

**Navigating Relational Perspectives Through Collaboration to Expand Students’
Experiences Of/With/In Places and Cultures**

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Abstract

Making sense of what to do about the many daunting socio-environmental issues that we face will require intercultural understanding, openness to learning, and a capacity to draw on the strengths of multiple perspectives and to recognize limitations of dominant perspectives such as Eurocentric science. Navigating multiple perspectives in the school science classroom can be particularly treacherous for Indigenous students, whose cultural worldviews have often been excluded or denigrated in Eurocentric educational contexts. We present findings from a partnership project that is designing, implementing, studying, and refining instructional experiences for middle school students from significantly/predominantly Indigenous communities in Alaska and Hawai'i. This paper describes our efforts to understand project partners' standpoints, acknowledging that in designing and implementing multi-perspective middle school science instruction, it will be critical to understand the multiple perspectives that we ourselves bring to the work. We present and discuss the views that project partners (including teachers) have shared concerning science, science education, multiple perspectives, and

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Indigenous cultural integrity and potential consequentiality for the project's collaborative work.

Five prominent themes relate to (1) the challenge of defining Indigenous and Eurocentric science for application in an instructional design context, (2) relationships with place, (3) centrality of language, (4) scaffolding and understanding learning through a multi-perspective lens, and (5) constraints associated with Eurocentric classroom and science contexts.

Introduction

When changes like coastal erosion occur (stemming from natural or human causes) that make usual ways of living in place impossible, how should people respond? Should they apply technological solutions to try to “fix” what is happening? Should they live with and adapt to the change? Are there possibilities beyond these two approaches? These are questions that science can help people explore, but that science itself, or at least science as understood from a Eurocentric perspective, cannot answer. Further, these are questions that people might apply very different approaches to exploring (Aikenhead, & Ogawa, 2007; Bang & Marin, 2015; Bang et al., 2012; Bang et al., 2018; Chinn, 2011).

The above web of questions and considerations serves as the *kumu* or *foundation* of our collaborative work on a project exploring local coasts and coastal erosion with middle school teachers and students in Alaska and Hawai’i who live in communities that identify as significantly or predominantly Indigenous. This web also serves as our *kumu* or *teacher* in that in working together, we (the project partners including teachers) are learners ourselves on a journey of expanding our understandings concerning science and science education and of grappling with how to interweave multiple perspectives in middle school students’ school science experiences. Our journey is not from point A to point B but rather a journey of visitations to one another’s places (geographical/physical, cultural, intellectual) through which we hope to grow our knowledge—but not to create one collective understanding or perspective.

We situate our work in Indigenous (Koya-Vaka’uta, 2017; Lowan-Trudeau, 2019; Naepi, 2019; Wilson, 2008) and sociocultural (Lave & Wenger, 1991; Tobin, 2012) perspectives and methods as well as in standpoint theory, which asserts that, “social location systematically shapes and limits what we know, including tacit, experiential knowledge as well as explicit

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understanding” (Wylie, 2003, p. 31). We acknowledge the extensive work that has been undertaken in this domain by multiple collaborations preceding ours (e.g., Aikenhead, 2001; Aikenhead & Ogawa, 2007; Bang et al., 2012; Cajete, 2008; Chinn, 2007; Medin & Bang, 2008).

Our project hopes to contribute to understanding in this domain through exploring how a multi-perspective approach that considers Indigenous and Eurocentric worldviews in science education may enhance scholarship through broadening how science learning can be defined, scaffolded, and understood in classroom contexts. In our curricular work, for example, we have expanded our ideas about learning from an initial focus on developing a multi-perspective science education learning progression. Science education learning progressions have been critiqued, in part, as portraying scientific knowledge in problematically unidimensional ways (Pierson et al., 2017; Sikorski, 2019). Over the past two years, we have detoured from our initial focus on creating a learning progression for students’ developing knowledge and practices related to coasts.

It has become clear to us that we cannot create a multi-perspective science learning progression when we have not sufficiently explored and defined what an appropriate multi-perspective aim for learning in this domain could or should look like and encompass. Therefore, a central focus of our efforts has been exploring what knowledge and learning that reflect multiple perspectives might mean and look like in classroom contexts. Relatedly, we are exploring how teachers and students can be supported in broadening learning experiences to encompass a wider and more nuanced domain of what is valued in the classroom with respect to what students may explore, wonder about, do, know, and/or learn.

The primary research questions our project is examining in this paper include:

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1. How can multiple perspectives be appropriately included in instruction in ways that demonstrate equity, value, and respect, rather than some perspectives being represented in deep ways while others are represented in shallow ways? And,
2. What does learning look like when it authentically represents multiple perspectives?

We realize that, given the centrality of multiple perspectives to our project, it is essential that we try to understand the multiple perspectives that we ourselves bring to our collaborative endeavors. Thus, the findings of this paper comprise an effort to elucidate a set of five themes that have arisen from our explorations and discussions concerning our research questions.

Our Findings/Discussion also provide comments about consequentiality—working to articulate how the themes and ideas are important for us to be cognizant of and to interact with consciously. We acknowledge that the themes we have identified have arisen through our researcher perspectives. A goal is that through our collaborative and participatory research we can jointly explore and better understand standpoints in peoples' expressed perspectives. Positionality statements for many of the project team members who have been involved in our collaboration are provided at the end of this paper.

Methods

Approach

Just as we have needed to expand our comprehension of learning in this project to encompass and value multiple perspectives, we are also working to expand our understanding of research methodologies. Many of the Eurocentric approaches to research methods that some of us have employed in the past are not relevant or appropriate for this project. One prominent example relates to common Eurocentric strategies for analyzing qualitative data. For example, in

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applying grounded theory (Strauss & Corbin, 1998), researchers commonly analyze evidence they have collected through developing a data coding system and attempting to apply their system with consistency (e.g., through iteratively and collaboratively refining coding frameworks with categories/attributes and indicators/values, and through attaining an adequate level of interrater reliability).

In a multi-perspective research project that includes Indigenous and Eurocentric participants and researchers (as well as people from other cultures and mixes of cultures), the aim of coming to consensus and coding data with consistency is problematic in several ways. For example, evidence might not mean the same thing to different people. As researchers, we cannot know that our understanding or interpretation of a piece of evidence is consistent with the meaning intended by the person who said or wrote what we are analyzing. The practice of codeswitching further complicates this issue (Mabule, 2015). People sometimes say what they think is appropriate for a certain context or that they think the person they are talking with or to will be able to understand. Thus, as we review evidence from the project, we need to consider the possibility that a participant who is asked a question might give a different response or performance depending on who is doing the asking.

