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Designing Justice-Centered and Intersectional Environmental and Climate Learning Across a Professional Network

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Abstract

Designing Justice-Centered and Intersectional Environmental and Climate Learning Across a Professional Network

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In our current socio-ecological and political realities, educational systems must be transformed to align with ongoing social, environmental, and climate justice movements. In particular, these movement spaces offer guiding principles regarding the interconnectedness of oppressive structures and the possibilities of moving toward more just and thriving futures (e.g., Murdock, 2020; Rhodes, 2022; L. Thomas, 2022). In this dissertation, I draw upon sociopolitical learning theories to explore how educators, educational leaders, and other adult allies can work across scales to support emancipatory learning and collective action. This research is situated within ClimeTime, a statewide initiative to strengthen climate education through the design of professional learning and open-access resources by educational leaders located across different institutional contexts. Leveraging critical qualitative methods, including critical ethnography (Madison, 2005) and critical design ethnography (Barab et al., 2004), I weave together stories of educational leaders' personal justice-related learning journeys as well as their engagement in the collaborative efforts of the professional network. These accounts reveal how rich histories of intentional, lifelong learning shape their justice-centered commitments and enactments. In addition, I provide in-depth

narratives from two ClimeTime projects: the STEM Storylines (project-based, action-centered, and transdisciplinary curricular resources for elementary learners) and the Climate Justice League (a professional learning community supporting teachers to incorporate social justice connections in their science classrooms). These case studies demonstrate the importance of critically attuned and relational professional support structures to nurture teachers' power as facilitators of liberatory learning experiences and community-rooted changemakers. Through sharing these stories, I also highlight how collective sense-making, dialogue and storytelling, and cross-pollination within sustained network spaces like ClimeTime are needed to disrupt oppressive logics within educational systems and move toward more intersectionally just possibilities. In these ways, designing learning for socio-ecological well-being requires multi-level and multi-sector transformations and the cultivation of holistic ecosystems of support and action.

Table of Contents

Chapter 1: Introduction……………………………………………………………………………………..1

Intersectional Approaches to Move Toward Social, Environmental, and Climate Justice………...4

Reimagining and Redesigning Educational Systems for Intersectional Justice…………………...9

Study Context……………………………………………………………………………………..11

Entering Into Theoretical Conversations…………………………………………………………16

Navigating Methodological Landscapes………………………………………………………….19

Research Collaborators…………………………………………………………………………...22

Data Gathering……………………………………………………………………………………24

Self-Nominated Network Members……………………………………………………...24

Case Study Collaborators………………………………………………………………...26

Secondary Data Sources………………………………………………………………….28

Data Analysis……………………………………………………………………………………..31

Analytic Memoing………………………………………………………………………..32

Content Memoing………………………………………………………………………...33

Thematic Memoing………………………………………………………………………33

Selective Transcription and Coding……………………………………………………...33

Methodological Memoing………………………………………………………………..34

Co-Analysis and Member Checking……………………………………………………..34

Positionality and Relationality……………………………………………………………………35

Overview of Chapters……………………………………………………………………………37

First Theoretical Interlude…………………………………………………………………………41

Onto-Epistemic Heterogeneity……………………………………………………………………42

Axiological Restorying and Axiological Heteroglossia…………………………………………..43

Desettling Settled Expectations…………………………………………………………...…44

Counter-Storytelling as Methodology……………………………………………………………47

Chapter 2: Counter-Storytelling to Disrupt Dominant Discourses of Developmental Appropriateness……..……………………………………………………………………………………...51

Tensions of “Developmental Appropriateness” in Environmental and Climate Learning……….51

Tension Between Focusing on Strengths Versus Problems, and Care Versus Action……54

Tension Between Individual Responsibility Versus the Need for Systemic Changes…...56

Tension Between Highlighting Local Versus Global Issues……………………………..58

Echoes of These Tensions in Systems of Environmental and Climate Education……….61

Counter-Storytelling to Desettle the Settled Expectations of Appropriateness…………………..66

Counter-Storytelling Against the Onto-Epistemic Narrowness and Whiteness of Developmental Appropriateness Discourses…………………………………………….67

Counter-Storytelling Against Racialized Innocence and Invisibilization……………….72

Counter-Storytelling Against Intergenerational Privilege and Inequity…………………79

Moving Beyond the Tensions and Binaries of Developmental Progression Logics…………...…84

Centering Non-Innocent Caring Relationships and Practices……………………………………86

Chapter 3: Designing Intersectionally Just and Justice-Centered Environmental and Climate Learning with Elementary Learners………………………………………………………….………………...91

Counter-Storytelling Against Deficit Logic About Young Learners in Educational Systems……95

Naming how Deficit Logic Prevents Equitable Access to Intellectually Challenging and Meaningful Science Learning Experiences…………………………………………….....96

Designing Standards-Aligned Science Learning in the STEM Storylines……………..100

Engaging Authentically with Real-World Phenomena…………………………………101

Transforming Power in Science Learning by Centering Learner Voice, Choice, and Agency…………………………………………………………………….……………104

Honoring Learners’ Existing and Growing Expertise Through Shared Sense-Making..107

Fostering Learners’ Identities as Scientific Thinkers and Doers………………………110

Counter-Storytelling Against Whiteness and Coloniality in Environmental and Climate

Education……………………………………………………………………………………..110

Naming Onto-Epistemic Supremacy in Environmental and Climate Learning………...112

Remembering and Honoring Ancestral Ecological Relationships and Practices……….113

Troubling Epistemic Normativity by Centering Heterogeneity and Pluralism…………115

Naming Whiteness and White Saviorism in Environmental and Climate Learning……119

Learning from Global Majority Expertise, Perspectives, and Leadership from a Stance of Humility…………………………………………………………………………..……..122

Counter-Storytelling Against Ageism in Environmental and Climate Learning………………..125

Naming How Ageism and Adult-Centrism Constrain Environmental and Climate Learning………………………………..……………………………………..125

Making Visible Youth Leadership and Science for Collective Uplift………………..…127

Strengthening Learners' Critical Awareness and Sociopolitical Consciousness……….130

Supporting Learners to Recognize Their Political Agency as Changemakers…………132

Intersectionally Just and Justice-Centered Learning for Possible Socio-Ecological Futures…...134

Second Theoretical Interlude……………………………………..…………………………………..136

Sociopolitical Consciousness……………………………..…………………………………..137

Political Clarity………………..…………………………..…………………………………138

Role Remediation……………..…………………………..…………………………………..142

Chapter 4: Pathways, Processes, and Practices of Political Clarity..………………...…………………..144

Histories of Developing Political Clarity Through Learning Experiences and Relationships….147

Moments of Exposure and Dissonance as Catalysts of Political Clarity……………….147

Seeing (In)justices in Local and Personal Contexts as a Source of Political Clarity…..161

Relationalities and Responsibilities as the Roots of Political Clarity…………………..167

Deepening of Political Clarity and Translation into Multifaceted Action………………………176

Political Clarity and Transformative Agency Within Professional Communities of Practice…..183

Chapter 5: Critical and Relational Change-Making with Teachers..………………...…………………...196

Iterative Design of Climate Justice League Learning Experiences…………..……….……..198

Practicing a Collaborative Stance and Centering Global Majority and Youth Expertise……….207

Designing for Relationality and Role Remediation in Justice-Focused Professional Learning...212

Responsiveness and Long-Term Relationship-Building with Educators……………….213

Positioning Educators as Expert Collaborators within a Shared Leadership Model…...218

Building Solidarity in Navigating Complexities of Transformative Changemaking…...225

Liberatory Action and Changemaking Within and Beyond the Classroom……………………..230

Chapter 6: Concluding Thoughts and Invitations…………...……..…………...………………………..238

References………………...………………...………………...………………...………………………..243

Appendix A: Protocol for the First Phenomenological Interview: Reflecting on the Past………………272

Appendix B: Protocol for Second Phenomenological Interview: Describing the Present……….……274

Appendix C: Protocol for Third Phenomenological Interview: Dreaming the Future………..…….……277

List of Figures

Figure 1: Map of ClimeTime Organizational Partners Across Washington State…………………………12

Figure 2: Conceptual Constellation for Chapters 2 and 3…………………………………………………41

Figure 3: Three Forms of Gaslighting Resulting from Developmental Appropriateness Discourses and Practices………………………………………………..……………………………………………..67

Figure 4: Conceptual Constellation for Chapters 4 and 5……………………………………….……137

Figure 5: Map of Climate Justice League Cohorts..……………………………………..…………..191

List of Tables

Table 1: Overview of Data Gathering Activities in the 2020-21 Academic Year…………………………30

Table 2: Desettling Settled Expectations Through Curricular Counter-Stories………………………….135

Table 3: Timeline of Climate Justice League Activities 2019-20……………………………………..199

Table 4: Timeline of Climate Justice League Activities 2020-21 (Southwest Cohort)…………………..201

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Dedication

To the future generations, to the ancestors, and to all of us learning to be good future ancestors.

CHAPTER 1: INTRODUCTION

Given the complex interwoven factors, processes, and effects of shifting ecological systems, lifelong learning across settings plays a critical role in our collective ability to respond to these changes and work toward environmental and climate justice. In order to design learning pathways that contribute to the wellbeing of human and more-than-human communities, it is crucial to recognize and start from the interconnected nature of systems of oppression, including socio-ecological, socio-political, economic, racial, and cultural injustices. Through dismantling oppressive structures and cultivating liberatory possibilities, transdisciplinary learning can strengthen and sustain systems of care, justice, loving relationality, and interdependent thriving.

Long histories of community-based movements offer rich conceptualizations and examples of praxis that can inform educators' efforts to work toward socio-ecological and sociopolitical wellbeing as interrelated justice projects. Community-rooted environmental work emphasizes the intersections between white supremacy, (settler) colonialism[1], and socio-ecological harm as well as envisioning more just possibilities for marginalized human and more-than-human communities. For decades, Black, Indigenous, Latinx, Asian, and Pacific Islander communities[2] in the U.S. have engaged in grassroots organizing to raise awareness of and address *environmental racism*, including the uneven enforcement of environmental

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[1] Colonialism is an exploitative process in which a colonial power exerts economic, political, and often military influence in another country. As a distinct form of colonialism, settler colonialism is a process (which is an ongoing structure, not solely a historical event, in settler colonial states like the U.S.) in which the settler-colonial power aims to eliminate and replace sovereign peoples with settlers as permanent, "rightful" inhabitants (Wolfe, 2006).

[2] Across the chapters of this text, I use a variety of terms to refer to racialized identities. Following Paris (2021a), I often name "Black, Indigenous, Latinx, Asian, and Pacific Islander" communities, although these identities can of course overlap. Naming these specific racialized identities is intended to honor the unique histories, experiences of oppression, and liberatory resistance practices associated with these communities. I also sometimes refer to "people of color," "students of color," and "communities of color," political terms that convey a commitment to cross-racial solidarity and collective action (Paris, 2021a). I tend to use this terminology to align with the language used by other scholars and by participants when I quote or otherwise refer to their ideas. Finally, I use the terms "people of the global majority" and "global majority communities" to emphasize that Black, Indigenous, Latinx, Asian, and Pacific Islander peoples are a numeric majority, globally speaking, rather than racial "minorities" (Croft et al., 2015; Souto-Manning & Rabadi-Raol, 2018). The language of "global majority" adopts an explicitly asset-based perspective that refuses to be defined in relation to whiteness (Lim, 2020). Similar to "people of color," the term unites Black, Indigenous, Latinx, Asian, and Pacific Islander peoples against white supremacy, including across transnational contexts (Encompass, 2019; Lim, 2020). However, like "people of color," the political solidarity of the term "global majority" can also elide differences between racialized communities.

protections and the disproportionate impacts of toxic pollution in their neighborhoods (Bullard, 1990, 1994; First National People of Color Environmental Leadership Summit, 1991; L. Thomas, 2022). As just one example, Hazel M. Johnson was a Black environmental justice leader who founded and led an organization called People for Community Recovery to resist unjust siting practices in her neighborhood of Chicago (L. Thomas, 2022). Johnson's broader movement-building efforts in addition to her local organizing work earned her the title of "Mother of the Environmental Justice Movement" (Child, 2014).

The specific language of *environmental justice* (EJ) first emerged within the U.S. from the work of African American civil rights leaders, but can be leveraged to describe activism and liberation movements across local, national, and transnational contexts (Murdock, 2020). We can look to the Delano Grape Boycott of the 1960s, for instance, as an expression of cross-racial solidarity between Filipino and Mexican farmworkers for the interconnected aims of labor rights and environmental health (Abbott, 2016). An EJ lens can also be used to critically analyze and resist the outsourcing of labor exploitation, human rights violations, and ecological damage to Global South countries for the benefit of rampant Global North consumerism (Wang, 2016; Patel, 2019). In addition, the framework of EJ must be held in conversation with Indigenous sovereignty and stewardship of lands and waters since time immemorial. Gilio-Whitaker (2019) advocates for an indigenized environmental justice that addresses histories of settler-colonial dispossession and Indigenous resistance and resurgence. Similarly, McGregor et al. (2020) offer a definition of Indigenous environmental justice that centers Indigenous ways of knowing and being, including relationalities with more-than-humans as agential beings.

Climate activism and articulations of *climate justice* (CJ) are closely informed by these long histories of environmental justice organizing, including principles of highlighting disparate impacts, uplifting marginalized voices, and sustaining community wellbeing, resilience, and leadership (Bullard et al., 2016; International Climate Justice Network, 2002; Rhodes, 2022; Schlosberg & Collins, 2014).

Climate justice emphasizes the realities experienced by *frontline communities*[3] within the U.S and in the Global South, including more severe climate change impacts that are layered onto existing inequities and vulnerabilities — despite their significantly lower contributions to the systems of globalized extractive capitalism responsible for climate change (Congressional Black Caucus Foundation & Redefining Progress, 2004; Robinson, 2018). Activists advocate for policy strategies that directly confront and heal these injustices, and for policymaking processes that center the participation of those who are most impacted. For example, scholar-activists like Dr. Olúfémi O. Táíwò demonstrate how climate change both emerges from and reinscribes global power imbalances, thus demanding tangible forms of reparations rather than neocolonial "solutions" from Global North countries (Táíwò, 2021). The Climate Justice Alliance, a coalitional organization grounded in environmental justice movements, works toward a *just transition* from extractive economies to regenerative economies that support healthy, democratic, self-determined, and thriving communities (Climate Justice Alliance, n.d., 2022). Black, Indigenous, Latinx, Asian, and Pacific Islander communities have been at the forefront of these resistance and liberation efforts (Asian Pacific Environmental Network, n.d.; Indigenous Environmental Network & Oil Change International, 2021; NAACP, n.d.). Although environmental justice and climate justice movements have distinct focuses, they are closely related and share common principles; as such, I will often refer to the two together in this text.

In recent years, a transnational youth climate justice movement has emerged, encompassing the work of many youth-led organizations such as Zero Hour, Sunrise Revolution, Earth Uprising, International Indigenous Youth Council, and Fridays For Future. Youth leaders in these organizations leverage a variety of strategies to advocate for urgent climate response, including strikes, marches, sit-ins, art-making, legislative lobbying, multimedia outreach, and legal battles (Margolin, 2020). Through these forms of grassroots organizing, youth activists simultaneously call upon adults to address the climate

[3] Frontline communities refer to communities who are most immediately and severely impacted by environmental and climate challenges (e.g., toxic dumping, air pollution, sea level rise). These often include Black, Indigenous, Latinx, Asian, and Pacific Islander communities, immigrant communities, low-income communities, among others.

emergency and engage in direct action to catalyze the socio-ecological transformation that many adults are unwilling to commit to (Bastida, 2020; Prakash, 2020; Villaseñor, 2020). Many of these youth climate organizations are led by Black, Indigenous, Latinx, Asian, and Pacific Islander youth, queer youth, and low-income youth. Their critical analyses and approaches are attuned to interconnected forms of oppression, the importance of identity and positionality, and the need for coalitional practices. These forms of youth activism are a powerful invitation for caregivers and educators to act as adult allies and work in solidarity with young people to build the radical futures they are envisioning and creating. More generally, these perspectives from environmental and climate justice movement spaces can guide educators and educational leaders in centering justice within learning experiences and broadening their socio-ecological and pedagogical commitments to include decolonial, abolitionist, and anti-racist dimensions.

Intersectional Approaches to Move Toward Social, Environmental, and Climate Justice

In many ways, these justice frameworks resonate with the principles of *intersectionality theory*, which emerged from Black feminist thought and praxis beginning in the 1960s and 1970s. Black women were marginalized within civil rights and racial justice movements, which were dominated by men, as well as within mainstream feminism, which was dominated by white[4] middle-class women and their concerns. In response, they cultivated their own political spaces, including organizations like the Third World Women's Alliance and the Combahee River Collective, that addressed their specific experiences shaped by racial, gender, class, and other social identity markers and foregrounded the necessity of

[4] In this text, I capitalize the names of racial groups (e.g., Black, Asian) to honor the collective cultural, experiential, intellectual, and political affiliations of communities who choose to identify with these designations (though the communities are of course not monolithic). However, I use lowercase when referring to white individuals as well as societal structures like whiteness and white supremacy. I have chosen not to capitalize "white" because there is a lack of coherent shared affiliation defining the group identity beyond the oppressive forces of white supremacy (de la Cretaz, 2020). In addition, the capitalized "White" identity is often used by white supremacists as part of their advocacy for white domination. This stylization also signals my commitment to the political project of decentering whiteness in and through education. However, there is active dialogue about this language choice among journalists and scholars, and I also appreciate the arguments in favor of capitalization, including the need to highlight the social construction of white racial identity, disrupt the neutrality and normativity of whiteness, and enact accountability for white individuals and institutions to dismantle white supremacy (Craven, 2020; Painter, 2020). I intend to continue learning about and reflecting on this stylistic-political choice.

liberation across all of these dimensions. Black feminist scholar-activists generated revolutionary theories of how systems of oppression operate simultaneously and inseparably, and how social movements cannot truly embrace justice while invisibilizing these realities (Combahee River Collective, 1977; A. Y. Davis, 1983, 2016; hooks, 1981, 1984). Building with these theorizations as well as critical legal scholarship, Dr. Kimberlé Crenshaw (1989, 1991) defined *intersectionality* in critiquing how courts failed to protect Black women because they operated under limited, one-dimensional understandings of discrimination. Utilizing an intersectional lens is crucial for recognizing the unique experiences of Black women, which are distinct from those of white women and Black men. Systems of oppression are interlocking and overlapping, and cannot be considered in isolation. Since Crenshaw's initial conceptualization, the framework of intersectionality has been leveraged to analyze the experiences of other racialized groups as well as other politically marginalized communities. Through the work of many scholars and activists, it has also expanded to address numerous societal structures, issues and disciplines, and transnational contexts (Carbado et al., 2013).

