use as they plan and enact units?

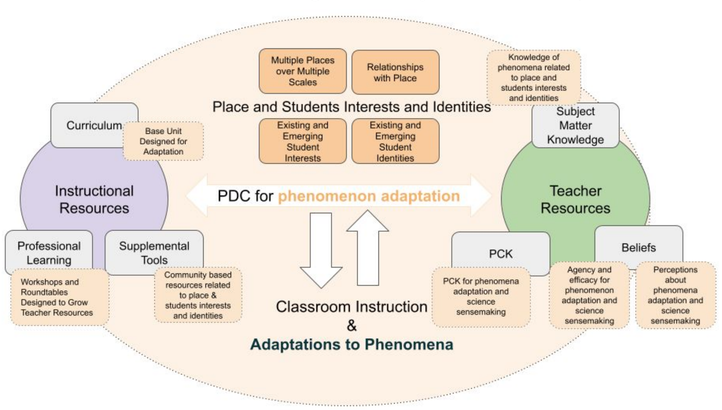
RQ2: How do teachers take up instructional resources designed for phenomena adaptation in their classrooms over multiple rounds of enactment?

RQ3: To what extent does positioning teachers to design phenomena adaptations impact teacher efficacy and teacher agency in science teaching?

RQ4: To what extent does phenomena adaptation influence student interests and experiences over time?

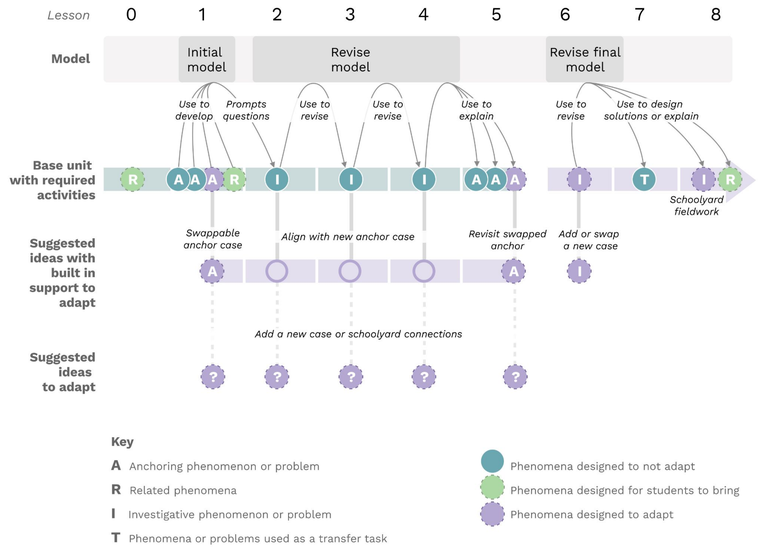
Theoretical Framework

Our theoretical framework draws on and extends *pedagogical design capacity (PDC)* to focus specifically on phenomenon adaptation (Brown & Edelson, 2003; Brown, 2009; Davis et al., 2011; Knight-Bardsley & McNeill, 2016).



Unit Design

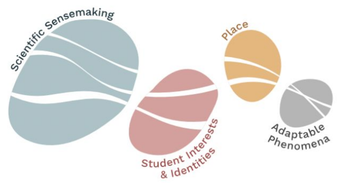
Units designed for phenomenon adaptation include built in supports for teachers to add or swap anchoring or investigative phenomena, and build on and incorporate related phenomena into instruction throughout the unit.



Professional Learning Design

The enactment professional learning includes two 2-day workshops and four half-day roundtable sessions, repeated over two years. Teachers dive deeply into place and students in Year 1, followed by phenomenon adaptation adaptation in Year 2.

How can I use **place** and my **students' interests** and **identities** to engage my students in **figuring out** science?

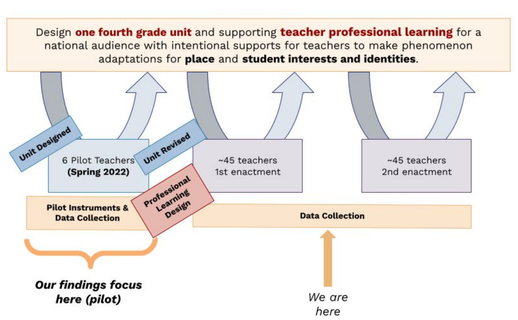


Research Design

Our study is mixed-methods, design based research across two phases: a one year pilot and a two-year enactment.

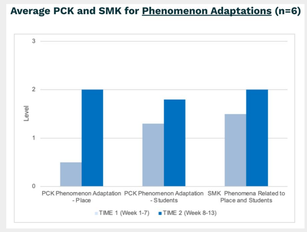
All Teachers
- Teacher pre- and post-survey
- Video journal reflections
- Classroom and student artifacts
- Student exit tickets

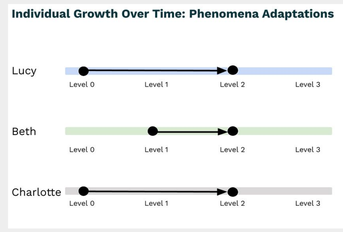
Case Study Teachers
- Classroom observations
- Teachers interviews
- Student focus group
- Classroom and student artifacts



Pilot Findings (4th grade, n=6)

Teacher Learning
- Most teachers made gains in: PCK for phenomena adaptations, PCK for science sensemaking, SMK for place/students and weathering, erosion, effects.
- On average, teachers made larger gains in PCK for place compared to PCK for students.
- Most teachers made large gains in PCK in scientific sensemaking.



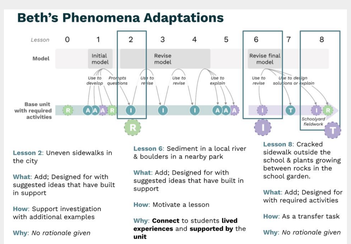


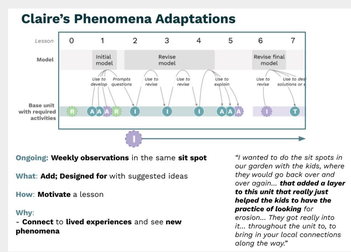
Phenomenon Adaptations

What kinds of phenomena adaptations do teachers make?
- All teachers adapted phenomena in the unit.
- None of the teachers swapped or eliminated phenomena.
- All teachers made adaptations that were designed for. Half made adaptations that were not designed for.

How do teachers use phenomena they adapt in instruction?
- Teachers used phenomena to motivate the lesson or as a transfer task when it was supported by the unit.
- Teachers supported unit phenomena/problems with additional examples when it was designed for in the unit and also of their own design.

Why do teachers adapt phenomena?
- There were many examples where teachers described a desire to help students see new phenomena and consider how to act in there lives.
- Teachers also were interested in connecting to students' lived experiences and cultural worlds.
- There were a smaller number of examples where teachers described assessment or student high interest as their rationale for adapting.





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