As a research group, to the extent possible, we can revisit ideas and expressions or engage in member checking (i.e., asking participants to review or reflect on their expressions and our interpretations of them), but there are limits to what we are able to do in this regard. Further, even if we were able to come to a shared understanding on the interpretation of an expression or performance, that does not necessitate that, from our different perspectives, we would all place the same value on that expression or performance.

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Given these issues associated with undertaking multi-perspective research, we have shifted over time toward methodological approaches that are more consistent with Indigenous research methods, which tend not to assume the need for unitary interpretations or valuations (e.g., Wilson, 2008). Participatory talk/discourse plays a central role in our project's evolving research methodology. While we collect data and evidence in ways that are similar to other science education research projects, how we analyze those data is evolving over time. As described in further detail below, for this paper we collected survey and interview data from project teachers and partners. Rather than coding evidence, however, we draw on the evidence as well as other issues that arise from project work as starting points for discussions. We record our discussions, and in this way, our discussions themselves become both further evidence as well as analyses related to our project. The themes that we share in the findings emerged from our discussions about issues that arose, our diverse perspectives concerning those issues, and reflections on implications for our project.

As a research group, we are trying to open ourselves to what, for many of us, are new ways of learning together. We do not claim that we all have expertise in Indigenous research methodologies or that this project research follows an Indigenous research methodology. It does seem reasonable, however, to share some ways in which we are opening our process to and taking inspiration from Indigenous research methodologies. While there are many illuminating resources in the area of Indigenous research, we highlight a few here that have been instructive to our work. These are the book, *Research is Ceremony*, by Wilson (2008) and the chapter, *Pacific Research Methodologies*, by Naepi (2019). Several guiding principles that have developed through our collaboration include:

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- Centering relationality and relationships rather than “truth” seeking as an aim of our research.
- Providing space for talk and perspective rather than quantification, unitary valuation, or even consensus in our analyses.
- Taking time to discuss our diverse perspectives concerning ontology (the nature of being and reality), epistemology (how we know), axiology (ethics and morals), and methodology (how we learn together)—related to contexts of instructional design and research.
- Discussing who our research is for, why we are conducting it, and with whom and how we should share what we are learning.
- Making space for telling stories as part of our collective discourse and learning.

Context and Participants

We present findings from our partnership project that is designing, implementing, and studying instructional experiences for middle school students from significantly/predominantly Indigenous communities in Alaska and Hawai’i. Our design context is multi-perspective, problem-based learning experiences in which students explore local coasts and coastal erosion. Instructional unit design was initially based on Cajete’s (1999) Creative Process Instructional Model. The unit begins with an Indigenous perspective, seeks to interweave Indigenous and Eurocentric science learning experiences, and concludes with a culminating student-team performance (e.g., sharing findings and possible community responses with other students, and community members).

Project partners include Indigenous culture and education specialists; science and technology education designers, researchers; professional development specialists; scientists;

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middle school teachers; and an evaluator. These roles are not mutually exclusive. For example, partners include Indigenous culture and education specialists who are also scientists, researchers, professional development specialists, and/or middle school teachers. While some of the partners have worked together in the past, this is a new collaboration with many partners who have not previously worked with each other. Presented evidence comes from the eight project teachers (four/state) and about a dozen other project partners who engage in various roles. The project teachers teach in schools in three Alaska Native villages and in four Hawaiian communities where school populations generally include at least half students who identify as Native Hawaiian or Pacific Islander.

Evidence and Sources

Data collection started at the beginning of project year two, which also coincided with our first and only four-day, in-person workshop attended by most project partners including teachers. Data collection with teachers was primarily undertaken during the workshop and included teachers' responses to a background survey and exit questions and dialogue recorded during two focus group discussions and one interview with each teacher. Initial data collection with other partners started shortly after the workshop and included responses to a set of reflection questions.

Evidence also comes from surveys completed by partners in late 2022 through early 2023 and from communications with teachers, including at monthly check-in meetings conducted via Zoom. The questions in survey and interview protocols were collaboratively developed by the partners to query perspectives and ideas related to science and science education. The questions sought to prompt people to use their personal ideas and definitions in the domains that scholars have written about as multiple perspectives (Aikenhead, 2001; Aikenhead & Ogawa, 2007; Bang

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et al., 2012; Cajete, 2008; Chinn, 2007; Medin & Bang, 2008) and Indigenous cultural integrity in education (Dehyle, 1995; Pidgeon, 2019). Our findings also draw on the many relevant discussions concerning our relational, multi-perspective project that have occurred since we began working together.

Ethical Conduct of Research

Informed consent was obtained from participants in this study. This study was reviewed and approved by a university Institutional Review Board with reliance agreements and administrative and community approvals in place from partners.

Thematic Findings and Discussion of Implications

We present our findings organized by theme and drawing on project evidence and discussion. To give prominence to the centrality of talk and discourse in our research, we frame each theme around contextual meanings of the theme within our project, examples from our discourse, and reflections on the theme by a team member—including on implications for the project. The five themes we address are: (1) the challenge of defining Indigenous and Eurocentric science for application in an instructional design context, (2) relationships with place, (3) centrality of language, (4) scaffolding and understanding learning through a multi-perspective lens, and (5) constraints associated with Eurocentric classroom and science contexts.

The Challenge of Defining Indigenous and Eurocentric Science for Application in an Instructional Design Context

Defining terms has been one among many challenging tasks our group has faced. This task is daunting for multiple reasons. First, our project partners have agreed that we should not aim to all place the same meaning and value on the objects we study—we try to invite and value

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multiple perspectives. On the other hand, our project has a joint task of creating an instructional product (a unit that engages middle school teachers and students in exploring coasts and coastal change). It is important for the instructional materials we develop to clearly articulate what teachers and students should think and wonder about and do during the unit instruction, and what they should aim to develop or take away (i.e., learn) from engaging in the unit instruction. In order to convey clarity of purpose to teachers and students, some level of embedded definitions, or at least shared understanding of definitions and purposes among partners, is necessary.