Intersectional analyses are critically important in environmental and climate movements in order to reveal and heal the violent ideologies that underlie harms imposed on human and more-than-human communities and effectively work toward socio-ecological liberation. Second-wave white feminists were unable to actualize their aims of social transformation because they excluded those who were most impacted by cisheteropatriarchy and intersecting systems. Similarly, leaders of mainstream environmental and climate action have historically failed to address how their initiatives relate to racial justice, decolonization, resistance to imperialism and global capitalism, and other forms of anti-oppressive work. This limited scope of engagement alienates people of the global majority and constrains the relevance and impact of mainstream environmental and climate advocacy. Intersectional commitments are needed to move toward sociopolitical, environmental, and climate justice as intimately interwoven projects.

This intersectional lens is especially essential given how mainstream environmentalism in the U.S. has historically been deeply entangled with white supremacy, cisheteropatriarchy, and settler

colonialism. For example, settlers constructed romanticized environmental imaginaries that privileged[5] whiteness and toxic masculinity and valorized violence against Indigenous peoples (Oluo, 2020). Colonial logics of "empty" "wilderness" sought to erase the presence of Indigenous sovereignty and stewardship since time immemorial in order to justify land theft in the settler-colonial project (Curnow & Helferty, 2018). Leading figures of the mainstream environmental movement, including John Muir and Theodore Roosevelt, espoused explicitly anti-Indigenous sentiments (NoiseCat, 2019). So-called protection and preservation of public lands within the U.S., beginning with the establishment of the first national parks in the late 1880s, has been inextricably tied to the dispossession of Indigenous communities (Whyte, 2018d). These sanctuaries were intended for use by upper-class white men who wanted a respite from urban life, and systematically excluded or segregated people of the global majority for many decades. These racist and colonial histories of human-nature separation, exclusion, displacement, and genocide influence notions of belonging and participation in current-day environmental discourse and activities. When mainstream environmentalism grew in the 1970s, marked by mass mobilization on the first Earth Day, it was a majority-white movement that largely invisibilized Black, Indigenous, Latinx, Asian, and Pacific Islander peoples and their activism related to the environmental, economic, and political health and dignity of their communities (L. Thomas, 2022). Without critically accounting for these social and political dimensions, mainstream environmentalism will persist in its overwhelming whiteness and perpetuation of harm against global majority communities.

As it stands, societal structures of white supremacy, cisheteropatriarchy, and settler colonialism continue to shape environmental and climate spaces, even within efforts that are committed to justice. In a recent collaborative partnership between Indigenous and non-Indigenous scientists, for example, decision-making authority and recognition of labor were unevenly distributed across participants based on gender identity, age, and Indigeneity (Dhillon, 2020). Despite declarations and practices of attempted

[5] I use the term "privilege" in this text to refer to systemic, unearned, and inherited advantages related to one or more dimensions of identity. I leverage this language to connect my work with broader scholarly conversations about the operation of power dynamics in learning environments (e.g., Esmonde & Booker, 2017).

solidarity within movement spaces, white settlers and settlers of color often unintentionally recenter whiteness and white privilege even as they work to foreground Indigenous sovereignty and environmental justice (Curnow & Helferty, 2018). Black, Indigenous, Latinx, Asian, and Pacific Islander community organizers continue to be sidelined in many policy-making processes and mainstream environmental movements in the U.S. (NoiseCat, 2019). These interpersonal and structural power dynamics reinscribe settler-colonialism and white supremacy and give rise to false environmental and climate "solutions" that fall short of truly transformative justice.

Failure to acknowledge intersecting harms and ongoing marginalization results in incomplete analyses and inadequate, misguided strategies. In many cases, proposed actions are "false solutions" that rely on technocratic and neoliberal levers and leave underlying systems of oppression unaddressed (Climate Justice Alliance, 2022). Environmental and climate rhetoric is often grounded in whitewashed understandings of history and projected future possibilities (Mitchell & Chaudhury, 2020). For example, some Indigenous communities understand climate change not as an unprecedented global crisis but as a threat contextualized within historical and ongoing settler-colonial violence (Callison, 2014; McGregor et al., 2020; Simpson, 2017). Climate change disparately harms Indigenous communities and directly threatens Indigenous lifeways, homelands, and wellbeing (Jantarasami et al., 2018). As with other attempts at Indigenous erasure and genocide, ecological injustices are a form of domination that reinscribes settler claims to stolen land and undermines Indigenous systems of relationality and *collective continuance* (Liboiron, 2021; Whyte, 2018b, 2018c). Many Indigenous scholars articulate how pervasive patterns of domination underlie both planetary damage and sociopolitical injustices. Specifically, capitalism, colonialism, and white supremacy are rooted in *human supremacist* logics that dichotomize and objectify human-nature relations, claim humans as exceptional, maintain the hierarchical positioning of Euro-Western knowledge systems over Indigenous and other non-dominant[6] ways of knowing, and

[6] I use a variety of terms, including "non-dominant," "marginalized," and peoples experiencing "systems of oppression," to indicate that many learners and communities encounter inequitable and unjust power dynamics within educational systems and society more broadly (cf. K. D. Gutiérrez, 2008). In upcoming chapters, I share in greater depth about these issues and possible entry points to dismantling these forms of dominance, marginalization, and oppression.

justify the continued extraction of "natural resources" for economic gain (Bang, 2017; Two Feathers NAFS, 2020). In these ways, the relational and sociopolitical harms perpetuated by governments and institutions are inseparable from ecological harms (Whyte, 2020).

The recent movement of *intersectional environmentalism* (IE), which draws upon Black feminist theorizations of intersectionality and previous EJ and CJ efforts, provides a framework to confront the historical and current whiteness of mainstream environmentalism (K. L. Gomez, 2020; L. Thomas, 2022). IE argues for "the protection of both people and the planet" and emphasizes that "social and environmental justice are intertwined and that environmental advocacy that disregards this connection is harmful and incomplete" (L. Thomas, 2022, p. 31). This movement, led by a coalition of Black, Indigenous, Latinx, Asian, and Pacific Islander young people, highlights how intersectional analyses and strategies are needed in order to heal from past violence and move toward true well-being and thriving. Thomas (2022) proposes IE as a set of guiding principles to support our collective journey toward dreams of social, environmental, and climate justice. Realizing these liberatory visions necessitates dismantling white supremacy, colonialism and settler-colonialism, imperialism, capitalism, ableism, cisheteropatriarchy, and all other interlocking systems of oppression.

IE involves recognizing how interrelated sociopolitical, environmental, and climate injustices disproportionately impact marginalized communities and lifting up the concerns of those who are most impacted. At the same time, intersectional environmentalist approaches include a commitment to centering global majority communities, including their particular histories, knowledges, practices, value systems, and forms of environmental action and leadership. Black, Indigenous, Latinx, Asian, and Pacific Islander communities have always sustained ecological relationships shaped by their social, cultural, and political experiences. For example, *kitchen gardening* has been developed by Asian diaspora families and communities in the U.S. as an adaptive response to harsh economic realities, enabling them to grow nourishing and familiar plants in order to collectively maintain their culturally significant foodways (Dao, 2019). Kitchen gardening is a source of deep ecological wisdom, including knowledge of plant health and

practices of saving and sharing heritage seeds within communities and across generations. These and other global majority ecological practices have been invisibilized within mainstream environmental discourses, which often claim that Black, Indigenous, Latinx, Asian, and Pacific Islander peoples "do not care about the environment." Recognizing the specificity of ecological relationships associated with different cultural and sociopolitical traditions is necessary for building coalitional movement spaces and cultivating solidarity within and across communities.

Honoring and amplifying marginalized communities and their knowledges, practices, and relationalities is crucial for moving toward justice for people and the planet. This focus is important in healing our relationships with lands and waters while and through participating in the caretaking, protection, and restoration of ecosystems (Kimmerer, 2013). Advocating for Indigenous sovereignty and leadership is especially critical, as evidenced by the strong presence of biodiversity and ecological wellbeing in lands managed by Indigenous communities worldwide (Garnett et al., 2018; ICCA Consortium, 2021; Schuster et al., 2019). Tangible actions such as returning private and public lands to tribal management are critical for ensuring the continuity and expansion of Indigenous stewardship and working toward healthy socio-ecological futures. In these ways, this dimension of IE also resonates with the need for complementary processes of decolonization *and* Indigenous resurgence in order to live in good relationship with the earth (Two Feathers NAFS, 2020). More generally, uplifting and learning from the leadership of global majority peoples is an essential dimension of working toward effective and just environmental and climate action (Johnson & Wilkinson, 2020).

Reimagining and Redesigning Educational Systems for Intersectional Justice

The intersectional environmentalism movement also highlights the important role of liberatory educational experiences in actualizing the aims of social, environmental, and climate justice. Justice-focused environmental and climate learning experiences that begin in the earliest years are needed to support young people's development of complex socio-ecological reasoning, ethical decision-making, and engagement with socio-ecological systems as multiscalar webs of interdependent relationships (Learning

in Places Collaborative, 2018). Supporting learners[7] to understand and respond to socio-ecological systems in historically and culturally situated ways is crucial for addressing interconnected justices within educational contexts. Although educators have developed and implemented a range of environmental and climate education strategies, transdisciplinary, transformative, and broadly coordinated approaches remain uncommon and undertheorized in formal educational systems (Kwauk, 2020). In order to deepen environmental and climate learning across settings, systematic support and infrastructure are needed to disrupt oppressive tendencies and cultivate emancipatory forms of education. In addition, building robust frameworks for foregrounding the lived realities of marginalized communities and their desired forms of justice within environmental and climate learning is critically important for collective dreaming toward more livable educational and socio-ecological realities. I use the phrase *intersectionally just* to describe learning experiences that actively attend to intersecting systems of harm and injustice, center the experiences and wellbeing of marginalized communities, and move toward just and thriving futures rooted in intersectional commitments.

Across the next chapters, I explore possibilities for transforming the full ecosystem of education in order to move toward intersectional justice. This includes, for example, offering ways to reimagine discourses and practices that unjustly constrain young people's engagement in meaningful learning opportunities. I weave together analyses of how educational leaders conceptualize justice, how their justice commitments shift and grow over time, and how these commitments are enacted within their environmental and climate education work. I share stories of how spaces for ongoing learning, relationship-building, cross-pollination, and mutual solidarity are critical for enabling both educators and educational leaders to engage in collective action. Systemic changes across these levels of educational systems are needed to equip and support educators to become changemakers and work toward sociopolitical, environmental, and climate justice in their local communities and globally.

[7] I frequently use the terms "students" and "teachers" throughout this text given that this research study is situated primarily within the formal educational system. However, I also often refer to these groups as "learners" and "educators" to indicate my belief that learning occurs expansively and across settings, not merely within formal schooling. These terms are also intended to recognize the presence of multidirectional shared learning, rather than solely a teacher-to-student delivery of information.

These narratives are especially necessary in the current context of an ever-escalating global climate crisis (IPCC, 2022). In recent years, a variety of policy and advocacy initiatives have emerged across the U.S. to reshape educational systems in response to socio-ecological challenges. For instance, in 2016, Portland Public Schools became the first public school district to pass a climate literacy and climate justice resolution, which resulted from sustained organizing by students, educators, parents, and community members (Bigelow, 2016). The policy requires schools to eliminate resource materials that contain false or misleading information about climate change, to provide teachers with professional development related to climate education, and to create and implement a grassroots climate justice curriculum (350PDX, 2016). In 2020, New Jersey revised its state educational standards and became the first state to mandate teaching about climate change across all subject areas and all grade levels in public schools (Mosley, 2021; NJDOE, 2020). In addition, recent research by the Aspen Institute outlines holistic opportunities for the education sector to take on mitigation, adaptation, teaching and learning, and equity-centered responsibilities in addressing climate change (K12 Climate Action Commission, 2021). Efforts such as these prompt a need for new resources, professional supports, research-based understandings, and other infrastructure to support learning that contributes to intersectional justice. At the same time, the increase in racialized right-wing pushback against liberatory social movements heightens the vulnerability of educators and educational leaders who are doing justice work and the urgency of developing systems to catalyze, nurture, and protect these forms of emancipatory praxis.

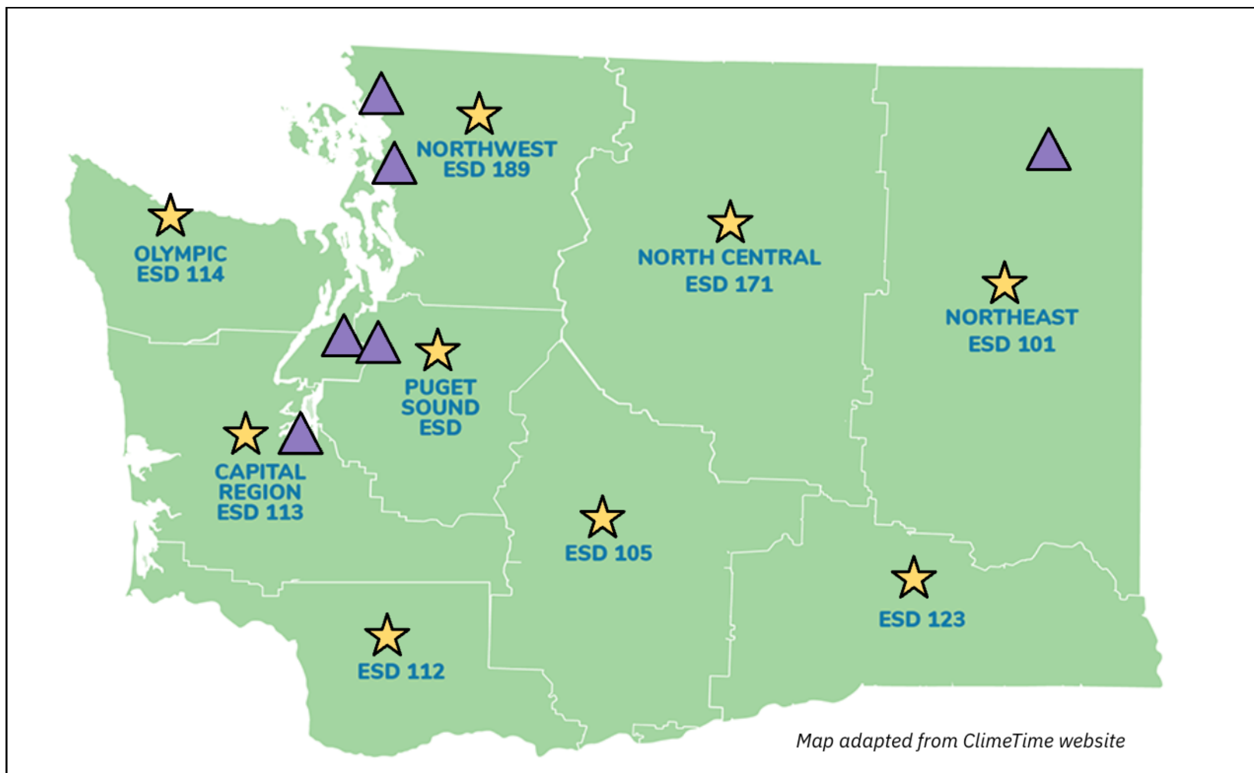
Study Context

The ClimeTime network in Washington State is one current effort to systematically strengthen equitable and justice-focused climate science learning through designing professional learning opportunities for PK-12 teachers and building a statewide *networked improvement community* (Bryk et al., 2011). The ClimeTime initiative emerged from a legislative budget proviso approved in Washington State in the spring of 2018 to "build capacity of science teachers in all regions to help youth understand climate science and promote a thriving and sustainable environment" (ClimeTime, 2019). The proviso

designated funds to support teachers in Next Generation Science Standards (NGSS) and climate science capacity-building via professional learning activities facilitated by leaders at educational service districts (ESDs) and community-based organizations[8] (CBOs) statewide (see *Figure 1* for a map of ESD and CBO partners in 2020-21). These professional learning experiences aim to strengthen teachers' science content knowledge, pedagogical approaches, connections to climate-related resources and experts, and confidence to address climate topics with learners. Many projects emphasize authentic scientific practices, locally relevant climate phenomena, and multiple ways of knowing. ESD and CBO partners also engage in related design activities, including the creation of curricula, instructional resources, and assessment tools.

Figure 1

Map of ClimeTime Organizational Partners Across Washington State



[8] Although the ClimeTime partners situated within non-formal educational contexts are described by the Office of Superintendent of Public Instruction as "community-based organizations," it is important to note that several of the organizations work across many communities within their regions as well as statewide. In some cases, these CBOs collaborate with locally rooted partner organizations to support teachers in more place-centered ways.

Note. ESD partners are represented with yellow stars and CBO partners are represented with purple triangles. CBOs often engage in project work across the state, but the symbols are located in the places where they are primarily based. Some additional organizations were involved in previous or more recent years, but this map represents only the organizations that were members of the network in 2020-21, the year of data collection.

Over the last several years, ClimeTime has become a robust network and community of practice that connects the implementation organizations and engages educational leaders in shared learning. Members of the network convene regularly throughout the year to deepen their knowledge, discuss their practices and insights, and cultivate collaborative relationships. The ClimeTime community is supported by a leadership team consisting of staff members from the Office of Superintendent of Public Instruction, the Association of Educational Service Districts, and the University of Washington Institute of Science + Math Education. Network activities are guided by several core principles: equity and justice, system coherence, infrastructuring, equitable classroom pedagogy, and multiple ways of learning (Morrison & Bell, 2019). As I will describe in following chapters, this climate science-focused professional network enables collaboration and innovation within and across geographically, culturally, socioeconomically, and sociopolitically heterogeneous contexts. Through iterative co-design of and engagement in shared learning experiences, network members aim to strengthen their implementation of equity- and justice-focused approaches to NGSS and climate science learning.

Although climate education efforts are gaining momentum nationwide, there is not yet substantial research about how multi-institutional systems of climate science learning can be created and nurtured (Henderson et al., 2017). In-depth examinations of such initiatives are needed to strengthen innovative practices and principles for cross-sector climate learning systems. As the first state-implemented, systematic, networked professional development initiative in the U.S. centered on climate science, ClimeTime is a powerful case study with rich insights for educators and educational leaders nationwide. The experiences of educational leaders within the ClimeTime network, especially their perspectives on challenges, opportunities, and strategies, can inform the design and implementation of similar educational networks and infrastructure in other states. Sustained research is needed to understand how educational

leaders conceptualize and enact justice-focused climate learning and how a state-level professional community supports cross-pollination and liberatory practice over time. The diversity of organizational, geographic, and sociopolitical contexts represented by members of the network illuminates the deeply place-based nature of climate phenomena, discourses, and associated learning priorities. The purpose of the present research is to investigate how network participants who are located across different institutional and geographic settings and working with different cultural communities engage in collaborative design activities using complex framings of justice to foster transformative change through PK-12 climate science learning.

