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Speculative Science Education toward Socioecological Care: Examining Relations and Tensions in a Critical Place-Based Science Camp

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Abstract: This dissertation explores the cultivation of socioecological care in a critical place-based science camp. The camp was intentionally designed to help youth develop socioecological care through (a) *paying attention* to the more-than-human world in ways that disrupt nature-culture binaries, (b) *recognizing* unjust socioecological relations and engaging in critical introspection, and (c) *envisioning* futures of collective thriving. Through qualitative analysis of interviews, artifacts, and video, my dissertation seeks to identify the myriad of ways youth engaged in these practices. I examine resources and experiences youth leveraged, and emergent contradictions and complexities in youth's development of socioecological care.

Background and objectives

The *Framework for K-12 Science Education*, a policy document that guides science education in the United States, argues that science education should "help students see how science and engineering are instrumental in addressing major challenges that confront society today, such as…solving the problems of global environmental change" (National Research Council, 2012, p. 9). Yet science is often taught in ways that perpetuate nature-culture binaries and neoliberal, human-centric thinking at the root of many environmental issues (Morales-Doyle et al., 2019). Amidst this reality, scholars call for alternative approaches that cultivate socioecological care and justice (NASEM, 2025). This dissertation heeds this call by offering and studying the enactment of a framework of speculative science education toward socioecological care.

Drawing on Indigenous and feminist notions of entangled and reciprocal relations (e.g. Kimmerer, 2013; Haraway, 2016; Puig de la Bellacasa, 2017), I conceive of socioecological care as the dynamic back and forth process of recognizing interdependence within interconnected webs of relations and assuming responsibility for one's role within those webs. My framework of speculative science education toward socioecological care consists of three processes—paying attention, recognizing, and envisioning—that aim to cultivate socioecological care. *Paying attention* entails a balance between learning how and what to pay attention to, and remaining open to receive and be moved by the more-than-human world. It requires key onto-epistemic shifts from practices in canonical science inquiry: attuning to relations rather than compartmentalizing parts, understanding more than humans as agentic beings and active interlocutors rather than objects to study (Marin & Bang, 2018), and embracing affective aspects of inquiry rather than striving for detached objectivity (Nxumalo, 2018). *Recognizing* involves critiquing status quo socioecological relations and injustices and reckoning with new understandings of the world and with one's roles and responsibilities. While traditional tools of science education such as analyzing quantitative data and using scientific models may support recognition, personal, familial, and cultural stories of place facilitate contextualizing socioecological issues and histories and critical introspection (Reigh et al., 2022). Finally, *envisioning* entails speculating about possible futures toward collective thriving. Importantly, this speculation is grounded in the critical consciousness developed through recognizing (c.f. Garcia & Mirra, 2023). I operationalize this framework through a critical place-based science summer camp and ask: *What does it look, sound, and feel like when youth pay attention to and recognize (human and more-than-human) stories of a place, and how and what futures do they envision for the place? What resources and experiences do youth draw on to pay attention to and recognize these stories and envision these futures? What tensions arise in their development of socioecological care?*

Methods

This dissertation was conducted within a larger research project focused on youth's science identity play through critical place-based learning and digital storytelling via podcasting, zine-making, and augmented reality. The context was a nine-day science summer camp focused on socioecological issues around a local creek and watershed. 29 youth from two middle schools within the watershed were recruited to participate. The aforementioned framework informed the design of camp activities. I collected field notes, video of most activities, camper artifacts, and mid- and post-camp interviews. Ongoing data analysis includes deductive and inductive coding, and reflective memo writing to qualitatively analyze artifacts, interview transcripts, and select video

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content logs. Additionally, I explore in-the-moment complexities and tensions in care via interaction analysis (Jordan & Henderson, 1995).

Preliminary findings and expected contributions

Preliminary analysis reveals complexities and contradictions in the ways youth pay attention to the more-than-human world. For example, youth slip between objectifying and acknowledging the personhood and relationality of more than humans. These oscillations are spurred by interactions with peers and instructors (e.g. picking up a macroinvertebrate and playfully chasing a friend to incite a laugh/scream, referring to more-than-humans as "brothers" following an instructor's modeling); engagement with scientific tools (e.g. disturbing macroinvertebrates for the sake of observation with nets and trays); curricular design (e.g. noting water's central role in supporting other more than humans through an ecological modeling activity); and discourses and practices learned in other spaces (e.g. a family practice of catching fish). Data also reveals countercurrents toward recognizing fraught socioecological histories and power relations against a current of individualistic thinking. For example, in several zines, youth highlight the impact of policies that harm more-than-human beings, yet youth also repeatedly emphasize individuals not littering or picking up litter as *the* way to care for the creek. Finally, preliminary analysis highlights disruptive beginnings toward envisioning collective thriving, despite the pull of binary and zero-sum thinking that puts more-than-human and human well-being in opposition. For example, several campers envisioned entwined human/natural spaces and well-being in a civic redesign activity, e.g. apartments with green roofs and rain gardens. Yet, some students questioned whether it was possible to provide for human wants and needs without harming other beings.

I anticipate this dissertation will offer theoretical and practical contributions. My framework of speculative science education toward socioecological care synthesizes a broad body of literature to offer a theoretical lens for understanding the development of socioecological care in science learning settings. Furthermore, by examining contradictions and tensions in the practice of care, I will offer insight into the complexities of socioecological care, which is inherently messy and fraught. Drawing attention to the various social, cultural, material, and curricular resources youth leverage in moments when care, or contradictions and tensions around care, arise will also yield implications for the design of science learning environments to foster socioecological care.

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