Defining science and associated domains and terminologies is challenging in a Eurocentric context (e.g., Latour & Woolgar, 2013) and even more so in a multicultural context (e.g., Aikenhead & Ogawa, 2007; Stewart, 2023). The task is further complicated by issues of power and history, which are wrapped up and layered with origins and etymologies. In a discussion concerning this issue, one of our team members shared,

The word “science” itself has so much baggage and power. If we say that word, science, without pointing out where it comes from and put the word Indigenous in front of it, we allow for the violence to continue. Power structures validate one and invalidate others; we have to point that out as the elephant in the room. By not pointing it out it still exists; it is crushing some at the benefit of others. The elephant doesn’t move.

The word science, itself, is of European origin. It cannot, therefore, accurately encompass, describe, or represent something that is Native Hawaiian. Native Hawaiians have their own words for exploring, wondering about, engaging with, and living in the world and the universe that the word “science” can only very imperfectly approximate. Thus, our definitional problems in this project extend and connect with other themes, like language use in instruction.

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How can we imbue equity of perspectives through creating an instructional unit that is primarily written in English when English words are insufficient for conveying Native Hawaiian or Native Alaskan meanings? Without arriving at any definitive, we offer the following reflections on evolving and flickering definitions of some terms that we have been grappling with in our collective efforts.

Science

Science is a set of diverse yet overlapping subcultures that may be viewed as socially mediated efforts to cultivate wonder and knowledge about the world and the universe. Different subcultures of science, to varying extents, share some common characteristics. For example, scientific communities often share the genre trait of emphasizing care and precision in language. This definition must be tempered with the understanding that, for example, if we went to a Hawaiian immersion school, the teachers and students would use entirely different words with different meanings when wondering about and engaging with the world—calling what they are doing “science” would be an insufficient, externally placed label.

Indigenous Science and Eurocentric Science

Both Indigenous science and Eurocentric science are problematic terms in that they lump what could be viewed as many areas (e.g., each individual scientific subculture whether geographical, disciplinary, or other) under a singular moniker. While acknowledging this problem and the variation and complexity that extend across the many subcultures of science, several characteristics (possibly stereotypes) are often applied to these domains. For instance, Indigenous science is often viewed as attending to both material and nonmaterial domains, whereas Eurocentric science is often viewed as limiting attendance to the material domain. Stewart (2023) expresses this idea when she states, “Māori knowledge is not necessarily

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restricted to the three-dimensional reality of the laws of physics, and therefore may have access to wisdom that western science has disallowed within its canon.” Indigenous science and Eurocentric science are, at best, imperfect terms.

School Science

We note that in schools, science is often portrayed as a universally accepted way of understanding the universe, rather than as a multifaceted constellation of loosely networked communities of practice. Similarly, the Eurocentric “science content” that is taught in schools is often uniformly portrayed as settled and certain fact rather than as understanding that is evolving, limited, and characterized by uncertainty (Abd-El-Khalick, 2002; Chiappetta & Fillman, 2007; Covitt & Anderson, 2022; Knain, 2001). As we will discuss in a later theme, the culture and discourse of science that dominates Eurocentric schools (including Eurocentric schools attended by Indigenous students), constrains teachers’ and students’ capacities to equitably engage with multiple perspectives within learning experiences.

Scientism

Scientism is an unwarranted belief that Eurocentric scientific methods and conclusions always lead to the best conclusions and actions (Scott, 2008). In an effort to avoid bolstering scientism, it is important to emphasize that while a broader set of domains is included in the educational experiences we are designing, answering many (most) questions attendant to these domains is beyond the scope of Eurocentric science.

Sometimes in our discussions, we observe a tendency for us to equate Eurocentric science with scientism. History suggests that Eurocentric science has often been more or less conducted and inculcated in ways reflective of scientism. In our project, we are exploring whether it is possible, in classrooms and in multicultural contexts, to untangle Eurocentric science from

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scientism (in the vein of sociocultural approaches like those of Latour and Woolgar (2013)) in order to retain some potentially useful parts of Eurocentric science while placing these parts on more equal footing with other perspectives. Whether or not such a disentanglement and reestablishment of multiple approaches is possible, especially in schools, remains to be seen.

Multi-Perspective Education

Here, we offer not so much a definition of multi-perspective education, but a designation of how we use the term in our project. In aiming to create multi-perspective educational experiences for students, teachers, and ourselves, we seek to include and value perspectives that are diverse in several ways. First, we try to be intentional in including and valuing perspectives from different cultures (often situated in place). Our collaboration has particular focus on the local cultures of the communities we are partnering with and the culture of Eurocentric science, but we are also trying to include perspectives of less prevalent cultures in project places (e.g., the Marshallese community in Hawai'i).

Second, in designing educational experiences, we seek to include multiple perspectives in the sense of attending to not just the domain of “science” (whether Indigenous, Eurocentric, or other), but also other domains—e.g., social, ethical, metaphysical, moral, geographical, community, historical, cultural, and decision-making. This scope of inclusion might be (stereotypically) viewed as consistent with an Indigenous science perspective and as extending beyond the circumscribed scope of Eurocentric science. In either case, however, our project’s multi-perspective lens extends beyond the traditional domain of questions that can be answered through applications of Eurocentric science. We view that a broad set of concerns needs to be included given the aim of engaging students in multi-perspectival learning experiences addressing locally relevant socio-environmental issues.

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Noelani's Reflection on Defining Indigenous Science

The learning that we are doing as a project team is happening along the way; this hasn't just led to a change in the focus of the curriculum that we are writing, it has changed the *purpose* of our curriculum. To successfully include science that respects multiple ways of knowing, the purpose of our curriculum has to align with multiple ways of learning about the world around us, intentionally include Indigenous languages, and acknowledge the different reasons we “do” science and relate to our world.

Relationships to humans and to our specific environments do more than connect us to place. Relationships define how we see the world and who is important, such as having personal names for ecosystem processes, and knowing the story behind specific place names.

Relationships to our coasts, our forests, our food, are the **foundation to Indigenous science**. In our traditional practices we perpetuate our applied science. Placing importance in the curriculum on the values and relationships that our students have with their beaches, and highlighting Indigenous practices, histories, and the socio-political struggles that are intertwined with the changes of our coasts expands the way we define science. It recognizes that the physical science of a changing beach is not apolitical, it is part of a larger conversation that recognizes the past and helps prepare us for a future.

Science is **lived** by Indigenous people; it is not just a way of knowing. By sharing with students how beaches are created and persist, we help them see the potential future of their coastlines while recognizing the multiple ways they connect to the coast, the multiple ways they interact and create relationships, and the multiple ways we can each be present as our coasts change.