In addition to analyzing the activities of the network as a whole, I also developed in-depth understandings of two case study projects within ClimeTime: the Climate Justice League and STEM Storylines. These ClimeTime projects are local educational innovations, situated within the broader landscape of the statewide network, that approach climate learning through lenses of emancipatory pedagogical practices and the intersections of environmental, climate, and social justice. The Climate Justice League is a professional learning community for K-12 educators facilitated by ESD 112 in partnership with EarthGen (formerly Washington Green Schools), educators, researchers, and leaders at grassroots environmental and climate justice organizations. The project was created in 2019-20 in response to teachers' desires for extended learning opportunities focused on the connections between social justice and science education. Over the course of several convenings, educators and facilitators collaborate to design, implement, and reflect on classroom activities that center just action and student agency. As a ClimeTime project that is explicitly focused on addressing justice issues in climate and environmental teaching and learning, the Climate Justice League is a rich case study for understanding justice-related learning pathways for educators and educational leaders. In particular, closely examining the Climate Justice League can reveal how justice-centered co-learning and co-design activities within the network support localized liberatory changemaking.

At the same time, the Climate Justice League is also a powerful example of how transformative

approaches spread through a professional community of practice. In the 2020-21 academic year, two other regional science coordinators in northwest Washington partnered with EarthGen to offer similar justice-centered professional learning communities adapted to their regions' unique needs and opportunities. Analysis of this case as Climate Justice League projects expand across the state can provide insight into how justice work in climate education can be supported at a systemic scale through shared learning, relationship-building, and cross-pollination of ideas and practices.

The second case study project is STEM Storylines[9], also developed in ESD 112. These elementary-level curriculum resources are co-designed with teachers and community partners, and are phenomena- and problem-based, action-focused, locally and globally relevant, and transdisciplinary. They support educators in attending to students' voice, agency, and emerging science-related identities. Importantly, the STEM Storylines developers engage deeply with feedback from educators to modify the design process and improve the usability of the Storyline structure and materials. One key dimension of this iterative process is pairing Storylines with professional learning experiences and scaffolded resources to build educator capacity throughout the region. By identifying specific barriers and creating targeted supports, project leaders are creating infrastructure to support equitable access to sustained environmental and climate learning. For these reasons, the STEM Storylines project is a strong case study for understanding challenges, opportunities, and capacity-building needed for environmental and climate education in early childhood and elementary classrooms.

Although there are many facets in the ClimeTime network activities, I focus on a few key strands in the following chapters. Engaging in intersectionally just environmental and climate education necessitates cultivating dynamic analyses of equity and justice concerns. As such, educational leaders' ideas, practices, ideological sensemaking, and personal learning journeys associated with sociopolitical, educational, ecological, and climate justice are especially crucial to understand. These narratives provide insight into the support and scaffolds needed to catalyze justice-related commitments in and through

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[9] This curriculum development effort is informed by the broader framing of Storylines as a design strategy in science education that focuses on authentic, coherent, student-centered inquiry (Reiser et al., 2021).

climate teaching and learning. Secondly, I investigate the role of trusting relationality and solidarity-building in supporting the justice-related learning and liberatory action of educators and educational leaders who are involved in ClimeTime efforts. Specifically, I highlight how justice commitments emerge, evolve, and spread through webs of relationships and accumulated shared learning experiences. Finally, I explore how ClimeTime network participants conceptualize and support early childhood and elementary students' engagement in justice-focused environmental and climate learning. Although this learning is lifelong, there are unique challenges, inequities, and opportunities that shape possibilities for transformative socio-ecological education with young learners. By sharing stories of educational leaders' emancipatory discourses and practices, I suggest ways to honor and uplift the intellectual and changemaking power of young people within our educational systems from an early age. Through learning with educational leaders in the network, this research aims to describe multiscalar capacity-building processes related to intersectionally just environmental and climate learning in order to deepen existing efforts and inform similar initiatives in other regions.

Entering Into Theoretical Conversations

In this research effort, I enter into conversation[10] with critical sociocultural and sociopolitical families of learning theories to analyze the discourse and activities of educational leaders within ClimeTime. *Sociocultural theories* highlight the socially and culturally situated nature of human cognition, development, and learning. These theoretical perspectives emerge from Vygotsky's (1978) descriptions of learning as a social process in which relational contexts enable and constrain possibilities.[11] Learning experiences, practices, and cognitive processes are mediated through and shaped by material and symbolic artifacts that carry significant histories (Kozulin, 1998; Lantolf, 2000). Within sociocultural perspectives, culture is conceptualized as an emergent phenomenon, created and

[10] Following a tweet by Dr. Django Paris (2021b), I describe this overview of theoretical influences as a "conversation" I am entering rather than a "framework" in order to indicate that I am engaged in an ever-evolving, non-predetermined process of connecting my thinking to the brilliant insights of other scholars.

[11] Although Vygotsky's theories have influenced the work of many scholars, they (and some of their intellectual successors) operate on assumptions of human-nature separation, human supremacy, anti-Indigeneity, and white superiority that are complicit with ongoing projects of colonialism and settler-colonialism (see Bang, 2017).

maintained through situated interactions. Learning is described as changes over time in forms of sense-making and participation in social activity (Rogoff, 2003). Many lines of scholarship have sprouted from this sociocultural foundation and emphasize different dimensions of socially embedded learning, such as everyday practices, object-oriented activity, and identity development (e.g., Banks et al., 2007; Engeström & Sannino, 2010; K. D. Gutiérrez & Rogoff, 2003; Lave & Wenger, 1991; Nasir & Hand, 2006; Nasir et al., 2006; Rogoff, 2014).

In the context of this study, sociocultural learning theories can offer insight into educational leaders' learning processes as they participate in the ClimeTime network and other climate education-related *communities of practice* (Wenger, 1998; Wenger et al., 2002). The sociocultural emphasis on multiscalar histories is well-suited to investigating shifts over time in educational leaders' values, beliefs, relationships, identities, and practices — for example, their ideas about intersectional justice and connections with educational systems — as well as changes in the communities and systems. At the same time, sociocultural perspectives align well with questions about how participants experience and engage in activity across multiple social and spatial contexts.

Sociocultural theories are conducive to analysis of how power disparities and social inequities operate in learning environments because they attend closely to context, histories, relationships, and forms of participation. Systems of oppression are often perpetuated through everyday interactions and through mediating artifacts that implicitly or explicitly exclude some learners and privilege others. Despite these resonances, analyses of power dynamics and connections between macro-level inequitable systems and micro-level learning activities have not been consistently integrated within sociocultural perspectives (Esmonde & Booker, 2017; Nasir & Hand, 2006). Esmonde and Booker (2017) suggest that the rich traditions of critical social theories such as critical pedagogies, queer theory, critical race theory, and settler-colonial theory can be leveraged to problematize and deepen sociocultural analyses and to design more liberatory learning spaces. In this research, I adopt these *critical sociocultural* lenses to analyze the learning and activities of educational leaders.

Similarly, scholars within the fields of learning sciences and science education have begun developing *sociopolitical theories* of learning that explicitly center issues of power in order to move toward justice for learners and communities with marginalized identities (Booker et al., 2014). Importantly, conceptualizations of justice related to learning spaces are dynamic, contested, and even contradictory — not predetermined (Tuck & Yang, 2018). In many learning environments, the positioning of dominant ways of knowing and being as superior to non-dominant knowledge systems is a particularly salient form of privilege and oppression. Failure to account for how power circulates in learning contexts leaves such sources of epistemic harm in place and falls short of describing the full range of practices, processes, and relations involved in learning and development (Bang, 2017). In contrast, sociopolitical analyses assume that historically accumulated power dynamics are always already present in spaces of learning and are institutionalized through normative discourses and structures (R. Gutiérrez, 2013; Learning in Places Collaborative, 2021; Philip & Azevedo, 2017). They explore lines of inquiry such as: Whose knowledge counts? What is the purpose of learning, and whose interests does it serve? How do value systems and entrenched assumptions show up in learning environments and experiences? How can we decolonize and reimagine education? Researchers using sociopolitical approaches articulate clear justice stances and work to transform educational systems by centering the agency, desires, and thriving of non-dominant communities (Philip et al., 2018).

A multitude of critical sociocultural and sociopolitical framings have been generated to describe liberatory, community-rooted, and affirming forms of science learning, including *rightful presence* (Calabrese Barton & Tan, 2020), *(w)holistic science pedagogy* (Patterson & Gray, 2019), and *expansive science learning* (Stromholt & Bell, 2018). In the next chapters, I draw heavily upon the concept of *justice-centered science pedagogy*, which structures learning around local and global justice-related issues that are salient in students' lives and positions learners as brilliant intellectuals, changemakers, and community leaders (Frost & Sanchez, 2020; Morales-Doyle, 2017). These ethical and political dimensions of science learning and the cultivation of "critical scientific capacity" are equally important

with young learners (N. R. Davis & Schaeffer, 2019). Justice-centered pedagogies involve intentional design of curricular content as well as pedagogical approaches to support transformative learning and social action. Attending to student experiences of learning — including questions of identity, positionality, emotionality, and felt responsibility — is also essential within these frameworks.

In summary, in this study I leveraged critical sociocultural theories and sociopolitical theories to design research protocols, gather data, and analyze themes regarding educational leaders' commitments, practices, and learning processes related to intersectional justice work in and through environmental and climate education. In the upcoming chapters, I intersperse theoretical interludes to introduce and describe specific concepts within these broad families of learning theories as they become relevant to my storytelling. I also weave in conceptual insights from closely related theoretical traditions, including critical race theory, critical pedagogies, and asset-based pedagogies. Informed by these theoretical lenses, my research approach is explicitly focused on issues of power, ideological change, and transforming oppressive socio-ecological and educational systems.

Navigating Methodological Landscapes

In this section, I describe the methodological landscapes I navigated[12] throughout the overlapping phases of my research effort. The overall research approach within the ClimeTime community is informed by *design-based implementation research* (Fishman et al., 2013) and *participatory design research* (Bang & Vossoughi, 2016). Design activities enacted by network collaborators include the creation, implementation, and refinement of equitable and justice-oriented curricular and instructional resources, professional learning experiences, formative assessments, and network convenings to support shared learning and cross-pollination. Through engagement in these collaborative design processes, members of the ClimeTime community continually strengthen their equity and justice commitments and practices.

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[12] Similar to the note on "theoretical conversations" above, I aim to disrupt the sense of static-ness and finality implied by the phrase "methodological framework" and clarify that my research journey was messy and open-ended, full of unanticipated twists and turns. Although some aspects of my research method aligned with what I initially conceptualized, others changed drastically in response to emergent needs, constraints, and opportunities.

The ClimeTime network is broadly framed within a *design-based implementation research* (DBIR; Fishman et al., 2013) approach that centers iterative co-design of learning engagements and system infrastructure following the *networked improvement community* model (Bryk et al., 2011). As a *research-practice partnership* (Coburn & Penuel, 2016), ClimeTime aims to build educational leaders' capacity to engage in equity- and justice-focused practices in their different contexts through close collaboration and expertise-sharing between researchers and practitioners. Consistent with DBIR principles, differently situated experts such as tribal education consultants, regional science coordinators working in formal education contexts, community-based organization leaders, education researchers, and state educational leaders all collectively identify and work to address *problems and opportunities in practice* related to educational equity and justice (P. Bell, 2019). As members of a state-level multi-sector network, participants are invested in the creation of curricular and instructional resources but also supports for professional learning and long-term, system-level innovations. Similarly, insights that emerge from research efforts will pertain not only to learner, family, and community experiences but also shifts in educational systems across scales and the development of relational and processual infrastructures needed to support lasting ideological and institutional changes.

Network activities are also informed by the practices and priorities of *participatory design research* (Bang & Vossoughi, 2016). In particular, approaches to collaborative design activities within ClimeTime are attuned to power dynamics and historicity. Processes of partnering, relationship-building, and shared learning within the network are considered a central focus of inquiry, iterative design, and theory-building. Creating and sustaining justice-focused changemaking across scales occurs through cultivating collective transformative agency and embracing the heterogeneity of local innovations. As such, the emphasis is on the spreading of liberatory praxis through "scaling method" within a networked community rather than replication of concrete artifacts (Bang & Vossoughi, 2016).

Within this broad methodological framing, I use a critical qualitative research design to explore the perspectives and practices of educational leaders in the ClimeTime community. Qualitative research is

distinguished from quantitative methods by an emphasis on meaning-making processes, an inductive approach to knowledge generation, and the researcher's direct activities as the primary form of data-gathering (Bhattacharya, 2017). Qualitative research operates from the stance that realities are dynamically and socially constructed rather than a fixed external entity that can be measured (Bhattacharya, 2017). My focus in this study is understanding educational leaders' conceptualizations of interconnected justice issues within environmental and climate education and how these ideas and practices shift over time through engagement in shared learning and action. An inductive research design enables me to describe themes that emerge directly from participants' sensemaking and lived experiences.

More specifically, I draw upon *critical ethnography* (Carspecken, 1996) and *critical design ethnography* (Barab et al., 2004) approaches to design specific methods of inquiry in order to understand the complexities of participants' justice-related learning, sensemaking, and enactments. Ethnography is typically characterized by its focus on social structures and cultural lifeways, immersive interaction with the study context and participants, and use of *thick description* to capture meaning (Bhattacharya, 2017; Geertz, 1973). In addition to these traditional qualities, critical ethnography emphasizes accountability for researchers' acts of interpretation and representation and works to generate socially just and emancipatory knowledge that "takes us beneath surface appearances, disrupts the status quo, and unsettles both neutrality and taken-for-granted assumptions" (Madison, 2005, p. 5). As with other critical approaches to research, critical ethnographers are concerned with identifying, dismantling, and transforming inequitable power dynamics and social injustices in order to imagine what "could be" (Carspecken, 1996; J. Thomas, 1993). Doing so requires attending to power relations within the field, broader society, and researcher-participant relationships. Critical ethnographic work includes engagement with research collaborators in dialogic interactions and continual reflexivity regarding the ethnographer's positionality and responsibilities (Madison, 2005). In the context of this study, a critical ethnographic approach involves centering practitioner expertise and decision-making, foregrounding participants' interests when

shaping research foci and scope, co-designing research protocols, emphasizing my role as a learner, and cultivating reciprocal knowledge-building relationships.

Research Collaborators

Collaborators in this study included members of implementation organizations, the ClimeTime leadership team, and educators and other participants involved with the network activities. Within qualitative research designs, sites and participants are selected using *purposeful sampling* to study cases that can provide rich, deep insights into the phenomena of interest (Merriam & Tisdell, 2016). For the present research study, all members of the ClimeTime leadership team and implementation organizations who are actively involved in the professional community were invited to participate. Although selection of study participants was primarily determined by participants' self-nomination and willingness to engage in research activities, I strived to ensure *maximum variation* (Patton, 2015) among participants with regard to institutional setting, geographic context, and background as an educator and educational leader.

In total, thirteen self-nominated network members participated as research collaborators. They represented multiple ESD as well as CBO partners from different regions across the state. The collaborators also held a variety of professional backgrounds, including experience in the formal educational system, non-formal and community-based education settings, field science research, and more. The group of participants was predominantly white and all non-Indigenous, and a majority identified as women. They held a variety of class backgrounds, ranging from low-income to upper middle class and generationally wealthy families; for some, these class identities have shifted throughout their lives. In addition to these race, gender, and class dimensions of positionality, participants highlighted other significant identities such as cisgender, queer, non-religious, graduate-educated, second-generation immigrant, parent, and environmental educator. In this text, I refer to all of these collaborators as educational leaders given their professional responsibilities of providing support to educators and students in different ways. Most participants shared that most of the educators they work with identify as white and many are women. A few mentioned that they work with teachers statewide, who have different

socioeconomic and educational backgrounds and are situated within diverse geographic contexts, including urban, suburban, and rural. The educational leaders who also work directly with students reported that these student populations are mixed in terms of racial, gender, and class identities. Self-nominated research collaborators are referred to with pseudonyms in this text in order to protect their privacy.

In order to balance breadth and depth of research findings, engagement with implementation partners from a variety of organizations was paired with case studies of particular projects of interest, as described above. For the in-depth case studies, I used *theoretical* and *critical case sampling* to identify collaborators and focal projects according to unique characteristics that were relevant to the focal areas of research (Merriam & Tisdell, 2016). These projects were located in ESD 112 but involved partners across multiple CBOs and ESDs in Washington State, both within and beyond ClimeTime. The case study collaborators in this research were Stacy Meyer, the Regional Science Coordinator in ESD 112, and Pranjali Upadhyay, the Integrated Curriculum Coordinator in ESD 112. Stacy, who identifies as a white woman, leads the development and facilitation of the Climate Justice League professional learning community in close partnership with Meredith Lohr at EarthGen (who also participated in the research as a self-nominated network member). Pranjali, who identifies as a woman of color of Asian Indian heritage, is the lead developer of the STEM Storylines curricular resources. Although they focus their energy on these respective projects (among other efforts at the ESD), Stacy and Pranjali frequently share ideas and collaborate, thus closely influencing each other's thinking and professional practice. As part of the case study research, I also engaged with groups of teachers who were involved in the two projects in different capacities — for example, educators who participated in the Climate Justice League or who co-designed and implemented STEM Storylines in their classrooms. Educational leaders, facilitators, and collaborative partners who were involved in these case study projects are referred to by their actual names, but all teachers who participated are described using pseudonyms.

Data Gathering

Data collection occurred primarily during the 2020-21 academic year, the third and final year of the first round of legislative proviso funding, although some activities began in spring of 2020 and extended into 2021-22. Given the COVID-19 pandemic, all data gathering activities took place online via the Zoom video conferencing platform. Qualitative research strategies of semi-structured interviewing, participant-observation, and artifact analysis were leveraged to address the research purposes. Collaborative qualitative methods, including co-design and co-analysis with network members, enabled nuanced descriptions and analyses of participants' practices, sensemaking, perspectives, and learning processes. Different data collection strategies were used with self-nominated network members and with case study collaborators in order to accomplish the complementary analytic aims of breadth and depth. In this section, I describe the primary data collection activities that took place with each set of participants, then outline secondary sources of data that added nuance and context to research findings across the study.

Self-Nominated Network Members

With the self-nominated members of the ClimeTime network, the primary data collection activities included initial group co-design sessions (September 2020), a one-on-one phenomenological interviewing series with each participant (September to November 2020), and group co-analysis sessions (December 2020). All of these conversations took place on Zoom and were recorded.

Co-design. In alignment with key dimensions of DBIR and critical ethnography approaches, I engaged with participants in co-design focus groups to shape the overall structure of research activities as well as the specific interview protocols. This collaborative process was crucial for centering practitioners' rich expertises in the designing of research. For example, participants hold salient experiences from their own project and organizational efforts that helped to highlight similar or contrasting themes across other educators' perspectives. At the same time, co-designing research foci and protocols was critical for foregrounding the problems and opportunities of practice that were of interest to participants. In addition

to making theoretical contributions to academic fields, this research aimed to generate knowledge that is of use for participants themselves as well as practitioners in other contexts.

Phenomenological interviews. In-depth *phenomenological interviewing* is an approach to research interviews that foregrounds participants' lived experiences and subjective sense-making in particular contexts (Seidman, 2013). Phenomenological interviewing consists of three semi-structured interviews that follow a specific sequence — first, a focused life history that establishes context for the phenomenon of interest; second, details of current experiences and circumstances; and third, reflection on the meaning of the experiences. In this study, engaging in multiple conversations over time enabled deeper exploration of the complex nature of justice-related sensemaking, including its tensions and contradictions. In alignment with the semi-structured nature of these interviews, interview protocols served as a starting point and touchstone for dialogue, but specific questions were adapted to the flow of the conversation to invite authentic reflection and highlight the particularities of each participant's meaning-making. All protocols were shared with participants in advance of interviews to allow for more intentional, expansive sense-making (see *Appendices A-C* for interview protocols).

Each interview in this series invited participants to reflect on connections between intersectional justice projects and environmental and climate education; processes of relationship-building, shared learning, and ideological sensemaking; and possibilities for environmental and climate learning in the early childhood and elementary years. Interview prompts were designed to invite concrete examples to clarify participants' perspectives and practices, including their personal meaning-making as well as their organizational activities. In particular, each interview involved in-depth discussion of an artifact (e.g., curriculum resources, professional development materials, communication documents, records of design processes, physical objects, photographs and data visualizations, etc.) connected with the focus of the conversation in order to elaborate on the details of participants' experiences.

The first interview focused on participants' pathways into environmental and climate education; their evolving definitions of social, educational, and environmental and climate justice; and their salient

experiences with relationship-building and shared learning related to climate education and climate justice, both within ClimeTime and beyond. The second conversation delved into participants' current engagement in climate education related work, and how their interests, understandings, and commitments translate into educational practices. In the third and final interview, reflections on past and present experiences were integrated with a future-oriented discussion of participants' hopes and visions for environmental and climate education, equity and justice, and their own personal and professional growth.

Co-analysis. After all phenomenological interviews were completed, I facilitated focus group sessions for shared discussion and analysis of emergent themes related to the research topics. These co-analysis gatherings served as opportunities for *member checking* to increase the accuracy, depth, and relevance of my analyses (Bhattacharya, 2017). At the same time, these opportunities to reflect with other network members may have informed participants' educational practices and supported them in strengthening their own project activities. Co-analysis processes are central to critical methodological stances that aim to remediate power dynamics in researcher-practitioner relationships and co-produce findings that are mutually consequential and liberatory.

Throughout the co-design, phenomenological interviewing, and co-analysis activities, critical ethnographic approaches were used to engage in shared learning and imagining to transform educational systems toward more intersectionally just possibilities. In other words, the research processes themselves aimed to contribute to ideological shifts, transformative agency, and sustained changemaking within the network.

Case Study Collaborators

With the case study participants in this study (Stacy and Pranjali), research activities were framed using a *critical design ethnography* approach (Barab et al., 2004). Within this collaborative process, I actively participated in design activities to strengthen the local implementation of the projects as well as the spreading of innovations throughout the network. The research collaboration was shaped by several aims, including understanding the intricacies of the project work; supporting project leaders in refining

their practices; co-developing detailed accounts of iterative design work within the Climate Justice League and STEM Storylines projects; and co-creating ways to share insights from these projects broadly with research and practice audiences. Dr. Deb Morrison at the University of Washington Institute for Science + Math Education, one of the leaders of the ClimeTime network, provided guidance during this process and was present at some gatherings.

As part of the in-depth and sustained nature of this collaboration, we held regular research check-in and co-design gatherings that served as spaces for critical reflection, storytelling, relationship-building, and strategizing. We engaged in shared learning about educational practices, design processes, research methods, and other topics of interest. In spring 2021, the focus of the check-ins shifted to sharing out about the projects through conference presentations and practitioner-facing articles. Meredith began joining the conversations and played an active role as a co-author, sharing her perspectives about the Climate Justice League project. Additional rich insights emerged during these convenings as we worked together to identify critical themes in the project work. These research and writing meetings took place on Zoom and were recorded for later analysis.

Through these check-in meetings, Stacy and Pranjali were highly involved in shaping the research foci as well as the specific data gathering activities within the case study projects, which were determined based on needs and priorities that arose throughout the year. These methods included what we called process interviews, which were one-on-one conversations in which Stacy and Pranjali described their design priorities and principles, key practices, design processes, feedback mechanisms, and changes to project structure and approach over time. To understand how teachers think about and leverage the STEM Storylines, we facilitated a focus group with three elementary educators in southwest Washington who were familiar with the resources both as co-developers and as teacher-leaders who had implemented multiple Storylines. In addition, we engaged in shared sense-making about artifacts generated by the teachers and students they support in order to determine next steps in their project work.

In line with the critical design ethnography approach, Stacy and Pranjali reflected that these research activities influenced their engagement in ClimeTime efforts and other professional endeavors. Our collaboration contributed to new ways of thinking about and enacting liberatory praxis within their project work. In contrast with extractive forms of research that primarily or solely benefit the researcher, this study enabled us to cultivate mutual support, trusting relationality, and collective learning in and through the research process. We became co-conspirators who continue to strategize and move together toward intersectional justice in educational spaces.

Secondary Data Sources

For both the self-nominated participants and the case study collaborators, self-reported ideas, values, and practices that were described in co-design, co-analysis, and interview conversations were contextualized with other secondary data sources. *Triangulation* of multiple data collection methods increases the credibility and usefulness of the research analyses and thematic findings (Bhattacharya, 2017; Patton, 2015). Specifically, I drew upon participant-observation and artifact analysis to supplement the primary data sources of design meetings, interviews, and focus groups.

Participant-observation. Observation is an important research strategy in qualitative studies, particularly in ethnographic research. In this study, I engaged in ClimeTime network activities as a *participant-observer*, interacting with network members and leaders while also observing the activities from an analytic perspective (Merriam & Tisdell, 2016). The degree and forms of participation were dynamically shaped by other supporting roles that I provided within network efforts. These observations included implementation sessions with teachers for the two case study projects; whole-network convenings; and optional within-network professional development events, including book study groups and topical webinars. For some of the self-nominated network participants, observations of one or more professional learning events they designed and facilitated were used to triangulate insights shared in the phenomenological interviews. At each session where I observed, I created typed fieldnotes in Google

Docs to document the main events, conversation topics, and other potentially important dimensions of the event. Participant-observation continued for the duration of the third year of the ClimeTime proviso.

Artifacts. A variety of artifacts generated within the network, some of which are public-facing and publicly available, provided additional context and triangulation for this research study. Artifacts from full-network gatherings and activities included slide decks, Zoom chat transcripts, and shared workspace documents (e.g., Google Docs, Jamboards) from convenings; public reports (e.g., case study reports, end-of-year reports); and public communications (e.g., social media posts, ClimeTime website content, portraits of practice). Partner organizations, including those involved with the case study projects, generated a variety of artifacts such as open-access curricular and instructional materials, professional support resources, slide decks and webinar recordings, and project planning documents (e.g., budget proposals, timelines, plans of work). In addition, ClimeTime projects and state-level evaluators created artifacts related to teacher and student experiences such as participation metrics and de-identified survey responses from professional learning events; resource usage data; and examples of work from teachers and students. I reviewed and analyzed these artifacts as necessary to better understand insights that arose from primary data sources.

Taken together, these primary and secondary data sources allowed me to identify numerous salient themes that emerged from the experiences of the self-nominated educational leaders as well as the case study collaborators. See *Table 1* for an overview of all data gathering activities, including a timeline of when they were completed, which participants were involved in each activity, and what specific forms of data were collected. At the beginning of each following chapter, I will provide more specific details about which data sources were most influential in shaping the narratives shared in that chapter.

Table 1

Overview of Data Gathering Activities in the 2020-21 Academic Year

Timeline	Description of activity	Participants involved	Forms of data gathered
Jul 2020 - Jun 2021	Participant-observation at full-network events, including design institutes, regular check-ins, book group sessions, topical professional development webinars	All members of partner organizations and leadership team (only a smaller subset attended book group and topical webinar sessions based on interest, though all members were invited)	Fieldnotes, artifacts (slide decks, chat transcripts, working documents, etc.)
Jul 2020 - Jun 2021	Research check-in and co-design meetings with Stacy and Pranjali to engage in critical reflection, storytelling, shared learning, relationship-building, design of research activities, strategizing about project work; shift in focus to sharing work more broadly in spring 2021	Case study project collaborators, including Meredith starting in spring 2021	Zoom recordings, handwritten and typed notes, artifacts (slide decks from professional learning events, working documents, examples of teacher and student work, resource usage data, etc.)
Sep 2020	Process interviews with Stacy and Pranjali to understand design principles, practices, and processes in the case study projects	Case study project collaborators	Zoom recordings, artifacts (working documents, etc.)
Sep 2020	Two co-design focus group sessions to design the research topic areas and interview protocols	Self-nominated network members	Zoom recordings, artifacts (slide decks, working documents, etc.)
Sep 2020 - Nov 2020	One-on-one phenomenological interviews focused on justice-related learning and practices and structured as: 1) focused life history, 2) details of current experiences, and 3) reflection on meaning and future possibilities	Self-nominated network members	Zoom recordings, handwritten notes, artifacts (artifacts selected by interview participants to elaborate on their reflections)
Nov 2020 - Jun 2021	Participant-observation at case study project sessions	Case study project collaborators, other facilitation partners, teachers involved in case study projects	Fieldnotes, artifacts (slide decks, chat transcripts, working documents, teacher and student survey data, etc.)
Dec 2020	Two co-analysis focus group sessions to gather collaborator insights on emergent themes from interviews	Self-nominated network members	Zoom recordings, artifacts (slide decks, working documents,

			etc.)
Dec 2020 - Apr 2021	Participant-observation at research collaborators' professional learning events to provide additional context for reflections shared during co-design, interview, and co-analysis sessions	Subset of self-nominated network members, based on availability and willingness	Fieldnotes, artifacts (slide decks, working documents, etc.)
Dec 2020	Topical professional development webinar on elementary climate learning	Subset of partner organization members and leadership team who attended based on interest, though all members were invited	Zoom recording, artifacts (slide deck, chat transcript, etc.)
Feb 2021	Focus group with elementary teachers to understand design and implementation of STEM Storylines, including challenges, opportunities, and liberatory possibilities	Case study project collaborators, teachers involved in case study projects	Zoom recording, handwritten notes, artifacts (examples of student work, working documents, etc.)

Note. Data gathering activities are listed in chronological order based on the start date. The formal data collection period was from July 2020 to June 2021. However, I began engaging in initial participant-observation and support of network activities starting in March 2020. In addition, collaborative sense-making conversations with Stacy and Pranjali as well as member checking with all participants continued into the 2021-22 academic year. Rows in this table are color-coded based on which participants were involved (red for full network, green for case study collaborators, and blue for self-nominated network members). Some artifacts are listed in association with specific events. Other artifacts are not mentioned here but were analyzed as necessary (e.g., public reports and communications, open access curricular resources, evaluation data, etc.), including artifacts related to the case study projects and broader network activities prior to summer 2020. In total, I gathered 76 recordings ranging from approximately one to two hours in length (32 with case study collaborators, 43 with self-nominated partners, and one at a whole-network event). I created a total of 39 fieldnotes ranging from four to 38 pages (17 from case study events, three from events facilitated by self-nominated participants, and 19 from whole-network events).

Data Analysis

In this study, I approached data analysis holistically in order to weave together educational leaders' stories in a contextualized way that would honor their experiences and expertise. To highlight themes in participants' sensemaking, I used inductive and iterative analytic strategies to investigate patterns and points of contrast that emerged directly from fieldwork and data sources (Merriam & Tisdell, 2016). Rather than following a linear process, I engaged in data collection, data analysis, and writing as overlapping activities that guided and shaped each other (Bhattacharya, 2017; Charmaz, 2014). Analysis

of recordings from interviews, focus groups, and co-design meetings was closely informed by my research foci and purposes, theoretical framings, and methodological approaches. The secondary data sources of fieldnotes from participant-observation and artifacts were analyzed as needed to contextualize or triangulate emergent findings from the primary data sources. Since these data sources took many forms, including non-text-based artifacts, they were analyzed using a holistic approach including both inductive and deductive interpretations (Saldaña, 2013). In this way, my analytic approach was both inductive and closely informed by the framing concerns, rationales, and commitments of the study.

To immerse myself in the data, I relied heavily on memo-writing, a strategy that is important in *grounded theory research* and frequently leveraged in qualitative methodologies more broadly (Charmaz, 2014; Glaser & Strauss, 1967). Specifically, I generated analytic memos, content memos, thematic memos, and methodological memos throughout the processes of data collection, data analysis, and writing. These memos guided my selection of salient excerpts in the data corpus to transcribe, code, and examine more closely. In the following sections, I describe each of these activities in more detail.

Analytic Memoing

Throughout the data collection process, I engaged in *analytic memoing* to reflect upon research activities and record emergent ideas (Merriam & Tisdell, 2016). I created an analytic memo in a Google document after each interview, focus group, research check-in meeting, and other event during the data gathering process. In these memos, I noted personal resonances with or reactions to participants' perspectives, reflections on my experiences of the encounters, challenges or dilemmas, initial ideas regarding the research focus areas, decisions and next steps regarding data collection and analysis, possible patterns and thematic connections, and any other salient noticings and wonderings (Saldaña, 2013). This record of my experiences throughout the research process was also an important aspect of engaging in critical reflexivity, or examining how my positionality within the research context influenced my activities and interpretations.

Content Memoing

For each recording — including those involving case study collaborators and educators in the case study projects, interviews with self-nominated network members, and gatherings with the network at large — I created content memos to describe the key events and interactions that occurred. Memoing took different forms for the various groups. For self-nominated participants, I recorded the main ideas that were discussed in each phenomenological interview in a Google document immediately following the conversations, supported by the handwritten notes I took during the interviews. I used a separate document for each round of interviews, but compiled together the content memos for all participants within each round so that I could search for patterns across interviews. For the case study collaboration and whole-group events, I created content memos after the formal data collection period was completed. These content logs were more detailed, consisting of a chronological summary of the conversation flow with timestamps. All content logs from the case studies were gathered in one Google document. Content memoing served a descriptive function in this study, allowing me to later recall what insights were shared during each encounter.

Thematic Memoing

In addition to reflecting on tentative themes in analytic memos, I also created targeted thematic memos at several points during data collection and analysis. After each of the three rounds of interviews with self-nominated participants was complete, I wrote thematic analyses guided by my research focus areas and outlining patterns and points of comparison across the set of narratives. For the case study collaboration, I did not engage in thematic memoing at designated times, but rather wrote memos synthesizing emergent insights at multiple points throughout the year as they became gradually more clear.

Selective Transcription and Coding

This practice of constant memo-writing enabled me to refine dimensions of my analyses over time. Based on the collection of detailed analytic memos, content memos, and thematic memos, I

selected target excerpts in the data set to transcribe and examine more closely. With the transcribed selections, I engaged in a more fine-grained coding process informed by my noticings throughout the year. As I coded these excerpts, I included clarifying notes about how I perceived them connecting with other pieces and with larger patterns. I had compiled a tentative set of themes based on my initial memoing prior to transcription and detailed coding. As I developed a more intimate understanding of the stories shared by participants, I iteratively adjusted the organization of these ideas and clustered participants' accounts into categories to construct an overarching narrative (Bhattacharya, 2017). This evolving constellation of themes eventually became my outline for writing these chapters — and continued to shift throughout the writing process.

Methodological Memoing

As I began to solidify my codes, categories, and themes, I wrote many methodological memos to support my sensemaking and decision-making as I constructed higher-level claims rooted in the specifics of the data. This form of memoing served as a record over time of my changing ideas during the data analysis and writing processes as I iteratively examined the intricacies of the data, refined my interpretations, and clarified my understandings about the themes and their interrelationships (Bhattacharya, 2017).

Co-Analysis and Member Checking

At multiple points during data collection and analysis, I engaged in co-analysis and member checking to strengthen my emergent findings and to center participant voice and expertise. This included sharing preliminary data syntheses and representations with case study collaborators during regular research check-ins, self-nominated network members during co-analysis sessions, and with the broader ClimeTime community during full-network convenings. These co-analysis opportunities added greater depth, nuance, and relevance by interweaving a multitude of practitioner perspectives. As I moved through the writing phases of this research process, I also shared drafts of my analyses with all participants to ensure the accuracy of my representations, confirm that my collaborators were

comfortable with how I described their stories, and invite revisions or additional reflections. Given the dynamic and social nature of meaning-making, these iterative processes created opportunities for trust- and relationship-building with each participant and reduced the risks of misinterpretation and misrepresentation. In addition, I refined my findings by seeking out feedback and guidance from my mentors, research group, and other critical friends and colleagues as I gathered and analyzed the data (Bhattacharya, 2017).

Positionality and Relationality

Collaborative analysis strategies are also critical because I enter this research with a multitude of socially constructed identities that shaped my actions, interactions with collaborators, and analytic interpretations.[13] Rather than conceptualizing these identity markers as static categories, however, I regard positionality as dynamically co-constructed in specific sociocultural and sociopolitical contexts. Different aspects of my identities become salient in different ways at different moments. Thus, I aimed to practice critical reflexivity as an ongoing, evolving stance in this research rather than as a set of *a priori* claims (Nagar, 2014).

My values, assumptions, and commitments as a researcher and educator are closely influenced by personal histories related to my interconnected identities. My work is informed by my experiences of racialization, which have been shaped by intersecting forces of orientalism, xenophobia, colonialism, white supremacy, language supremacy, ableism, cisheteropatriarchy, and other forms of oppression. As an educator, I am especially attuned to how these broader systems impacted my learning and development as a young person navigating the U.S. educational system and moving between contradictory cultural worlds. I am continually deepening my analysis of these structures through engagement with storytelling practices, dialogue with critical friends and colleagues, and theoretical gifts like Asian Critical Race Theory (Curammeng et al., 2017; Iftikar & Museus, 2019).

[13] In addition to the dimensions described in this section, I also took on new professional roles during the timespan of this research project. Specifically, I began working with EarthGen as an education consultant in December 2020. During the data gathering period (2020-21), I was not directly involved in the facilitation of the Climate Justice League project. However, in the following year (2021-22), I did actively contribute to the development and implementation of the professional learning community cohorts.

I hold especially dear my identity as a woman of color and ground myself in the accountability practices, decolonial ethics, and cross-racial and transnational solidarity work of women of color feminisms (Fujiwara & Roshanravan, 2018). Following the powerful leadership of activists like Grace Lee Boggs and Yuri Kochiyama, I am guided by the responsibility to struggle for the collective liberation of all marginalized peoples. I am also an immigrant settler on stolen Indigenous lands — I grew up on the lands of the Očhéthi Šakówiŋ, Quapaw, Myaamia, Osage, Kaskaskia, and Kiikaapoi peoples in what is presently called St. Louis, and I currently reside on Duwamish and Coast Salish lands. As such, I am committed to becoming a "welcome guest" (Hernandez, 2022) by building relationships with these lands, waters, and living beings and contributing in tangible ways to the sovereignty and thriving of the Indigenous peoples who are the rightful stewards of these lands. As an Asian American settler, these practices are necessary for aligning my energy with decolonization and Indigenous self-determination rather than being complicit with the settler state (Day, 2016; Fujikane, 2008; Saranillio, 2013).