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We have struggled with providing the space for Indigenous languages, cultural contexts, and representing the science of Indigenous ancestors, yet we have struggled together. We are motivated to create a curriculum that shares the changes our coastlines are experiencing, and most importantly, empowers our learners to be present.

Relationships With Place

As a multi-perspective education project, we need to recognize different types of relationships that exist between people and the places that they inhabit. It's also important that we recognize these different types of relationships and expressions of these relationships as we examine and make sense of students' experiences. Through the project experiences, what are students learning about places and about how people inhabit and connect with their places?

Multiple permutations of expressions of relationship with place were evident in the perspectives that were shared but seemed to be more detailed and prominent among responses from teachers compared with responses from other partners. This may relate to the fact that, during the workshop the middle school teachers were deeply concerned with considering how they would enact the project instruction about coasts and coastal erosion with their students in their local places (each characterized by important cultural and geographical/geophysical distinctions). Non-teacher partners may have been more focused on the project as a whole when responding to questions—they discussed place but were more likely to discuss “place in the abstract” rather than “specific places.”

Relationship with place was discussed in ways that seemed to evoke Indigenous worldview, Eurocentric worldview, and an aim of bridging between views. For example, one teacher who identified as Indigenous shared, “I think our area prides ourselves in having that beach because our ancestors chose that certain area versus inland.” A teacher who identified as

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White seemed to view place as a lever for helping students bridge perspectives. She shared, “And I think exploring data in the context of this larger cultural beach is going to be really powerful in marrying the two ideas of a more Westernized sense of science and then more traditional ways of knowing place and knowing how a place has changed over time if that makes sense.”

Place was also considered from both inward and outward looking perspectives—that is, teachers discussed the importance of students connecting with their own coasts as places and of students expanding their spheres of awareness and connectedness through experiences such as video exchanges in which Alaskan and Hawaiian students will connect and share their coastal learnings with each other. Additional place-centered perspectives foregrounded ideas including stories of place, sense of place, subsistence practices (living in place), and concern and gratitude for place.

The prominence of place across partners’ shared views and the diversity of ways in which partners evoked and invoked place highlights that our project will need to consider expressions of place carefully. One of our research goals relates to identifying how and the extent to which Indigenous and Eurocentric perspectives surface and are engaged with in classroom discourse. The spectrum of expressions around place highlights that it will be difficult to interpret place dialogue in the classroom that foregrounds different perspectives. One example of this challenge is evident in references to place that suggest either a “caring for” or a “taking from” perspective. There is an implication that when we use some words, such as the Hawaiian word *‘āina*,¹

¹ We agreed to use the convention of italics for non-English words in this paper. The context of this usage is important. This paper is intended for a mostly English-speaking audience. If we were using Hawaiian words in Hawai’i, we would not use italics because Hawaiian is the primary language of the place; English is the “foreign language.” We pose for consideration, within the “United States,” does it make sense to label Hawaiian and Yup’ik as foreign languages that should be italicized?

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commonly translated as land, that a “caring for” perspective is adopted. In contrast, the word resources is often interpreted to refer to something that is taken away and used. These meanings can get tangled up when people from different cultures are talking with one another. The words we use to describe place and to communicate across cultures complicate our interpretations, and consequently, the insights that we take away and use to inform things like instructional design. When one teacher who identifies as both Native Hawaiian and White was asked how she thought the project would impact her students, part of her reply included,

Like really what do scientists do? And like I said earlier, for me it’s all about, I want you to stay home here, and I want you to be the scientist in the field. That’s where I come from. Or at least protect the areas that are important to us—our marine environment, our mountains, like all of these resources that we have.”

Some of the words this teacher uses suggest a taking care of or “protecting” aim, yet she also uses words like “resources,” which often have “taking away” implications. One of our partners suggested that if the teacher had been talking to a fellow Hawaiian instead of to our non-Indigenous project evaluator, she might have used the word *‘āina* instead of resources. We are using a participatory approach to explore possibilities and permutations of meanings and interpretations, without coming to single conclusions about intended meanings of expressions.

Ho‘oululāhui’s Reflection on Relationship With Place

When I consider connection to place, I think of it as personal, cultural, and influenced by my past experiences as well as my understanding, which may have been gained by others informing me about that particular landscape or who lives or once lived there. And when I say “who,” I mean all living things, not just the human people. I view our connections and

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relationships to place as complex and shaped and influenced by our experiences, values, and how we view and engage with our environment.

For example, if four different people spent an hour at the same coastal area, they could easily have different experiences and learn very different things. At the end of that hour, they would likely all have unique connections to that place as, even if they are from the same culture, each person brings with them different experiences, knowledge, skills, abilities, and interests. They are each individual—it is not possible for all to have the same experience or build the same connection or relationship to that place.

Yes, different views are interpretive, but that doesn't mean there is nothing to gain from seeking to understand perspectives that are different from one's own. In fact, I would argue that adding to our ability to recognize the value of our different ways of connecting to place and gaining understanding is of utmost importance today. And so, another aspect of our research is aiming to better understand what we can learn from the multitude of ways we connect to and learn from places. In our curriculum, we hope to help students consider the many ways of knowing and learning from a place. One way we hope to do this is by introducing them to a variety of perspectives from which to learn about their coastlines. Some of these are: different cultural practices and worldviews, different kinds of science, people of different ages (their teachers, elders/*kūpuna*) and other community members such as fisher people and gatherers, surfers, tourists, and animals or plants that live there.

Centrality of Language

Considering the role of languages in education has played a very prominent role in our project discussions. While the project had always planned to integrate Native Hawaiian and Native Alaskan languages into the instructional materials, issues like what language the

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curricular design starts with and how Indigenous languages are part of the instructional materials has been an increasingly pointed and significant focus of our work. Several issues related to languages that we are grappling with include the following. First, because Native Hawaiian and Yup'ik and Alutiiq worldviews are each distinct from a Eurocentric worldview, attempts to translate words from one language to another inevitably fall short. It is simply not possible to express a Yup'ik worldview or to create an instructional material that adequately represents the Yup'ik worldview in a format that is primarily in the English language.

Culture is inextricable from language (e.g., Basso, 1996). Thus, teaching Indigenous children in schools in the English language—and not embedding this significant portion of children's time in local, Indigenous language use—is a form of cultural genocide (Battiste & Henderson, 2018). One of our partners relayed how this was recognized from early times of contact. She shared that, “when white education was established, an Elder in Alaska who had not yet even met a white person said, ‘our way of life is gone.’”