I am also rooted in my cultural and diasporic identity as a second-generation Chinese American immigrant, and I am actively working to grow those roots by reclaiming the familial, ancestral, and multigenerational knowledges and histories that make my existence possible. Of particular relevance to this project, I am curious about my ancestors' relationships with the lands and places they inhabited and the ecologies that shaped them. I am interested in how these knowledges, relationships, and practices are related to histories of regional and transnational migration — and how my relatives have sustained their lifeways across time and space. My commitments to environmental justice, climate justice, and intersectional environmentalism are informed by these diasporic identities and my desire to understand them more deeply.

In addition, I enter this work as an educator who was lucky enough to learn and play alongside young children in outdoor, community-based educational settings. These encounters in the woods, the gardens, the mountains, and the rivers and lakes taught me to honor the brilliance, creativity, passion,

and power that young people hold. These experiences also showed me — before I was exposed to the theories and the research literature — that learning is always taking place across the many spaces and relationships that youth navigate. Young people are more than capable of changing the world, and they are already doing so. Our responsibility as adults, and especially as educators, is to learn from them and stand in solidarity with them as they work to realize the liberatory possibilities they are collectively envisioning. These interconnected commitments guide my inquiry and praxis within this project and beyond.

Issues of positionality and critical reflexivity are closely tied to considerations regarding ethical relationality that are core to my thinking personally, theoretically, and methodologically. In designing these research activities, gathering data, and analyzing and sharing findings, I aimed to center care, responsiveness, reciprocity, accountability, vulnerability, and relational responsibility with research collaborators (Nagar & Shirazi, 2019; Tolbert et al., 2018). Approaching research from a lens of care is particularly crucial in the current moment of overlapping and intensifying sociopolitical and socio-ecological crises.

Within DBIR and critical research approaches, processual and relational understandings of validity are important measures of the research's trustworthiness and rigor (Hayashi Jr. et al., 2019; Tuck & McKenzie, 2015). In other words, the process, content, and outcomes of research should be consequential and transformative for participants (and the educators, youth, and communities they support) as well as significant from a scholarly perspective. In co-creating "narratives of engagement" (Tolbert et al., 2018), critically attending to politics of representation necessitates honoring collaborators' self-determination of how they and their work are presented. In this text, I hope to hold the responsibilities of engaging generously and respectfully with participants' stories as well as moving together toward more intersectionally just commitments and practices.

Overview of Chapters

In addition to this introduction, this text contains four main chapters interspersed with two

theoretical interludes, followed by brief concluding thoughts and invitations. In this section, I provide an overview of the focal topics addressed and stories shared in each chapter.

In chapter 2, I analyze how assumptions and discourses of developmental appropriateness are often used to restrict young learners' engagement in intersectionally just and justice-centered forms of environmental and climate learning. I look closely at perspectives shared during one-on-one interviews, network conversations, and research check-ins with Stacy and Pranjali to understand how tensions related to appropriateness shape participants' thinking. I assert that these beliefs and practices, though well-intentioned, can impose psychological and intellectual harm on young people, particularly those who are intersectionally marginalized. I then suggest ways to move beyond developmentalist frameworks in order to nurture what I describe as non-innocent forms of caring relationality.

In chapter 3, I build on the theme of disrupting inequitable and unjust constraints in order to cultivate liberatory forms of environmental and climate learning for young students. I investigate how overlapping systems of oppression — specifically, deficit logic, white supremacy and colonialism, and ageism and adult-centrism — impact the learning experiences of elementary students and reinscribe the harms, erasure, and marginalization that are perpetuated in society more broadly. These structures shape the content of learning, pedagogical approaches, and other dimensions of educational systems. In this chapter, I explore how intentionally designed curriculum resources like the STEM Storylines can support more emancipatory, intersectionally just, and justice-centered learning opportunities for young learners.

In chapter 4, I clarify how facilitating liberatory learning experiences with young people requires educators and educational leaders to deepen their own critical consciousness and translate their political commitments into action. In this chapter, I weave together stories from the self-nominated participants to describe themes in educational leaders' justice-related learning processes. Focusing on the Climate Justice League project as an example, I demonstrate how justice commitments can be enacted through educational leaders' support of teachers' professional learning. I then share how cross-pollination and relationship-building within the ClimeTime network enabled the justice-centered innovation to spread

across other regions.

Finally, in chapter 5, I share how critically attuned professional learning experiences are crucial for educators to develop their critical consciousness and transform their practices with students as well as develop broader forms of sociopolitical agency. Supporting teachers in this way requires educational leaders to disrupt the entrenched power dynamics in educational systems and cultivate sustained and sustaining relationships with educators that honor their expertise. I emphasize how the Climate Justice League became a space of solidarity, care, and collective action for the teachers and educational leaders involved in the project. In these ways, I highlight how relationality is central in transformative changemaking in and through educational spaces.

By interweaving stories across levels of the educational system — from discourses that shape policies and practices, to curriculum materials and pedagogical approaches, to professional learning supports and communities of practice — I demonstrate how a holistic ecosystem of support is needed to move toward intersectionally just and justice-centered environmental and climate learning. Although these chapters touch on many dimensions that were salient within the ClimeTime context, they of course do not address all of the emancipatory changes necessary for sociopolitical, environmental, and climate justice.

Intersectionally just and justice-centered environmental and climate learning must be broadly designed and implemented in order to respond to global ecological precarities and ensure the collective wellbeing of human and more-than-human communities. Youth, families, and communities who are marginalized by intersecting forms of harm and oppression are often most vulnerable to the impacts of changing climate systems. Transformative science teaching and learning must attend to these disparities and center the worldviews, lived experiences, brilliance, and healthy futures of learners and their communities. The critical research approaches in this study are powerful methodological tools to desettle persistent power dynamics and structural injustices in order to imagine and create more livable and caring possibilities.

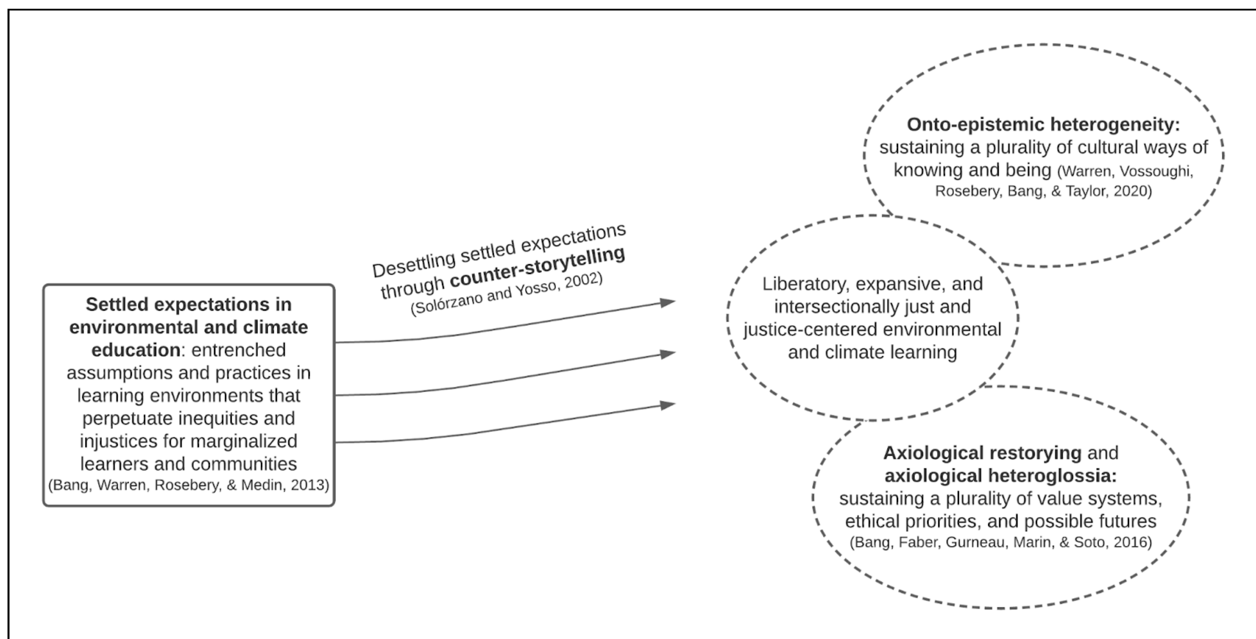
Although educators have begun to address climate topics within formal schooling systems — and there are long histories of community-based organizing and learning — there are not yet robust theoretical and practical understandings of how educators and educational leaders can build and sustain systems of justice-centered climate learning for learners of all ages. This research aims to highlight how educational leaders' justice-related learning pathways and shifts in practice can be supported through webs of relationality and influence within and across communities of practice. ClimeTime network members' perspectives and practices can contribute to theory-building understandings of ideological change and transformation, educator sensemaking, and the systemic infrastructure needed to support these processes. At the same time, this research can offer educators, educational leaders, policymakers, and other community members practical insight into the challenges, opportunities, and abundant possibilities in justice-centered teaching and learning about complex socio-ecological issues.

FIRST THEORETICAL INTERLUDE

To nourish intersectionally just and justice-centered environmental and climate learning, I draw upon a constellation of concepts from critical sociocultural and sociopolitical learning theories that guide my analyses and arguments in the next two chapters. *Onto-epistemic heterogeneity* (Warren et al., 2020) refers to the plurality of culturally situated ways of knowing and being that learners and communities practice. *Axiological restorying* and *axiological heteroglossia* (Bang et al., 2016) describe the multiple value systems, ethical commitments, and imagined futures that exist within and across communities. Given these forms of heterogeneity, a continual process of disrupting *settled expectations* (Bang et al., 2013) is necessary to move beyond normative onto-epistemic and axiological assumptions that shape learning environments. I leverage the method of *counter-storytelling* (Solórzano & Yosso, 2002), informed by *critical race theory* (Delgado, 1995), as one powerful way to desettle dominant discourses and work toward expansive forms of learning (see *Figure 2* for a representation of how these concepts work together).

Figure 2

Conceptual Constellation for Chapters 2 and 3



Onto-Epistemic Heterogeneity

Heterogeneity is a fundamental and always-present reality in learning processes (Rosebery et al., 2010). Teaching and learning are inherently cultural endeavors and all learners hold sense-making repertoires that are valued within their families and cultural communities (Bang et al., 2016). Rather than viewing difference as a deviation from the "norm" or an anomaly to be assimilated, the concept of *onto-epistemic heterogeneity* recognizes that learning necessarily involves negotiating a multiplicity of meanings, understandings, worldviews, and ways of being — and that learners' ways of being (*ontologies*) and ways of making sense of the world (*epistemologies*) are not separable. Warren et al. (2020) write:

> By onto-epistemic heterogeneity we mean to highlight two key ideas. First, that knowing and being are inextricably tied; and second, that liberatory education ought to be deeply rooted in the pasts, presents, and futures that sustain and imagine multiple values, purposes, and arcs of human learning. This viewpoint is distinct from equity efforts organized by access paradigms that position the disciplines themselves as settled and exempt from reproach or historicity. In short, greater access to settled forms of disciplinary knowledge is not only insufficient, but functions as the newest form of assimilation and domestication into Western supremacy, perhaps more insidiously through a veneer of liberal inclusion (Melamed, 2011). (p. 278)

As the authors emphasize, this framing of onto-epistemic heterogeneity includes not just the acknowledgement of multiplicity as a powerful reality, but also a commitment to sustaining this pluralism within and through learning spaces. This commitment is crucial given the historical and ongoing erasure of non-dominant cultural perspectives and privileging of white Euro-Western perspectives in the U.S. educational system (Paris & Alim, 2017). As educators, we have an obligation to support youth in strengthening their dynamic cultural identities, understandings, and practices; critically reflecting on dominant forms of knowing and being; and learning to navigate between multiple knowledge systems (Bang & Medin, 2010; Barajas-López & Bang, 2018; Medin & Bang, 2014). Prioritizing these processes

in learning encounters is critical in order to move beyond assimilatory notions of education and instead nurture the *intellectual health* and holistic thriving of young people, families, and communities (Two Feathers NAFS, 2020).

Axiological Restorying and Axiological Heteroglossia

Axiologies refer to shared systems of values and ethics and are intimately and dynamically related to ontologies and epistemologies in how we navigate our communities and socio-ecological worlds. Although science is often presumed to be neutral and objective, both scientific practice and science learning are always shaped by political and ethical assumptions and implications that we as educators must explicitly and critically engage with (Bang et al., 2018; Medin & Bang, 2014; Morales-Doyle et al., 2020).

Bang et al. (2016) build on a lineage of thinking within design-based research methods to advocate for a focus on *axiological innovations* in order to “sustainably disrupt historically shaped inequities and cultivate transformative agency from within communities” (p. 29). Axiological reimagining is needed to address ethical dilemmas, respond to issues of power and injustice, and envision new moral possibilities and value systems. In particular, this involves recognizing and disrupting taken-for-granted assumptions about what is necessary and good in learning environments. The authors critique how “axiological normativity and assumed stability” (p. 29) tend to go unquestioned in learning contexts, further imposing harm on learners from non-dominant communities. For example, this might include explicit or implicit beliefs about the purpose and value of science, science learning, and education in general; definitions of equity, justice, and community well-being; positionings of different communities and their concerns as central or peripheral; and ideas about possible and desirable futures. Bang et al. clarify:

> Importantly, we are suggesting that axiology is not a given, that it is inherently variable, context dependent, and shaped by unfolding activity. In the work we have been involved in, we have relentlessly worked toward making visible axiological norms such that decisions in the design,

> implementation, and study of learning and learning environments support and cultivate axiological heteroglossia toward decolonial, just, and sustainable futures. (p. 29)

The concept of *heteroglossia*, drawn from Russian scholar Mikhail Bakhtin's work in literary theory, describes how different language use patterns within a single language reflect speakers' or writers' distinct perspectives, lived experiences, and interpretations of the world. Similarly, *axiological heteroglossia* indicates how individuals and communities carry a variety of ethical priorities and purposes, and that the axiological commitments of marginalized communities should be made visible, respected, and sustained in learning environments and in educational research (Bang & Vossoughi, 2016).

In the following chapters, I suggest that moving toward intersectionally just and justice-centered environmental and climate learning demands critical attention to questions of what is considered desirable, appropriate, and important for young people and their communities to experience in learning environments. To collectively respond to current and future socio-ecological realities, we need to trouble our assumptions about the goals and best practices of science, environmental, and climate education — and the power imbalances that have enabled these dominant assumptions to become ingrained in our educational systems. In doing so, we can create openings for the axiological concerns and commitments of learners, families, and communities to become central in shaping the design and facilitation of learning.

Desettling Settled Expectations

Holding space for onto-epistemic and axiological heterogeneity requires us to dismantle the oppressive tendencies that shape learning encounters. In their 2013 article, Bang et al. think with decolonial and critical race theories to characterize *settled expectations* as "entrenched, usually hidden, boundaries that tend to control the borders of acceptable meanings and meaning-making practices" in learning environments (p. 303). The authors clarify that these settled expectations give rise to pervasive deficit-based assumptions about learners with non-dominant cultural identities and other intersecting marginalized identities in educational contexts. At the same time, discipline-specific settled expectations continually position white, Euro-Western knowledge systems and ways of knowing as "correct" and

normative while invisibilizing or actively suppressing alternative onto-epistemic and axiological possibilities.

To clarify this latter point, Bang et al. provide an in-depth analysis of how settled expectations about nature-culture relationships constrain possibilities for shared sense-making in science education. For example, what is categorized as “alive” or “not alive”? How do we understand and describe the agency and intentionality of more-than-human beings? What are the roles and responsibilities of human beings in relationship with other living beings, and are humans positioned as separate from or part of nature? The authors highlight how disciplinary settled expectations about these and other questions can harm and alienate learners from marginalized communities:

> These boundaries function ideologically to (a) restrict the content and form of science knowledge valued and communicated through education and (b) devalue and dismiss boundary-expanding forms of knowledge, experience, and meaning-making with which students approach scientific phenomena. One consequence of STEM-related settled expectations as manifested through the nature-culture divide is to locate students, particularly those from nondominant communities, in untenable epistemological positions that work against engagement in meaningful learning of scientific ideas, practices, and phenomena. (p. 304)

Bang et al. advocate for the need to actively *desettle* these settled expectations through critical engagement with “knowledge-power relations, historically structured inequalities, and assumed assimilation into particular knowledge paradigms” (p. 304). Adopting a critical stance toward power dynamics and settled expectations is necessary for moving beyond learning environments as spaces of “epistemic control” (p. 311) in order to support more expansive onto-epistemic and axiological possibilities in science learning.

In their descriptions of classroom and community-based learning encounters, Bang et al. focus on how entrenched assumptions in curriculum and instructional practices impose restrictions on learners’ ability to meaningfully make sense of scientific phenomena. In the following chapters, I leverage this

concept of settled expectations to call into question how hegemonic ideologies inhibit our ability to center intersectional justice within environmental and climate learning, especially for early childhood and elementary students. Within the U.S., environmental and climate learning spaces have been shaped by the dominance of white, Euro-Western worldviews in mainstream environmentalism, as described in the introduction chapter.

Desettling the settled expectations that show up in mainstream discourses, curricular design choices, and pedagogical approaches is essential for dismantling the dominance of whiteness and Eurocentrism in environmental education and foregrounding onto-epistemic and axiological heterogeneity in environmental and climate learning (Nxumalo, 2019; Nxumalo & Cedillo, 2017; Nxumalo & ross, 2019). As Bang et al. (2013) argue, a desettling stance includes "imagining multivoiced meanings of core phenomena as open territory for sense-making" (p. 308) and honoring the dignity and wisdom of students' and communities' heterogeneous ways of being and knowing in learning environments. Embracing this multiplicity of marginalized global majority onto-epistemologies and axiologies is critical for working toward intersectionally just and justice-centered learning as well as envisioning ways to move collectively toward environmental, climate, and sociopolitical well-being and thriving in our socio-ecological systems. Given the interconnected harms inflicted by human supremacy, white supremacy, (settler) colonialism, and global capitalism, building more just possibilities depends on our ability to imagine beyond dominant Euro-Western modes of knowing and being in relationship with land (Bang et al., 2018).

In upcoming chapters, I think broadly about how the concept of settled expectations manifests within the content, processes, and practices of environmental and climate education. For example, I'm interested in what topics and phenomena learners are invited to inquire about, what forms of brilliance and agency we believe young people hold, which youth and community expertises and experiences we honor within learning environments, and more. In chapter 2, I share insights co-constructed with Stacy and Pranjali to imagine beyond the discourses of "developmental appropriateness" that are common

within mainstream environmental and climate education. In chapter 3, I explore how the violent settled logics of deficit-focus, colonialism and white supremacy, and ageism and adult-centrism often shape environmental and climate curriculum and constrain possibilities for youth sense-making — and suggest that curriculum design can also enable more transformative, liberatory, and intersectionally just forms of learning.

By mapping this constellation of concepts from critical sociocultural and sociopolitical scholars, I hope to clarify how a deep commitment to the central role of multiplicity in learning is the underlying rationale as well as the desired outcome of desettling settled expectations in environmental and climate learning. Heterogeneous ontologies, epistemologies, and axiologies are always present in learning environments but are differently validated and valued as a result of historical and current power imbalances. By directly confronting and moving beyond these settled assumptions, we open up learning spaces of onto-epistemic heterogeneity and expansive axiological possibilities that can sustain more meaningful sense-making, global majority learners' and communities' well-being, and our collective socio-ecological dreaming.

Counter-Storytelling as Methodology

In addition to these conceptual threads, in these chapters I draw upon the analytic strategy of *counter-storytelling* (Solórzano & Yosso, 2002) to position Pranjali's perspectives and stories as compelling critiques of dominant discourses and practices in environmental and climate education. Counter-storytelling is a key practice within *critical race methodology* (Solórzano & Yosso, 2002), which in turn is inspired by the lineages of scholarship and praxis within *critical race theory* (Delgado, 1995). Counter-storytelling is a powerful approach to desettling settled expectations in order to move toward intersectionally just and justice-centered learning.

Critical race theory (CRT) emerged as a branch of critical legal studies in the 1980s and proposed several tenets to explain why mainstream civil rights legislation was failing to provide communities of color with substantial improvements in circumstance: that racism is a permanent reality in U.S. society

that is rooted in historical atrocities and perpetuated by the legal system; that legal progress results only from *interest convergence* (D. Bell, 1980), in which white populations only allow policy shifts that also (or primarily) benefit themselves; and that dominant narratives center whiteness and white superiority as the norm while invisibilizing the perspectives of people of color, which prevents genuine social transformation (E. Taylor, 2009). Importantly, CRT scholars emphasize that the lived experiences, stories, and voices of marginalized peoples hold potential to clarify the inner workings of racist systems and must be valued and validated as sources of insight in legal scholarship and practice (Delgado, 1989, 1995; E. Taylor, 2009). Crenshaw's (1989, 1991) concept of intersectionality, as described in the previous chapter, is situated within this theoretical lineage and is a crucial lens in CRT.

In the following decades, CRT grew into a broad family of theories and spread into other fields beyond law, including rich lines of scholarship within education (Dixson & Rousseau Anderson, 2018; Ladson-Billings & Tate, 1995; E. Taylor et al., 2009). The principles of CRT have been used to critically analyze many dimensions of U.S. educational systems, including curriculum, instruction, assessment, funding, and (de)segregation in schools, and highlight how education perpetuates racial disparities through the inequitable processes and outcomes experienced by students of color and white students (Ladson-Billings, 1998). For example, the concept of interest convergence can help explain why educational systems are resistant to liberatory change — because these forms of transformation do not serve the interests of white individuals who hold sociopolitical power and privilege.

Critical race methodology, as described by Solórzano and Yosso (2002), translates the commitments of CRT into educational research strategies. The authors clarify how educational research has often been generated from positions of racial and related privilege, erased the voices of marginalized students and communities, proposed theories that label non-dominant racial and cultural communities as deficient, failed to account for the profound impacts of systemic racism and racialization, and contributed to the continued oppression of learners within the educational system. Within critical race methodologies, racial and intersectional analyses and the perspectives, wisdom, and well-being of communities of color

are centered throughout the research process. Storytelling and subjectivity, and the creative interweaving of theoretical and experiential knowledge through the sharing of *counter-stories*, are crucial ways to critique and refute the racialized deficit logics of "monovocal" or "majoritarian" storytelling (Delgado, 1989; Solórzano and Yosso, 2002). Solórzano and Yosso emphasize, however, that counter-stories are powerful not only in resisting dominant narratives but also in building within- and cross-community solidarity, sustaining cultural and collective thriving, and moving toward more emancipatory futures:

> We define the counter-story as a method of telling the stories of those people whose experiences are not often told (i.e., those on the margins of society). The counter-story is also a tool for exposing, analyzing, and challenging the majoritarian stories of racial privilege. Counter-stories can shatter complacency, challenge the dominant discourse on race, and further the struggle for racial reform. Yet, counter-stories need not be created only as a direct response to majoritarian stories. As Ikemoto (1997) reminds us, 'By responding only to the standard story, we let it dominate the discourse' (p. 136). Indeed, within the histories and lives of people of color, there are numerous unheard counter-stories. Storytelling and counter-storytelling these experiences can help strengthen traditions of social, political, and cultural survival and resistance. (p. 138-9)

As described in this definition, counter-stories refer to stories that are often obscured and that expand beyond dominant narratives — through direct response or by providing affirmative visions of alternate possibilities.

This methodological approach of counter-storytelling resonates with the need to create space for onto-epistemic and axiological multiplicity by desettling the settled expectations that shape and constrict environmental and climate learning. Settled expectations persist when people holding dominant worldviews maintain disproportionate institutional power and influence and dominant assumptions, discourses, and narratives go uninterrupted. In environmental fields, the underrepresentation and exclusion of global majority and other marginalized communities is well-documented and persistent, particularly in positions of leadership and decision-making power (D. E. Taylor, 2014a, 2015, 2021). As I

will describe in more detail in the following chapters, the continued privileging of white, Euro-Western perspectives in environmental organizations and environmental education harms, dismisses, and alienates Black, Indigenous, Latinx, Asian, and Pacific Islander children and their communities (Nxumalo, 2019; Nxumalo & ross, 2019).

In the next chapters, I share critiques of dominant discourses and practices in environmental and climate education through counter-stories from Pranjali's personal experiences as a student and young person, as a mother of two young children, and as a woman of color working within a predominantly white field, geographic region, and institution. In chapter 2, I describe how Pranjali's lived experiences inform her critical engagement with ongoing dialogue about developmental appropriateness within the ClimeTime network, and how this engagement creates opportunities for collectively desettling settled expectations. In chapter 3, I analyze how Pranjali's experiential knowledge and her justice commitments that have emerged from these experiences provide an onto-epistemic and axiological foundation for her curriculum design work — which in itself acts as a counter-story to the hegemonic, oppressive tendencies of mainstream environmental and climate education.

CHAPTER 2: COUNTER-STORYTELLING TO DISRUPT DOMINANT DISCOURSES OF DEVELOPMENTAL APPROPRIATENESS

In this chapter, I describe how concerns about developmental appropriateness, though well-intentioned, are a form of deficit logic that often constrains the liberatory possibilities of environmental and climate education for young learners, particularly those who are most marginalized by intersecting injustices. Supporting youth agency, power, and leadership in and through justice-centered environmental and climate learning requires us as educators to instead recognize and position young people as capable learners and agents of change.

In the following sections, I describe a series of events that took place within the ClimeTime network in the 2020-21 academic year, tracing how different discourses related to developmental appropriateness emerged. I explore how the ideas and tensions expressed in network conversations and one-on-one interviews with network members resonate with broader systemic tendencies in environmental and climate education (see chapter 1 for a description of the group of educational leaders who participated in this research effort). I then introduce critical insights co-constructed during research co-design meetings with Stacy and Pranjali, and drawing upon their curriculum design and professional support efforts, to problematize how developmental appropriateness discourses constrain youth engagement with justice-centered environmental and climate learning. I share counter-stories from Pranjali's experiences as a student, a mother, and a woman of color that invite us to think about, talk about, and learn with young people differently. In doing so, I emphasize how our positionalities and justice commitments as educators are shaped by our identities and experiences with navigating multiple systems of oppression.

Tensions of "Developmental Appropriateness" in Environmental and Climate Learning

In sharing an ethnographic narrative of conversations about developmental appropriateness in the ClimeTime network, my aim is not to critique these particular moments but rather to unearth and desettle the entrenched beliefs about young learners that dominate mainstream environmental and climate

education, as well as science education generally. At the same time, I hope to honor the specific nuances and layers within the perspectives shared throughout these dialogues. The concerns expressed by educational leaders in the network reflect deep care and intentionality in inquiring how we as adult allies can best support young people in understanding, loving, protecting, and sustaining meaningful relationships with their socio-ecological worlds. These conversations also indicate the open-endedness and ambivalence that educational leaders hold in engaging with questions of developmental appropriateness. Given the complexity of environmental and climate topics and the realities of eco-anxiety, climate grief and despair, and other strong emotional responses to environmental and climate devastation, this ambivalence is understandable. For these reasons, I frame the dimensions of developmental appropriateness discourses that emerged as "tensions," not to be resolved but rather to be continuously reconsidered.

In the full-network ClimeTime convening in November 2020, network leaders invited Pranjali to share about the design principles and processes involved in her STEM Storylines curriculum development. In her presentation, Pranjali highlighted the importance of early childhood and elementary STEM learning opportunities, some challenges in elementary-level NGSS implementation, and how the Storylines aim to support elementary teachers in navigating the barriers they experience. Pranjali emphasized key features of the Storylines, such as project-based learning, authentic and salient real-world phenomena, and centering learner voice and agency. She then shared how recent STEM Storylines have incorporated connections to climate science and climate change topics. Pranjali invited network participants to explore and discuss four examples of climate-related Storylines in breakout rooms, including units spanning kindergarten through fifth grade.

When participants returned to the full group, one educational leader posed a question about using the language of "climate change" versus "climate science" with elementary learners. This wondering segued into a conversation about what age-appropriate climate learning should look like at different grade levels, and concerns about what one small group described as the "crisis mode" approach they saw in the

Kindergarten-level Storyline, "Animal Sanctuary." One participant mentioned the concept of *ecophobia* popularized by the white environmental educator David Sobel (1999), which posits that children who are exposed to environmental challenges at a young age will respond with fear and distance themselves from ecological worlds. Another added that gaining traction for environmental learning is difficult in part due to children's negative emotional reactions to the content, especially when not all teachers are prepared to "talk students off the ledge." A few participants suggested that rather than focusing on environmental and climate problems in the elementary years, we should focus on building research- and standards-aligned foundational understandings of climate science and cultivating children's sense of wonder and connectedness with nature. As the session came to a close, network participants expressed desire to engage more deeply with this topic through further dialogue, especially since more recent research has generated different orientations to questions of developmental appropriateness.

In response to this interest, network leaders arranged a brief follow-up resource-sharing and discussion about ecophobia and developmental appropriateness on the second day of the convening. In addition, the December 2020 session of the UW-hosted topical webinar series was dedicated to a more substantial conversation about these and related issues. In close collaboration with Stacy and Pranjali, I designed and facilitated three lines of inquiry with a subset of network participants who attended the topical webinar: (1) developmentally appropriate language and approaches to elementary climate learning; (2) centering care and action to avoid despair and anxiety in elementary climate learning; and (3) supporting access to environmental, climate, and science learning in elementary contexts. In the first portion, I shared several resources and reflective prompts aiming to trouble how positional privilege and dominant settled assumptions shape developmental appropriateness discourses — including recent research from Dr. Fikile Nxumalo, Dr. Marianna Souto-Manning and Ayesha Rabadi-Raol, and resources from the Intersectional Environmentalism movement.

Over the course of the 90-minute session, participants wrestled with a number of tensions related to developmental appropriateness that shape their stances and practices when engaging in environmental

and climate learning with young learners. These tensions echo similar concerns that the network members described during our one-on-one phenomenological interviews. Given that not all educational leaders in ClimeTime were present at the topical webinar, participated in research interviews, or expressed their ideas during the full-network conversations, these themes don't comprehensively represent the viewpoints of all network members. In addition, individual educational leaders' perspectives are of course more complex and multilayered than can be captured in this thematic analysis. However, the recurring articulation of these concerns in individual and group sense-making encounters indicates the salience of the tensions for at least some ClimeTime participants. In the sections below, I outline three interrelated tensions that the educational leaders discussed and share quotes from the December 2020 topical webinar as well as individual interviews to exemplify and clarify the nuances of each tension.

Tension Between Focusing on Strengths Versus Problems, and Care Versus Action

Several members of the ClimeTime network expressed concerns about focusing on environmental and climate damage with young learners, even when problems are presented through a solutions-oriented lens. These concerns seem to be motivated by a desire to avoid deficit-based approaches. For example, Dylan (a white man) shared in an individual interview:

> And not it being about fear and disaster, and I even dance around the edges of… I mean, a lot of work within the ClimeTime work is often around good solutions-oriented stuff. Which I think is good on many levels. I mean, I think it's good, at least if we're gonna talk about problems, we should be thinking about solutions with kids and engineering, creating new solutions for our problems. But I think that still is kind of forefronting the problem on some level, even if... and I think kids need to think about solutions, there's ways to do that, that's great. But we have to make sure that we're also forefronting the wonder, and the value…

In this excerpt, Dylan reflected on a sense of reluctance to center the challenges experienced by communities at the expense of highlighting the assets that are present. Dylan continued:

> ...like when I take kids into a city park, I don't wanna just be going, 'What would make this a

> better place?' which is good to do. But 'What is valuable about this place? What is it providing to us as kids? What is it providing to animals? What is it providing to our community? What is it providing to our stormwater, what are the different things that it already does and we are benefiting from and others are benefiting from?' And *then* going to a place of 'Okay, and how could it be even better than it is now?' You know, let's think about that.

By sharing these concrete examples of questions posed to young learners, Dylan clarified what it might look like to forefront connection, wonder, and gratitude rather than identifying deficiencies. Although Dylan doesn't dismiss the possibility of students exploring the potential for improvements in their communities, this envisioning should be rooted in a foundation of appreciation. Similarly, in the December topical webinar, Dylan advocated for "starting from finding the value" and "finding the positives" in order to center and nurture children's relationships with their local places. Dylan again mentioned that wondering together about "what could be better about this place" and "what are the challenges within this place" could follow from this initial appreciative inquiry. In doing so, Dylan conveyed that highlighting strengths and building children's connections should take precedence in a learning experience and be the central focus.

Other participants offered similar reflections about how to focus environmental and climate learning with young children and which dimensions of relationality to emphasize. During the conversations in the topical webinar, Riley (a white woman) shared a related tension between foregrounding care as opposed to action-taking. Riley said:

> ...it's easier for me to imagine how to develop practices of care at an early elementary level when I think about like… when I think about trying to build a relationship and how care, like I know what care looks like in my relationships. So I can kind of imagine how that could play out with young learners and like what an important foundational piece that is… And with action, it's almost like, I still feel like our society and my community is figuring out what action looks like and so that's harder for me to think about, developing stances and practices of action with young

> learners. So that's just sort of my brainstorm in this moment is like, I'm leaning more toward thinking about care as central to this phase of learning. But wanna be challenged on that, I guess.

In this excerpt, Riley added a layer of nuance to the tension that Dylan identified between highlighting value versus identifying challenges. Riley expressed that it is more intuitive to focus on supporting caring and appreciative relationality, in part because caring practices feel more familiar and clearly defined. In contrast, collectively identifying harms and taking action to address these problems feels more uncertain, both at an adult level and with children. This ability to more easily imagine and enact care is connected, in Riley's reflections, to the belief that care is an "important foundational piece" to cultivate in the early childhood and elementary years and "central to this phase of learning."

Tension Between Individual Responsibility Versus the Need for Systemic Changes

In the webinar, Riley also articulated a second tension related to developmental appropriateness. Riley shared a sense of ambivalence about the tendency, in environmental and climate education with young learners, to focus on individual actions, agency, and responsibility. For example, environmental curricula often encourage children to recycle, conserve water, choose certain foods over others, and reduce their food waste. During the webinar conversation, one participant mentioned having conversations with young children about everyday decisions like buying plastic-wrapped versus non-packaged carrots, how many paper towels they use, and which shoes or toys they choose — and providing information about the implications of these choices. In response, Riley reflected:

> I hear the empowering aspect of talking about individual choice and your sphere of influence and all of this, but at the same time, from my *adult* analysis, climate change is about harmful systems, and really *isn't* about individual choices, and so I think, choice is a privilege, right? And I think that… that's a tension point for me, because on one hand, that is a more complex analysis that I think requires, again, that foundation of feeling connected and feeling in a place of awe and wonder... and responsibility and stewardship for local environment and local place, and then at the same time, I don't want to be teaching young people that if they don't buy the organic carrots

> at the market, then they are responsible for climate change. Because I think that kind of thinking exists in adults and is *problematic*… So how do we talk about systemic stuff with little tiny kiddos? That is my big inquiry at this moment.

Riley highlighted two interconnected issues in this reflection: firstly, concern about over-emphasizing children's individual actions within their spheres of influence when ecological damage and climate change are broad systemic issues; and secondly, that a curricular and instructional focus on individual responsibilities can reinscribe injustices in failing to account for the dynamics of power and privilege that shape individuals' differential ability to make particular decisions. Specifically, an emphasis on consumer choices grants agency only to those who hold socioeconomic privilege, while casting blame on people who experience financial constraints. While recognizing the importance of supporting learners' sense of personal empowerment, Riley worried that this focus on individual agency would mislead children about the true causes of environmental and climate harms and how systemic injustices impact different communities' lifeways and well-being. This pedagogical dilemma of deciding when and how to introduce ideas in order to create developmentally appropriate framings while still providing accurate foundations of understanding was a theme throughout the tensions that participants described.

In one of our interviews, Dylan expressed similar concerns about how responsibility is framed in environmental and climate learning. In addition to the possibility of instilling misconceptions, Dylan reflected on the potential harms of placing the burden of addressing climate change on young learners:

> I personally find climate change very stressful and overwhelming and it's hard to actually, realistically, make a personal difference in it. It's huge systemic things that need to be addressed by our society. I don't think it's fair to put that on kids or on anybody, I mean, except society, me as a voter and as a member, you know, as an adult, on some level.

Later in the conversation, Dylan continued:

> I believe it is not the kids' job to save our world right now or in the future. It's our job to save the world right now. Right? But they are going to be of an age where it will be their job because it's

> an ongoing process of saving the world, and trying to make things work, and resilience, and being able to cope with the things that we don't change. They need all of those foundations.

In these quotes, Dylan clarified that asking young children to take responsibility for systemic transformation is both unfair and developmentally inappropriate. In referencing the adult roles of voting and otherwise participating as members of society, Dylan positioned climate change as an issue to be addressed through collective response rather than through individual action. In particular, *adults* are obligated to enact these forms of civic engagement, and to prepare youth with the "foundations" to take on these responsibilities and challenges in the future.

Morgan (a white woman) shared a similar sentiment about appropriate roles for children during our one-on-one conversations: "I think the other thing I want to say about our youngest learners is that I want kids to be able to be kids. And [name of colleague] says that it's not fair for adults to expect children to solve adult problems. That's something that resonates with me." Morgan further explained that educators should ensure young children have access to unstructured play in outdoor spaces, as one important dimension of what it means to "be kids." In these ways, Dylan and Morgan asserted that responding to the complexities of environmental damage and climate change should not be the domain of young learners, but rather the collective responsibility of adults.