She continued, reflecting on how current efforts to re-integrate Native languages into education are problematic or even non-sensical, and asking, “why would you want to translate the term photosynthesis into a Yup'ik equivalent?” As part of an effort to create culturally relevant instruction in Alaska, this partner continued:

Translating a word like photosynthesis, at that point the school was doing Yup'ik for Yup'ik's sake and not asking ‘why do we need to do this?’ There was a group who struggled through translating all these originally English terms into Yup'ik by making up new words. When I read/see/hear Indigenous anything worldview, curriculum, (science) I have a structured and defined way I think about that,

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which is not a footnote or just going to ask an Elder to start with. This is probably a difficult conversation but if it weren't challenging it wouldn't be worth doing.

Activities take place in Eurocentric schooling of Indigenous students that are labeled as culturally responsive education, such as inclusion of local, Indigenous languages that, upon reflection, clearly display the ongoing impacts of colonization on people, community, and culture. Our partner continued her reflection on local, Indigenous language integration into the Eurocentric school curriculum by asking, "saying the pledge of allegiance in *Yugtun*, why are we doing this?"

Dale's Reflection on Centrality of Language

In so many ways, language represents or is a reflection of power. One example of this that is probably familiar to all of us is suppression of Indigenous languages by forcing the use of English to communicate. In my state of Alaska, this practice extended beyond schools to include all public meetings for many years. Imagine a tribal government forced to hold its meetings using English to discuss issues of importance to people who could then not understand what was being said about them! The result of forcing the use of English as the formal language for communication has been the erosion and extinction of many Indigenous languages. Now, with few speakers remaining for some languages and dialects, there is justifiable concern about keeping languages viable and growing their use.

A challenge we've faced in the project is we began the development of the instructional unit in the English language and, consequently, the unit is almost all in English. Because Indigenous worldviews are embedded in and in many ways inextricable from Indigenous languages, this has created an imbalance. It is difficult to confer equal value on Indigenous

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perspectives when the unit is written in English with modest inclusion of Indigenous words and descriptive phrases.

In our project, we've seen firsthand the inadequacy of simple word-for-word translations from English to a Native language. English words are like code for something.

Take waves for example. In English, we use the word to mean any kind of waves, or we add a verb to it, "crashing waves" or "rolling waves." To describe the same concept in a Native language can involve all the senses and ways of knowing and more than a single word.

By incorporating glossaries and meaningful text for students in the Hawaiian and Alaskan Native languages, we've learned that the worldview is richer and more complete. As researchers, we've grown in our understanding and respect for Native languages as a valid and appropriate way to communicate with Indigenous students about important scientific phenomena.

Constraints Associated With Eurocentric Classroom and Science Contexts

To consider problems that the limited nature of Eurocentric science and constraints of Eurocentric schooling systems poses for designing science education experiences, we begin by offering several questions to ponder:

- What questions can be answered with a Eurocentric scientific approach, to what extent, and with what limitations?
- (Why) should domains that extend beyond what can be answered with Eurocentric scientific approaches be included in the school science curriculum?
- How can the affordances and limitations of Eurocentric science be conveyed in school science instruction?

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- How can the “school science” curriculum (especially in contexts of place and with respect to locally relevant issues such as coastal change) be expanded to value other ways of knowing and interacting with the world?

While we often adopt very limited conceptions of goal school performances from a Eurocentric science perspective, a multi-perspective approach forces us to widen our lens. Consider, for example, a question such as, “Why is the physical shape of our coast changing over time?” Applying a Eurocentric, physical science lens, one might provide a mechanistic explanation concerning changes that happen in response to the physical forces that waves exert on the coast. With a wider lens, many more explanations are possible. For example, one might explain that the physical shape of the coast is always changing in response to cyclical, seasonal events. Or one might explain that climate change and sea level rise are impacting the shape of the coast. And/or one might explain that colonization has led to the changing shape of the coast (see the history of Pearl Harbor for a relevant example). While these and many other potential explanations have value and validity, school science is often presented as having one correct answer to questions, and students thus often interpret school science tasks as asking them for “the one correct answer.” The extent and ways in which we might be able to push the boundaries of the “school science” box, therefore, has been a central and recurring concern in our discussions about both instructional design and research.

Common Eurocentric system characteristics affect school classrooms in other ways as well. For example, teachers and students are often required to focus most of their time and effort during instruction on certain curricula, certain standards, and certain ways of valuing the outcomes of students’ school experiences (e.g., through grading their performances). Both opening space (time) for and opening different ways of valuing multiple perspectives in school

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experiences is difficult for teachers, who are constrained in what they are allowed to do and how much time they have to do it in.

One area in which a tension surfaced with some frequency was around how the coastal erosion instructional design could adopt a more step-by-step linear versus a more storied framing. Stories were largely viewed as reflective of instruction foregrounding Indigeneity while a Eurocentric approach was seen as more linear. One teacher who identified as White shared a preference for a more linear approach. He said,

To me, this isn't a curriculum... [that I] I can look at it and I can get an idea of the information that's there and the direction and the questions and the stuff like that. And then from there, I would build out the side pieces, whether it's the native tongue extensions or the science experiments for lack of a better word. I would build them secondly after I've seen the bulk, and here we've really done the extensions and I still haven't seen the actual what I'm supposed to use to teach, unless it's just those guiding questions, and if it's just those guiding questions then I'm gonna have a little bit of trouble.

For this teacher, other perspectives and cultures were perceived as needing to come “secondly” after the core curricular (Eurocentric science) content of the unit is set.

In contrast, a teacher who identified as both White and Indigenous seemed comfortable expressing how aspects of Indigenous story and of Eurocentric-style inquiry might work together. She shared,

All our knowledge comes from one place, so right. So, you're gonna do some of the simulation. You're gonna do some of this hands-on. You're gonna like do the demo model wave tank thing. So, I feel like what we get from *mo'olelo*, from

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ancestral knowledge, I think has become more important. They recognize the Indigenous knowledge. So, I like that component 'cause for me that's like, oh, let's build some evidence. Where can we get information to try to understand this phenomenon?