Tension Between Highlighting Local Versus Global Issues

Lastly, ClimeTime participants wrestled with the tension of whether to focus solely on local issues or also to explore global interconnections with young children. For example, Morgan shared during the topical webinar:

> I'd like to add to what [Dylan]'s saying, if I could… I feel like so much of what needs to happen in our earliest children's years is building that sense of connection and wonder to their local environment. And not to say that they shouldn't learn about the problems, because that's definitely appropriate, especially when it's locally based, and an area that they can have an impact on. I think what I get most concerned about is when I see resources that focus on faraway places

> that the kids don't have the ability to visit or directly influence. And there's actually a chapter in *Untamed* where, which we were talking about before a lot of people got on the call, but the five-year-old learns about the polar bears, and she's just devastated, and the mom spends a ton of time trying to figure out how to help her and the polar bears, and ultimately just lies, and says like 'The polar bears are fine, can you please start going to sleep again?' And parental, teacher, and student inability to respond to these kinds of emotional needs can result in student, parent, and even teacher rejection of including environmental education in the classroom at all. This kind of emotional impact is something I worry about perpetuating in our kindergarten classrooms, as an example. Especially for our youngest learners, environmental education should be grounded in a local context and at a level that allows the students to engage in research and action they define and direct.

Morgan emphasized that environmental and climate learning with young children should prioritize building connections with nature and exploring close-to-home circumstances in which children can have an impact. Similar to the previously described tension of individual versus systemic action, this concern is related to the limited scope of control that young learners hold, as Morgan conveyed when mentioning distant places where children "don't have the ability to visit or directly influence." Morgan also highlighted the negative emotional experiences that learning about faraway issues can impose on students by sharing the example of the "devastated" child in the memoir *Untamed*.

In addition to the limited spheres of influence of young children, participants also reflected on frameworks of conceptual development in navigating the tension between local and global phenomena. In one of our individual interviews, Ann (a white woman) shared about focusing ClimeTime-related projects on "precursor conceptual ideas" relevant to climate science rather than directly addressing the complex processes of climate change. When I asked for clarification about the rationale behind this decision, Ann responded:

> Just the [NGSS] standard, it's as important to learn the precursor ideas to be able to answer the

> questions about climate shifts and climate change than it is to talk about climate and… as I understand it, I was a middle school teacher, but as I understand it, the conceptual progression of learners is: younger kids are me, me and my family; older kids are me and the school or the neighborhood; older kids are more, and older kids are more, so to have K-5 kids look beyond their school… like I know they can, I've seen teachers do it, I've seen teachers bring water issues in Africa into a third grade classroom, but is that… is that super important? Maybe. Or, is it super memorable? Maybe…

In this excerpt, Ann described how the Next Generation Science Standards (NGSS) scaffold the development of "precursor ideas" in the elementary years (e.g., local observations of weather patterns over time) rather than focusing on climate change as a global phenomenon. She also referred to child development frameworks describing the broadening scopes of concern that children embody at different ages. Although distinct from Morgan's statements about limited scopes of influence, Ann shared related considerations of young children's conceptual awareness expanding gradually as a developmental progression. She expressed uncertainty about the appropriateness and relevance of introducing distant issues to elementary students. Instead, Ann centered elementary climate learning on establishing foundational scientific understandings to prepare for later engagement with the complexities of changing climate systems.

These three tensions represent a few of the threads that emerged in recent conversations about developmental appropriateness within the ClimeTime network. Similar questions also arose in previous years of network activities, but remained at a relatively abstract level and did not explicitly address the needs of the youngest learners. In 2020-21, following Pranjali's presentation about the STEM Storylines and the December webinar on elementary climate learning, this sustained interest led to subsequent topical webinars to brainstorm relevant climate change phenomena across the grade bands, followed by a presentation at the March convening by the nonprofit Talk Climate about age-appropriate strategies for talking with children about climate change. In 2021-22, network leaders invited Pranjali and me to share

insights from our research collaboration at a network meeting and facilitate another conversation on this topic with educational leaders. Across these small-group and full-network encounters, participants' expression of complex nuances and uncertainties in their concerns, their eagerness to engage in extended discussion, as well as their openness to wrestle with different perspectives all reflect the need for ongoing dialogue about these issues. These network events created space for educational leaders to participate in shared sense-making, to be influenced by multiple stories and voices, and to critically reflect on their own pedagogical assumptions and practices.

Echoes of These Tensions in Systems of Environmental and Climate Education

The tensions articulated by these ClimeTime participants resonate with the pedagogical principles that David Sobel and other environmental educators advocate for, which revolve around the core idea that "what is important is that children have an opportunity to bond with the natural world, to learn to love it and feel comfortable in it, before being asked to heal its wounds" (Sobel, 1999, p. 10). He proposes three stages of developmentally appropriate environmental education: focusing on empathy in early childhood, exploration in the elementary years, and social action in adolescence (Sobel, 1999). Sobel urges educators to focus on young children's access to firsthand experiences in nature and ability to build relationships with their local places rather than exposing young learners to environmental challenges, particularly those that are distant and abstract, which can lead to anxiety, fear, despair, and dissociation. Similarly, some ClimeTime participants shared concerns that prematurely burdening young children with the responsibility to understand and solve daunting environmental and climate crises is unfair and could alienate learners from building caring connections with local ecosystems. Some participants also echoed Sobel's concerns about young children's limited scope of control and agency in addressing large-scale or faraway global issues.

In addition to the conversations about these tensions during the November ClimeTime convening, the December topical webinar, and in individual interviews with educational leaders, similar concerns about developmental appropriateness also frequently arise in Pranjali's interactions with teachers in

Southwest Washington. In a research check-in meeting, Pranjali shared that teachers sometimes feel surprised and dismayed by the complex, serious topics that Pranjali addresses in the elementary STEM Storylines, including sea level rise and erosion, deforestation, and habitat loss. In making sense of the responses to her STEM Storylines work from educational leaders in the ClimeTime network, Pranjali reflected that the uncertainty and discomfort they expressed about what young learners can handle, and the desire to wrestle intentionally with these tensions, resonated with broader discourse patterns she has experienced.

These stances are often consciously informed by Sobel's pedagogical principles and the concept of ecophobia. During the individual interviews and group conversations, several ClimeTime participants explicitly referred to this literature in explaining their viewpoints. For example, Dylan said during our first one-on-one conversation:

> ...within the environmental education field, we have seen over the years the ways in which we can end up start talking about crisis and talking about disasters and that what that does with kids and adults and everybody, from what I've read, is not create a sense of 'let's solve this' but create a sense of fear of the environment and pull-back from the environment. [...] And, so I think a big part of my thinking for quite a long time has been like, I don't wanna create more ecophobia, right? I wanna focus on those connections and the good things and the hope, especially in the younger ages, which we typically work more with.

Similarly, Morgan shared during our second interview:

> I guess I would say that the biggest influencers for me in thinking about this... [...] to me the crux is around David Sobel's work around ecophobia and, if we introduce children to problems of scale that are too large for them to really have an obvious hand in fixing, or that are too far away for them to connect to directly, that that can create this kind of backlash syndrome where people feel overwhelmed by environmental problems and just would rather forget that they're happening, which is easy enough to do, really... So, for me, the focus for a long time has been on thinking

> about developmental appropriateness. The other place where I see this really clearly is in the Guidelines for Excellence from NAAEE [North American Association for Environmental Education], and what K-12, what learners should know and be able to do in 4th, 8th, and 12th grade, and then again in the Next Generation Science Standards, where climate change doesn't come into play until middle school.

Dylan and Morgan situated their own thinking within the influence of David Sobel and other environmental educators who express concerns about the developmental appropriateness of discussing environmental challenges with young children. These excerpts indicate their familiarity with Sobel's ideas and their implementation of pedagogical practices in alignment with Sobel's design principles.

In this reflection, Morgan also positioned these stances in relation to standards within the fields of environmental education (NAAEE Guidelines for Excellence) and K-12 science education (Next Generation Science Standards). Indeed, the structure and content of NAAEE's K-12 Guidelines, which set learning targets for fourth, eighth, and twelfth grade environmental education, seem to resonate with the developmental framings espoused by Sobel and other educators. For example, in the guiding principles at the beginning of the standards document, the authors assert that "instruction should be guided by the learner's interests and treated as a process of building knowledge and skills *appropriate for their developmental level* [emphasis added]" (NAAEE, 2019, p. 15). This focus on age-appropriateness is also present throughout the K-4 benchmarks, which frequently mention local environmental topics and individual actions and responsibilities. One learning target suggests that educators "give examples from situations over which [students] have some control (for example, in the classroom, at home, or in the community) and that are appropriate to their level of understanding and ability" (p. 39).

Developmentalism is even more central in the Guidelines for Excellence for early childhood environmental education, in which "Developmentally Appropriate Practices" are named as a key characteristic of high-quality programs and educators' application of ideas by theorists like Dewey, Piaget, and Vygotsky is highlighted as an indicator of quality (NAAEE, 2016). In connecting personal

commitments to the frameworks created by this professional organization, Morgan indicated that these developmental progressions — for example, building children's sense of ecological connectedness and wonder before asking them to respond to serious environmental issues — are broadly affirmed within the field of environmental education.

Morgan also mentioned the Next Generation Science Standards, a guiding document within the field of science education, as an important source of insight about how to approach environmental and climate learning across ages and grade levels. Similarly, in the excerpt shared above, Ann connected her focus on "precursor conceptual ideas" in the elementary years to NGSS recommendations regarding young students' foundational knowledge and conceptual progressions. In the November convening and December topical webinar as well, several participants cited NGSS in rationalizing a focus on "climate science" rather than "climate change" in the elementary years — for example, by noting that the term "climate change" is not mentioned in the science standards until the middle school grade band.

ClimeTime participants' references to educational standards, professional guidelines, and scholarship in the field seem to indicate a belief that these developmental principles are "best practices" that are universally applicable to all learners. In contrast, these bodies of knowledge are socially constructed and shaped by the specific subjectivities, positionalities, and worldviews of the researchers, policymakers, and educational leaders who contribute to them. The writing processes for the framework documents are attuned to this reality to some extent: for example, the NAAEE Guidelines are co-created by educational professionals from different settings and institutional affiliations and iteratively refined through public feedback cycles to incorporate a breadth of perspectives (NAAEE 2016, 2019). However, there is little evidence that authorship teams were assembled with direct attention to equitable participation of marginalized racial or cultural communities and incorporation of non-dominant communities' knowledges, sense-making practices, and lifeways. This inattention is a serious shortcoming given the persistent under-representation of global majority populations in mainstream environmental organizations in the U.S., particularly in leadership roles (D. E. Taylor, 2014a, 2015,

2021). This lack of representation is also a challenge within the ClimeTime network itself, in which the majority of the participating educational leaders are white and many come from a middle-class background.

As CRT scholars demonstrate, “majoritarian storytelling” in educational systems is generated from positions of institutional and systemic power that privilege white, upper-middle class, Euro-Western worldviews while failing to include the perspectives of the global majority and other intersectionally marginalized communities (Solórzano & Yosso, 2002). As such, mainstream scholarship and professional guidance documents do not necessarily account for the experiences and well-being of all children, particularly those with non-dominant identities. Claims of uniformity, normativity, and universality work to invisibilize onto-epistemic and axiological heterogeneity and reinscribe the entrenched dominant discourses about young learners that “control the borders of acceptable meanings and meaning-making practices” (Bang et al., 2013, p. 303). By excluding the lived experiences of marginalized students, educational systems fail to fulfill their purpose of supporting young people in making sense of their lifeworlds, present realities, and possible futures.

Concerns about ecophobia and related assumptions about developmental appropriateness appear frequently — in individual and group sense-making, in research literature, and in educational standards — and can be understood as settled expectations within the fields of environmental and climate education. These assumptions include both onto-epistemic (What ways of thinking, learning, doing, and being are young children capable of?) and axiological (What *should* we talk about with young children? What is important or valuable for them to understand and experience?) dimensions, and influence how educators design and facilitate environmental and climate learning experiences in their various contexts. While these patterns and tendencies arise from well-intentioned considerations for young children’s well-being, I argue in the following sections that they can function to prioritize the well-being of children with dominant identities over those that are systemically marginalized and to restrict the expansive sense-making experiences that all young learners are able to access.

In reflecting on the conversations about the STEM Storylines during the November ClimeTime meeting, Pranjali identified the tensions that emerged as a space of onto-epistemic conflict. She shared:

> I felt really, I didn't feel personally attacked, but I was like, wow, this is a real clash of epistemological perspectives. It's a real clash between my experience and my perspective and somebody else's and it's hard to… it took me a while to process it.

The pervasiveness of discourses of developmental appropriateness in mainstream environmental and climate education reflects the need for counter-storytelling to amplify non-dominant onto-epistemic and axiological perspectives. My hope in sharing these stories is to support continued deep engagement with these tensions and invite us as environmental and climate educators to collectively call into question our assumptions about what young children are capable of and what our responsibilities are as adults and as educators.

Counter-Storytelling to Desettle the Settled Expectations of Appropriateness

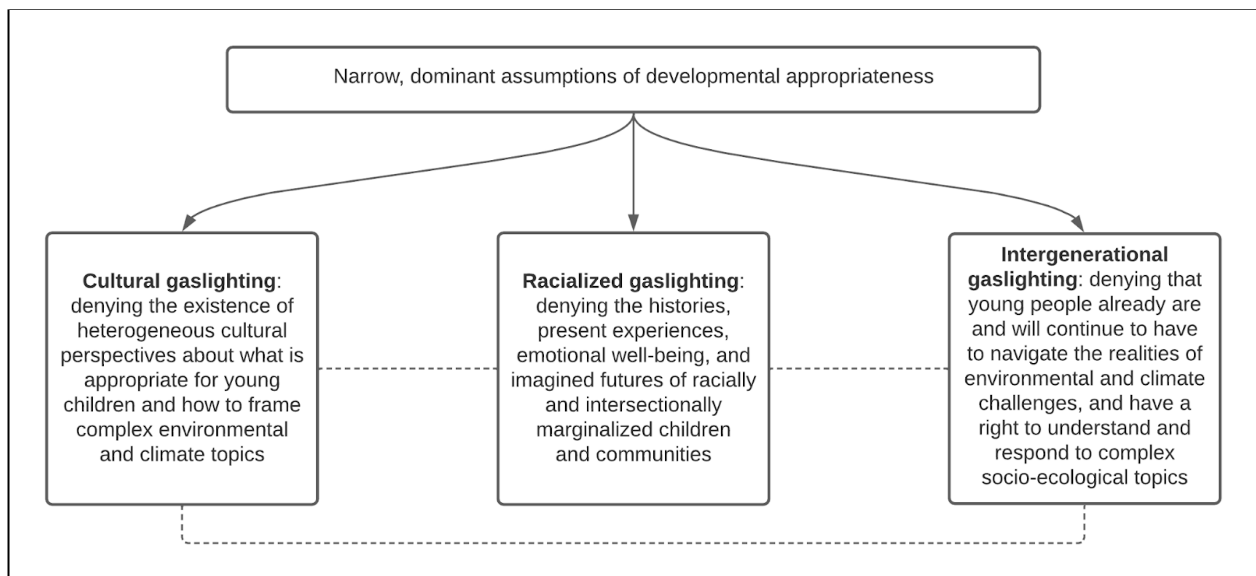
In the next sections, I share counter-stories from Pranjali's lived experiences as a mother and a woman of color to foreground how conflicting onto-epistemic and axiological viewpoints are rooted in our different positionalities and lived experiences. Using counter-storytelling as a methodology, I interweave these narratives with conceptual insights from scholarship in early childhood education, asset-based and critical pedagogies, science education, and environmental education to clarify how personal experiences reflect and relate to sociopolitical analyses (Solórzano & Yosso, 2002). As Solórzano and Yosso highlight, counter-stories can "challenge the perceived wisdom of those at society's center by providing a context to understand and transform established belief systems" (p. 142). Although the critical conversations and storytelling described here were initially sparked by discussions within the ClimeTime network, our focus is on desettling how developmental assumptions manifest in educational, caregiving, and other social systems more broadly.

In this context, I demonstrate how the "perceived wisdom" of developmental appropriateness discourses often comes from positions of power and privilege, which invisibilizes and harms marginalized

communities. To critically analyze these injustices, I leverage the concept of *gaslighting* to characterize behavior, enabled by a differential of sociopolitical power, that intentionally or unintentionally leads someone to doubt their own realities and emotional experiences (Stark, 2019; Sweet, 2019). In the following sections, I describe three forms of gaslighting (see *Figure 3*). I first share how onto-epistemic narrowness and the persistent whiteness of environmentalism and environmental education gaslight learners and communities with non-dominant cultural identities (*cultural gaslighting*). I then explore how beliefs about young children's innocence and need for protection are racialized constructs that gaslight the lived experiences of marginalized students (*racialized gaslighting*). Finally, I critique how dismissal of children's concerns prioritizes adults' comfort over the psychological and socio-ecological well-being of young people and perpetuates intergenerational inequities and injustices *(intergenerational gaslighting*).

Figure 3

Three Forms of Gaslighting Resulting from Developmental Appropriateness Discourses and Practices



Counter-Storytelling Against the Onto-Epistemic Narrowness and Whiteness of Developmental Appropriateness Discourses

In direct contrast to the presumed uniformity and neutrality of developmental appropriateness discourses, counter-stories from Pranjali's experiences reveal the cultural specificity of what we as

educators consider appropriate and inappropriate and how we engage with challenging topics with young children. In a research check-in meeting just prior to the December webinar, Pranjali shared:

> I think it's a cultural construct of what is developmentally appropriate and what is not. So, I think it's something to consider when we're talking about teaching students from different racial, ethnic, cultural, linguistic backgrounds, right? Who is deciding what's appropriate and what's not? And whose voice is at the table, being able to help work through that cause I feel like different cultures have different ways of grappling with issues and talking to their kids about issues and I feel like some are maybe more open to discussing some difficult topics.

In this reflection, Pranjali connected the tensions about developmental appropriateness to the rich lineages of scholarship and examples of practice in the literatures of asset-based pedagogies, including *culturally relevant pedagogies* (Ladson-Billings, 1995) and *culturally sustaining pedagogies* (Paris & Alim, 2017). These frameworks emphasize the need to honor and support "linguistic and cultural dexterity and plurality" (Paris, 2012, p. 95). In these framings, classrooms and schools should not be spaces of assimilation into dominant cultural norms, but rather places where learners' heterogeneous cultural ways of knowing and being are explicitly uplifted. This includes, in this case, a variety of culturally situated perspectives about the appropriateness of particular content, framings, and practices within environmental and climate learning.