Other constraints and challenges that were discussed related to the discomfort of identifying as White and teaching Indigenous students, and the importance of having a more foundational and equal role for Indigenous collaborators in the instructional development. The following example is from one of multiple teachers who identified as White expressing discomfort:

And so, it was awkward for me. Like here I am, this White woman, and I'm teaching them, and I had so many kids ask me... '*Kumu*, are you Hawaiian?' ...I'm like, 'No,' but they were very confused I think by like, what is she doing here? Why is... who's this White lady teaching us culture, you know?

Several partners suggested the importance of a larger role for Indigenous collaborators in the curriculum development. One partner highlighted that although the unit will include a dual language glossary, the English words were chosen first and were identified by the Western developers. She identified the instructional design work as "Western first." For some of the areas of challenge, it is more immediately possible to imagine ways we might navigate as a collaboration. For example, one partner wrote, "*We* could give equal participation to Indigenous voices in the writing of the curriculum." In other areas, such as the discomfort of partners who identify as White in navigating Indigenous contexts, discussion and engagement will be important, but resolution of the tension may not be a goal.

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Another project partner shared about how there is sometimes a perceived need among Indigenous communities to obtain a Western education not because this is an education that is valued within the community, but because it is needed to “get a seat at the table” in Eurocentric-dominated contexts. She went on...

So, it's almost like, we call it getting the *palapala*—getting the paper, you know.

If you get those diplomas and those certifications and that background in Eurocentric science or similar, they see your work or practices closer to being at their level. Otherwise, how are we going to have a voice in how the natural resources we need for our practices and livelihoods are managed? The degrees from institutions help to elevate your work in their eyes. And so, you have a choice to work in that Western kind of Eurocentric type of environment within that field—they can now recognize your expertise. Maybe you decide to go work on the land, or for a nonprofit or for, you know, a community group and apply your skill sets there.

But it gives you those options, and it helps you understand their language, and speak in their language, and get treated a little bit better because for some it elevates your work.... And it's only, I think, because so many people have done that that we're even at this place that we're at today. And so otherwise we just don't get a voice in how things are done.

One project partner offered a succinct reflection that we have returned to often as a touchpoint for considering how we can continue to nudge the instructional design of our unit in a direction that is consistent with equity among perspectives, even if we have not yet accomplished our goal. He concluded, “I do not think multi-perspective education is two scoops of Whiteness

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with Native sprinkles; that is still Eurocentric science.” We are seeking to understand both the external and internal constraints that we are facing as we explore what is possible for creating learning experiences that push aside some structures and expectations of Eurocentric schooling to raise up, make room for, and authentically include multiple perspectives—Native Alaskan, Native Hawaiian, and more.

Nicollette’s Reflection on the Constraints of Eurocentric Classrooms and Science Contexts

While our goal is a multi-perspective unit that honors varied and complex viewpoints, we have faced challenges due to limitations with Western classrooms and science constructs. American schools are largely designed from a Eurocentric perspective that has historically capitalized on education as a colonizing and dominating force in Indigenous communities. Communities, schools, and teachers work to create appropriate and culturally sustaining learning environments, but Eurocentric ideals that permeate school spaces can still impact teaching and learning.

Because of this, the possibilities for a multi-perspective coastal erosion unit are sometimes restricted. There are concessions that must be made for time, reasonable access to beaches, and existing curriculum maps. In addition, class periods are also usually siloed into subjects, where topics like history, arts, and sciences are presented as independent rather than interconnected. Required school science content can perpetuate strict ideas about what counts as scientific knowledge, which observations are considered valid, and whose explanations are considered true. It is not enough to simply “drag and drop” an activity or vocabulary word that is representative of the local Indigenous culture; we must consider how activities, language, and approaches can be taken up within a school context.

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In the development of an equitable, dynamic unit, we've found ourselves faced with these obstacles. It is in these stuck places where partner and teacher perspectives have contributed to shifts in the unit that help us move toward our goal of an authentic and equitable multi-perspective unit. We continue to consider, refine, and play with new designs that will holistically engage students with the complexity of the world around them, helping them to navigate and communicate interwoven concepts in science and culture.

Scaffolding and Understanding Learning Through a Multi-Perspective Lens

Much of this paper has attended to the importance of and challenges associated with interweaving multiple perspectives into students' learning experiences, especially when students come from non-dominant cultures. There is another facet that merits consideration, however, when seeking to interweave multiple perspectives into student's learning experiences. That is, if we do build something together and if teachers and students engage in a designed learning experience, how could we ascertain in what ways their experiences were successful? Measuring only or predominantly Eurocentric learning outcomes would be an insufficient and perhaps ill-placed approach to considering whether a multi-perspective learning experience was successful. Further, measuring itself may be an inappropriate approach for reflecting on how and where the project may have succeeded and where it may have fallen short (in different ways and using different lenses). These questions of "what should we look for?" and "how should we make sense of what we see?" during the unit instruction and/or afterwards is a topic that we continue to explore.

As suggested in the introduction to this paper, we have found that an aim of developing a multi-perspective learning progression around students' developing understanding of coasts and coastal change is not a simple or straightforward proposition. While scholars have begun

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considering how learning progressions might encompass multiple facets (rather than unitary designations) of knowledge and practice at an upper anchor or goal level, in our project, we are still exploring what knowledge and practice mean in a multi-perspective light as well as what other goals (e.g., wondering, caring, honoring, surviving) need to be included and/or central in our examinations and considerations of success. The diversity of perspectives concerning what success means and the challenge of defining success in a context like our project has been evident in the ideas that partners have expressed.

For example, when asked about how she would determine or assess success, one teacher in Alaska shared,

I do a lot of observational success type of assessments. So, if they're asking me a lot of questions and not just like reading a story, for example, if they're making a question about like, oh, what color are their shoes, or why do you think it's that color? Like, it doesn't seem like they're connecting with the information, but if they're asking relevant and deeper questions even if they can't answer those questions, it shows me that they care and that they're trying and that they wanna know more...

Well, first of all, if they don't fight me on it, [laughter] if I say we're gonna go outside, do this, and write in our nature journals, if they don't argue, then that's already a sign that they like what they're doing. But then, I also look into those nature journals and see how much they wrote and how much they observed and their detailed drawings and things like that. And then I try and do little mini exit tickets, even if it's just a discussion. So, if they discuss with their partners or ...

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just a small group and they are actually in depth with their details and things like that... It's a lot of observational assessments.

Another team member shared an extensive reflection on the fundamental mismatch between “standards” and what is valued locally in Alaska.

This is bringing to mind a lot of the challenges and struggles that I've experienced personally and working with Native people here in Alaska. About six or seven years ago I was part of a group that created cultural curriculum for LKSD, which is one of the biggest rural school districts in the state. What we were trying to do was take Yup'ik cultural values and create courses... and we had to make sure that we were teaching to standards. So, we had to use social studies and health standards. And then cultural standards... they always seem like over here, you know. That the main thing that you're trying to do, or the main focusing had to be academic rigor. And so, it was a lot of head thinking and not a lot of soul growing or soul searching.

So, in *Yuyurok*, which roughly translates into the Yup'ik way of being, or the Yup'ik pursuit of life, or the way that you're supposed to live your life, the ancestral goal, or the traditional goal, like the whole reason why you would be taught *Yuyurok* was to survive, to live. And to live honorably and to live respectfully with yourself and for yourself, and then that would radiate to other people. So, to me the big challenge was, how do you take something that seems so straightforward as that and translate it into a curriculum where you need to check boxes, and you're meeting standards, and you have a lesson plan, and an instructional plan, and all of that? Where you know, basically you're trying to

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instill in students a sort of behavioral change, not just in school, but throughout their whole life, that hopefully improve their families, the community, and just the Indigenous people, you know, in the area that we were writing this curriculum for. And then, so that was a big challenge for me, like a big mind challenge, because it reminded me a lot of when I was doing my master's work, which was also around Indigenous education, and trying to really take Indigenous issues, but also having to work within a framework of well, Eurocentric and Western standards. So, that was a big mind struggle for me too.

The latest one that I was a part of was a Yup'ik language assessment that LKSD school district is trying to write and accomplish. So, in LKSD, it's one of the last lingering places where very young children grow up speaking the language, and some of the schools provide Yup'ik instruction in Yup'ik language arts and Yup'ik social studies. They're delving into, like Yup'ik sciences and Yup'ik math, but those are kind of in the future. So, Yup'ik language assessment. One of the big issues that I saw with that is, that the instructional framework for teaching Yup'ik language hasn't been standardized. So, when do you teach this, and then what's the benchmark for that? And then, when do you have that kind of like a progression of the Yup'ik language...

That's kind of what I was thinking, so you're trying to balance Western-centric or Eurocentric western scientific standards and marrying them with Indigenous science knowledge and a lot of the same questions came up of, you know, what is Alaskan, Indigenous scientific knowledge? And it got me thinking of my work that I did in the Yup'ik curriculum. Where in the Western world we

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tend to compartmentalize things and things fit neatly in a box. Or you can say, okay, this belongs in the science subject, or this belongs in language arts, and so on and so forth. Where, you know, I have yet to find an Indigenous community or Indigenous society where things aren't holistic. Where, if you think about science, education, it also invariably includes a person's spiritual belief within that community.

So, you know, in the curriculum that we wrote and we met about... and in the steering committees where we had Elders and former teachers and current teachers, a lot of the conversations were circular, and you know, when we're trying to write a health curriculum and meet health standards for the State of Alaska, we couldn't talk about it without talking about Yup'ik beliefs of spirituality and Yup'ik beliefs of their connection to the Earth, which, you know, would be Earth science related, but didn't quite fit. So, I'm really kind of comforted to know that other people in other places are struggling with these same kinds of issues.

Grappling with what aims to have for multi-perspective learning experiences in our project is a significant challenge that we will continue to work on together throughout the time of our partnership. We have also been thinking about how we should try to observe and make sense of teachers' and students' project learning experiences to come to some sort of conclusions regarding success. Our conclusions need to encompass multiple ways of not just knowing, but also of valuing. Both our instructional unit and the ways we are observing and collecting evidence of project learning experiences continue to evolve.

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This year, we are collecting evidence including classroom video, discussions with teachers about their implementations, teacher journals and interviews, student artifacts and performances, and student interviews. Our intuition is that consistent with our bent away from deductive forms of analysis and toward more multi-faceted and storied forms of discourse as research, that generating classroom case studies may provide a productive approach for collaboratively exploring, reflecting on, and sharing about teachers' and students' multi-perspective learning experiences and accomplishments.

Joy's Reflection on Scaffolding And Understanding Learning in a Multi-Perspective Project

Learning in a multi-perspective project goes beyond what is recommended in the Next Generation Science Standards. It requires culturally responsive teaching and activities that integrate local knowledge, traditions, songs, dances, and stories that all contribute to a more comprehensive understanding.

Weaving multi-perspectives together in a cohesive storyline has its challenges, as well as, assessing learning outcomes. In this project, we started off with a typical Eurocentric format of question and answer to gauge learning and serve as the assessment for how student learning was progressing. As we monitored feedback from teachers implementing this in their classrooms and after much discussion with our diverse research team, we realized that this format was not engaging students and it was not honoring multifaceted, non-linear world views. A multi-perspective curriculum cannot be boxed into what knowledge is based on solely the Eurocentric perspective. We needed to shift our design out of the Western framework and change the scaffolding of how we were presenting the information and how we can understand what students are learning.

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We are addressing these challenges by adopting a logbook format, which will provide several resources, lenses, and approaches for students to select from (e.g., aerial maps, historical data, information about plants and animals, computer simulations, Elder and fisher stories, and using the Emory method for beach profiling). With this format, students have the responsibility to direct their own learning with an end goal of student groups producing a community-facing awareness project that will serve as a legacy for future classes to build upon.

We also changed our science practices focus from computational thinking and have adopted a more holistic systems thinking focus instead. We found introducing students to systems was more in line with the dynamic, interconnected nature of the social and environmental topic of coastal erosion and to intentionally move away from the more linear, formulaic Western mindset.

Our aim is to be culturally responsive in our scaffolding and understanding of learning in a multi-perspective project. We are realizing that the Western science approach is only one small facet within the intricate phenomena of coastal erosion, and we are doing our best to evolve to provide a more expansive learning outcome for our students.

Conclusion

Making sense of what to do about the knotty and daunting environmental problems that we will continue to face in contexts spanning from local communities to global society will require intercultural understanding, openness to learning, and a capacity both to draw on the strengths of multiple perspectives and to recognize the limitations of dominant perspectives such as Eurocentric science (Chief et al., 2017; Covitt & Anderson, 2022). In ongoing efforts, our project is navigating endeavors to grow these critical, relational competencies through

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collaboration of our partners and communities. While we do not make any claims to generalizability, our work on navigating efforts to interweave and value multiple perspectives may be of interest to others who are already undertaking or are considering similar work. We offer this work with an interest in both sharing the story of our journey with others and inviting other collaborations to share and teach us about their own experiences in this realm.

Research Team Positionality Statements

Dale Cope (she/her) is a lifelong Alaskan of Danish, Russian, and German ancestry. Dale grew up in the early statehood environment of Alaska and her deep convictions about equity were shaped by the early experiences she saw and crystallized over 30 years of work in rural Alaska with Alaska Native populations. Dale is now a grandmother raising two Alaska Native granddaughters following traditional expectations of family responsibility. Her interests and work related to equity for all also focus on individuals who are differently abled, both physically and cognitively. Dale started her education career as a middle school science teacher in a minority-majority school in an industrial community, an experience with two relative benefits. First, she recognized the need and justness of extending her passion for equity to all, beyond her initial interest in Alaska Native people. Second, she came to realize how different her background and worldview was from her students. Dale has a deep respect for indigenous ways of knowing and the soundness of indigenous science. In Dale's worldview, she places indigenous ways of knowing as the contextual and connected umbrella within which isolated western science concepts fit.

Beth Covitt (she/her) is an Ashkenazi Jew originally from Cleveland, Ohio. She lives on the lands of the Séliš and Qlispé peoples. Her work explores the limited but useful role that

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Eurocentric science education can play in preparing people for participation in socioscientific issues that invariably involve larger constellations of knowledge, views, and values. Beth is not optimistic about the likelihood of a just and equitable transition that would avert catastrophic impacts of climate change given, among other causes, the dominance of neoliberalism. She appreciates the opportunity, though, to attempt to work toward a just and equitable transition. And, she is grateful to learn from and collaborate with people who inspire her every day. Beth is also thankful for her family, who are tremendous companions on this trip.

Nicollette Frank (she/her) is of Norwegian, Scottish, Ashkenazi Jewish, and Native Hawaiian descent. She spent part of her youth on the lands of the Séliš and Niitsítapi peoples, where she now lives and works. Prior to her position at the University of Montana, she was an early childhood teacher and teacher educator in the Southeastern United States. She is the first in her household to obtain a college degree and will graduate from the University of Georgia in 2023 with a PhD in Educational Theory and Practice. Her interests tend toward critical and creative pedagogies in teacher education and development, and she appreciates this opportunity to collaborate with knowledgeable and insightful colleagues. Years in the field of education have instilled in her the conviction that thoughtful questions are often the most fruitful sites of learning.

Sarah Haavind identifies as white, third generation mid-western on one side, and colonial New England Anglo-Saxon Protestant (WASP) on the other. She grew up on the borders of Spanish Harlem and (black) Harlem in Manhattan, attending public schools where white was the minority. Many neighbors were Jewish, including Holocaust survivors who showed us the tattoos branded on their arms at the camps. These early influences shaped her career in education to focus on issues of diversity, equity and access. Her partner is Jewish (son of a first-generation

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Russian immigrant and a Polish survivor). Their first of three children was born with Down Syndrome, illuminating additional avenues of underrepresentation for equity, inclusion and access. She considers herself an ally and collaborator in exploring multiple perspectives; in this project opening entry points between indigenous and eurocentric science approaches to teaching and learning.

Joy Massicotte (she/her) is of French Canadian and Irish descent. She was raised in Simsbury, CT where Native Massacoets tribes lived before English settlers of Windsor moved in. She has lived in many areas before settling in New England as she is accustomed and drawn to the cyclical, pronounced feel of the four seasons. Her bachelor's degree is in Environmental Studies and she has a Master of Science in Natural Resource Management and Administration from the University of New Hampshire. Her thesis was evaluating the effectiveness of Non-governmental Organization programs in third world countries, and she found that Native participation in the development, planning and execution of projects was paramount to a project's success. She continues to pursue Native ways of knowing through her work as a Curriculum Developer at the Concord Consortium and by attending Native American ceremonies as she feels they are the Wisdom Keepers to the natural and spiritual world which she feels has been lost in our Eurocentric culture.

Born and raised in Hilo, Hawai'i at the foot of Mauna Awākea along the Wailuku River in the ahupua'a of Hilo, **Ho'oululāhui Erika Perry** is of Kanaka 'Ōiwi, Eastern-European, Ashkenazi Jewish, Italian, and Scottish descent. She currently resides with her family in Waikahekahe in the moku of Puna on Hawai'i Island. For the last couple decades her work has been in the arena of place-based environmental education and 'āina-based learning in Hawai'i.

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Her current research interests focus on sense of place and the challenges incurred with outsider-initiated education efforts that target Kanaka ‘Ōiwi students or community.

Noelani Puniwai was conceived, nurtured, and continues to raise her three children in the district of Puna, Hawai‘i. As a mālama ‘āina warrior, native Hawaiian community member, and science educator, Noelani tries to facilitate the communication of knowledge between scientists, local communities, and management agencies with a focus on indigenous seascapes and ocean health/abundance. Her family name means surrounded by-- all about—water; making water her purifier, her connector, and her kuleana (responsibility) to conserve and protect from the tops of the mountain to the depths of the sea.

Carolyn Staudt identifies as white, second-generation Hungarian on her mother’s side and Irish on her father’s side. Her grandparents on both sides entered the country through Ellis Island. She grew up in a small farming town in Ohio. She was the first on her mother’s side to receive a college degree. Her partner grew up in rural Georgia also on a farm. She taught high school and college science and mathematics for twenty years in the Midwest. For the past twenty-five years she has lived in Concord, Massachusetts, home of the Pennacook Indians that named the area “Musketaquid”. During her time in Concord, she has worked with teachers and students throughout the country including Alaska using digital tools. She is very interested in discovering multicultural perspectives and exploring how different teaching methods assist in honoring those perspectives.

Aloha. I am from the island of O‘ahu, my family lives in the valley of Pālolo and I spend much time in the Tuahine rain that falls upon the university in Mānoa. I am **Bruce Ka‘imi Watson**. He mea ‘imi i nā mea e hiki ke ‘imi aku ai, an ‘Ōiwi philosopher, historian, and educator in an occupied nation. My research swims in the areas of ‘Ōiwi philosophy as captured

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in mo‘olelo and the history of Hawai‘i, especially the history of education. My current research projects focus on agnotology in a Hawai‘i context, haole ignorance.

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