Pranjali also highlighted the role of power and privilege in determining which cultural perspectives are validated in learning environments. By asking "Who is deciding what's appropriate and what's not?" and "Whose voice is at the table?" Pranjali recognized that differential access to decision-making power and institutional processes prevents non-dominant cultural communities from shaping mainstream conceptions of appropriateness. In a separate research check-in meeting, Pranjali shared an example:

> So I think about some of our Indigenous students and communities, I know that they talk more openly about their relationship with nature, and deforestation, and damage to the environment,

> starting from a very early age, than what might be deemed appropriate by dominant culture. So it got me thinking about just… I saw like a little nugget of white supremacy culture in that criticism.

These examples help to clarify how the childrearing beliefs and practices in some non-dominant communities, in this case Indigenous communities, stand in contrast with dominant norms about how to approach young children's learning about complex socio-ecological issues. Decisions about what and how to share are not objective or neutral, but rather are situated within particular cultural worldviews. These conflicting stances show up not only in curriculum design and instructional practice, but in popular youth media and other forms of storytelling. Pranjali reflected on how culturally specific stories are another exemplar of these different onto-epistemic and axiological commitments:

> ...thinking back about some of the stories that I was told when I was a kid, with pretty gruesome details, that are just part of our legends and our mythology, and we tell those stories to our kids when they're really young and it's like, for someone to say like, 'Well, it's not developmentally appropriate,' that's culturally not okay. And so I thought about it that way too. And I know that, other cultures, similar situation, we just are exposed to things differently. We share things differently with our children. And it's not really a matter of developmental appropriateness... and it got me thinking about Disney, like I don't let [name of son] watch much Disney, cause I don't think much of it is developmentally appropriate, like he hasn't seen Bambi, I think Lion King is really traumatic, like the whole separation from the dad and the dad dying and stuff. And so it got me thinking, well would you have trouble with... cause I have an issue with Bambi, so we could argue about this real seriously. But the question is, I think we need to take a step back and I think more perspectives at the table would be important if we were to have a deeper conversation about this.

By contrasting Indian legends and myths with the plotlines of Disney movies, Pranjali connected her past experiences as a child with her current practices as a parent to demonstrate the contradictions within

dominant discourses of developmental appropriateness. She asserted that the logic of appropriateness could be used to condemn global majority communities' traditional storytelling practices, and that this is "culturally not okay." Pranjali then continued by naming the disturbing themes in popular forms of Euro-Western children's media, thus demonstrating the subjectivity of claims about developmental appropriateness and the hypocrisy of disparaging non-dominant cultural communities' stories.

These counter-stories highlight how settled expectations about developmental appropriateness work to impose white Euro-Western cultural norms and demand that global majority communities adopt the onto-epistemic and axiological commitments of white, upper-middle class worldviews. In this way, dominant discourses of ecophobia and appropriateness are a form of *cultural gaslighting* of global majority students and communities. By connecting this tendency to the concept of gaslighting, I emphasize how universalized developmental norms invisibilize the existence of heterogeneous cultural perspectives on what is "appropriate" for young children and how to frame these topics, thus harming learners and communities with non-dominant cultural identities and practices. In this way, cultural gaslighting is one outcome of the white supremacy and assimilationist practices that pervade U.S. educational systems (Alim et al., 2020; Warren et al., 2020). In order to desettle these entrenched assumptions, we must recognize that beliefs about appropriateness are not objective and universal truths, but rather social and cultural constructs. Then, in recognizing this reality, we should foreground the multitude of non-dominant cultural perspectives in conversations about appropriateness within environmental and climate education. These shifts are needed to confront the power imbalances that allow those in positions of privilege to determine what is appropriate for racially and culturally marginalized young learners.

This form of onto-epistemic privilege reflects the broader issues of the persistent whiteness of environmentalism, environmental ethics, and environmental education. In one of our research check-ins, Stacy shared how the commonly understood meanings of environmentalism continue to be dominated by white middle-class conceptions — for example, emphasizing individual choices and consumer behaviors

like recycling and driving a hybrid car. Stacy described how these narrow definitions of what it means to be an environmentalist contribute to an exclusionary "assumption that people who are interested in environmental ethics and environmental education come from a certain kind of cultural worldview." This narrowness of perspective and practice translates into approaches to environmental education by shaping how environmental and climate topics are discussed and what histories, narratives, and practices are seen as relevant to children's socio-ecological learning. Stacy reflected that although these narrow forms of environmentalism seem outdated, they continue to inform environmental education organizations' design and facilitation of learning experiences. In a later conversation, Pranjali elaborated on this idea with stories from her own cultural community:

> ...I remember at the meeting we had, someone saying 'Well, you know, if a family is not having enough money and is barely having money to purchase food, then is it fair to be asking the kids to think about recycling and environmentally friendly practices at home?' And I think that's a really… that's not what environmentalism really is, so I think bringing in the intersectional-ness of environmentalism would help people to understand that it's really not about developmental appropriateness, but it really is about Western perspectives being valued more than others, because talking about recycling, I'm sorry but that's not really environmentalism, right? Like in my culture, we didn't talk a whole lot about recycling, but we have a goddess that's the earth goddess, and we were talking about respecting your mother, she's a goddess, she's a mother. And that can happen… those conversations about the environment can happen with any population of students, regardless of their class or their ethnicity, so… I think white folks have really dominated this environmentalism space, and it's just really hard to deconstruct that.

Pranjali highlighted how onto-epistemic exclusion and appropriateness discourses operate to restrict possibilities in environmental and climate learning. Pervasive whiteness and corporate influence in mainstream environmentalism often prevents educators from thinking beyond individualistic white middle-class practices like recycling and buying organic food. This narrowness of perspective in terms of

what qualifies as environmentalism then informs concerns that certain "environmentally friendly practices" are beyond the scope of control of young children, especially those experiencing poverty and those holding other intersecting marginalized identities. These dynamics connect with the previously described tension between the inadequacies and inequities of emphasizing individual action and the unfairness of asking children to take responsibility for making systemic changes. In this way, developmental appropriateness discourses are often both based on and perpetuate onto-epistemic narrowness in understandings and practices of environmentalism.

By sharing her counter-story about ecological relationships shaped by the cosmological beliefs of a non-dominant cultural community, Pranjali emphasized why intersectional environmentalist perspectives are urgently needed to honor the breadth of ecological relationships and practices and hold space for onto-epistemic heterogeneity (L. Thomas, 2022). Given the longstanding and current whiteness of the field, learners from global majority communities may feel alienated by narrow conceptions of environmentalism that invisibilize their own culturally resonant forms of ecological caring. These limitations harm all learners, including those with dominant cultural identities, by constraining the ways that young people are invited to cultivate and deepen their own ecological understandings, relationships, and practices.

Counter-Storytelling Against Racialized Innocence and Invisibilization

Developmental appropriateness discourses reflect not only the power and privilege of dominant onto-epistemic perspectives, but also power and privilege related to how consequences of environmental damage and climate change are unevenly distributed across communities. The tensions expressed by ClimeTime network participants, and echoed in mainstream environmental education literature, reflect a desire to protect young children from premature exposure to challenging realities. However, substantial research indicates the disproportionate impacts of environmental- and climate-related harms on communities of color, immigrant communities, communities experiencing poverty, and other intersectionally marginalized frontline communities (Alvarez & Evans, 2021; Gordon et al., 2010;

Grineski et al., 2017; Lakhani, 2019; Patnaik et al., 2020; D. E. Taylor, 2014b). In this context, the desire to protect children's psychological well-being by avoiding discussion of such issues often reflects the privileged perspectives of white and wealthy communities. During a December research co-design meeting reflecting on the November convening, Pranjali wondered:

> When we're thinking about developmental appropriateness, is it because this isn't something that a typical white middle or upper class family or student would be dealing with and so it's not developmentally appropriate, or is it actually not developmentally appropriate? Like talking about deforestation, I think they also mentioned deforestation, that's going to make [kids] so sad. Well, there's a lot of communities where there's literally deforestation happening in the backyard and there's changing land and things are changing before students' eyes and just to think that it's not appropriate to talk about that…

The idea of some students already being aware of environmental and climate challenges also emerged in an individual interview with Meredith:

> I think for a long time, there was this sense of like, kids are too young and you shouldn't introduce them to these problems until they've fallen in love with nature and understand why it would be worth protecting, and what I've noticed is that even in the past couple of years with ClimeTime, as the evidence becomes more and more pronounced and available and kind of in all of our faces... I mean, kids already know about climate change! And too, I think kids who live in impacted communities know that they're experiencing pollution, and they know that they don't have access to green space, and so this idea of protecting them from that information actually seems outdated to me.

Discussions about discourses of age-appropriateness recurred throughout the year in research check-in meetings with Stacy and Pranjali. In a conversation in February, Stacy again called attention to these dimensions of privilege and marginalization:

> When we're framing something as grade level appropriate, is that what we're really saying? Are

> we really saying that this is what learning experiences should look like because we're upholding this vision for [the] white middle class child and their experience in school, even though that's not addressing the needs and experiences of other students and youth, specifically Black and Brown students?

In these reflections, Pranjali, Stacy, and Meredith highlighted that many students are already aware of and experiencing the ecological, climate, and sociopolitical injustices that privileged communities designate as “inappropriate” to discuss with young children.

Socio-ecological harms are more urgent, visible, and connected to historical oppression in some communities than others, and marginalized communities’ conceptualizations of these harms often diverge from dominant perspectives. For example, centering the safety and comfort of white middle class children dismisses many Indigenous communities’ understandings of current climate change and environmental transformation not as new, unprecedented crises but as ongoing realities of settler-colonial violence and disruption of lifeways that have been imposed for generations (Callison, 2014; Whyte, 2018a, 2018d). In addition, climate-related displacement and migration are escalating realities impacting young people, families, and communities across regional and transnational contexts (Cho, 2021). These entanglements of power and positional privilege within discourses of developmental appropriateness resonate with Dr. Fikile Nxumalo’s (2019) characterization of children’s “asymmetric inheritances” of environmental and climate harms and the need to attend to learners’ “differential implicatedness and situatedness within anthropogenically damaged places” (p. 19). Given the global and interconnected nature of ecological and climate systems, all communities are impacted in some way — but communities that are least responsible for climate change are most affected.

Pranjali highlighted analogous asymmetries in conversations about race and racism. Educators often express similar concerns about the developmental appropriateness of discussing racial identities, racialization, and racial violence with young learners. However, these concerns can reflect the privileged stance of being able to *choose* not to engage with these topics. For many Black and Brown families,

systemic racism is an urgent and potentially dangerous reality that must be confronted, in part through open conversation with their children. Pranjali reflected:

> Like if you look at race, Black moms and dads have to talk really frankly and openly about race and violence and violence towards them, and one could say, 'Well that's not developmentally appropriate, talking to a five year old about being injured and killed possibly by the police.' Well, it actually *is* developmentally appropriate for that family to talk about that, because that is a reality they might have to deal with.

Here, Pranjali offered a critical reframing of "appropriate" to mean what is attuned to the lived realities of each child and family. Science education scholars have described how families in intergenerational learning spaces enact storytelling practices regarding topics that hold *social gravity*, meaning they are consequential for familial, cultural, and collective well-being (Tzou et al., 2019). However, due to power imbalances in environmental and climate education, and in education more broadly, appropriateness in schooling contexts is typically defined relative to a presumed norm of white middle- and upper-class experiences and fails to account for the concerns and considerations of families with marginalized identities. This form of invisibilization reveals the need for us as educators to critically reflect on questions such as: When we talk about appropriateness, which learners and communities are being centered? Who is involved in deciding what is appropriate and significant to discuss? Who is forced to confront environmental and climate realities and who gets to choose not to engage? When we refuse to address these topics, what conceptions of safety and well-being are we upholding, and for whom?

For Pranjali, her own positionality and childhood experiences, including her early exposure to unsettling ecological realities, closely inform her pedagogical commitments within environmental and climate education. Reflecting on the interactions with ClimeTime network members in the November convening, Pranjali shared:

> I was thinking more deeply about it and I think there wasn't enough time for me to really expand on some of my own positionality and some of what goes into my work, but… I'm not the

> traditional white middle class person and I've had a lot of experiences growing up, like as a kid, like as a zero year old all the way up till today, really, real intense experiences because I went to India for two months every year. And I've seen a lot of things at a very young age that I don't think your typical kiddo from Washington would see. Like I remember when I was five or six, we were walking and there was a really bad smell and my dad's like "Oh yeah, that's probably like a rotting animal or something." So we're like walking in India, we're walking, trying to get to the place we're supposed to go. And then the smell gets stronger and stronger and we finally get to this dead dog corpse. And it's covered in maggots, it's partially decomposed, and my dad was like, "Oh, look, the dog died and nobody took care of him after and now it's just kind of decomposing and that's what happens to animals." I could bring up like ten other things, but there's a lot of experiences that I've had, and just hearing some of the attitudes that I heard as far as developmental appropriateness... My concern to continue with that thinking would be, are you gaslighting certain cultures or certain people that have experiences that a certain dominating culture deems as developmentally inappropriate?

By sharing about how her childhood experiences visiting India shape her work as an educator and curriculum designer, Pranjali offered a counter-story that desettles dominant developmental appropriateness discourses in several ways. Firstly, concealing environmental and climate issues from young learners operates under the assumption that children otherwise wouldn't be aware of these issues. Pranjali's counter-story about an encounter that occurred when she was five or six indicates that, for at least some learners, this assumption is misguided. Pranjali's counter-story also calls into question the axiological implications of restricting children's learning using the logic of age-appropriateness. Displacing the commonly claimed ethical imperative to "protect" young learners, this counter-story suggests that *not* engaging with children's lived realities is a form of *racialized gaslighting*. With this conceptual framing, I call attention to how prioritizing privileged children's innocence and safety can result in the denial of the histories, present experiences, emotional well-being, and imagined futures of

racially and intersectionally marginalized children and communities.

Pranjali expanded on this idea later in the same conversation, reflecting that "there's a lot of gaslighting of cultural experiences and invalidation of our students' experiences that are just not called out in STEM education... like if I talked about that rotting corpse my teacher would have probably shut me down." Pranjali emphasized that these early formative experiences with "pretty gruesome stuff" influenced her STEM-related interest and identities in high school because she felt motivated to address the environmental challenges she witnessed. Discourses of appropriateness can, by dictating what should and shouldn't be discussed in classrooms, foreclose on opportunities to nurture learners' socio-ecological understandings, relationships, and commitments.

Through the erasure of lived experiences that are deemed abnormal or inappropriate, dominant assumptions about developmental appropriateness marginalize students and communities who experience these issues as daily realities. Nxumalo (2018a) similarly problematizes mainstream environmental and climate education that invisibilizes young children's experiences, asserting that "rather than focusing on a return to an idyllic nature and childhood relationship, what is urgently needed is climate change education for young children that is situated within the actual ecological contexts in which all children's everyday lives are situated." Nxumalo advocates for pedagogical approaches that authentically respect, validate, and respond to children's lifeworlds and concerns rather than projecting adult assumptions about childhood and children's need for protection.

In highlighting the attachment to "an idyllic nature and childhood relationship" in mainstream environmental and climate education, Nxumalo also critiques the pervasive influence of romanticized conceptions of children's relationships with nature, in which the innocent (presumed to be white) child plays and learns in pristine natural environments that are undisturbed by the corruptions of adulthood and society. These imaginaries, inherited from Euro-Western philosophers like Jean-Jacques Rousseau, William Wordsworth, and Henry David Thoreau, have long informed advocacy and pedagogical practice in mainstream nature-based education, particularly in the early childhood years (Nxumalo, 2019; A.

Taylor, 2013). Nxumalo and ross (2019), building with Robin Bernstein's (2011) concept of *racial innocence*, demonstrate how these powerful associations of childhood, innocence, and nature are constructed and reinforced in ways that exclude Black children, position Black childhoods and ecological relationships through deficit lenses, and frame "innocence as the exclusive possession of white childhood" (p. 504). In other words, there exists a historical and persistent ideological nexus of childhood, nature, whiteness, and innocence that excludes and dismisses the socio-ecological worlds and relationships of global majority and intersectionally marginalized children (Nxumalo & Cedillo, 2017).

In addition, discourses of childhood innocence are often used in early childhood education and early childhood environmental education to justify curricular and instructional avoidance of challenging topics like U.S. settler colonial violence against Indigenous communities (Nxumalo, 2016; Templeton & Cheruvu, 2020). Environmental education tends not to directly address "the interconnected effects of settler colonialism's Indigenous displacements and anthropogenic ecological damage" (Nxumalo, 2019, p. 91). Nature-based programs often engage with lands and waters as ahistorical and neutral places for children to discover rather than as contested entities with layered socio-ecological histories (Bang et al., 2014; Nxumalo, 2019). The apolitical ways that outdoor learning spaces are conceptualized and constructed often perpetuate existing inequities and erasures. Templeton and Cheruvu highlight how discourses of appropriateness and protection in early learning contexts center the supposed innocence of the white settler child, limit adults' ability to understand and support young children, and constrain children's possibilities for learning and becoming. Similarly, mainstream environmental and climate education often implicitly prioritize the psychological safety and well-being of white middle-class settler children as the assumed audience of curriculum and instruction.

Racialized language of innocence and appropriateness can be used to dispossess, marginalize, and silence youth with global majority and intersectionally marginalized identities in several ways. By restricting what is considered acceptable for young children to experience, educators position the privileged socio-ecological worlds of white middle- and upper-class children as normal, normative, and

desirable. Racially marginalized children are excluded from the protections of childhood innocence, while assumptions about appropriateness and inappropriateness continue to invisibilize their lived experiences. Desettling the settled expectations of appropriateness is crucial for confronting the dynamics of power and privilege in these discourses and engaging in axiological restorying about what it truly means to center learners' psychological well-being in environmental and climate learning environments.

Counter-Storytelling Against Intergenerational Privilege and Inequity

The concept of developmental appropriateness as a form of gaslighting is more broadly relevant as well. In the previous section, I focused on how appropriateness discourses and racialized conceptions of innocence protect white middle-class children while gaslighting children with non-dominant identities and their ecological realities. In this next section, I aim to challenge how intergenerational power, privilege, and inequities can also gaslight young learners, including those with dominant identities as well as those with marginalized identities. By sharing counter-stories from Pranjali's schooling experiences, I suggest that not supporting children to navigate their current and future worlds is a disservice and an ethical and intellectual failure of our educational system.

In a research co-design meeting, Pranjali framed the avoidance of challenging topics as a form of deception:

> You know, there's a way that children need to be equipped with some of those skills to be able to navigate that process of understanding what's happening to their planet, you know? It's like really… it's terrible, and it's constant, and it's not stopping, it's only getting worse, you know? And you know, in some ways if we don't prepare kids for that reality that's gonna be around them, like it already *is* around them… then we just lied to them, right? We've just hidden things and lied to them and not prepared them to actually be healthy, right?

In a later conversation, Pranjali elaborated on how her commitment to transparency with young learners is connected with her personal experiences of feeling misled by her education. She shared an example:

> But don't our kids have a right to know? Like, this stuff in the Amazon was happening when I

> was a kid, Chevron just going in and destroying the communities there, and people are still suffering from terrible diseases from the pollution in that area and it was going on when I was a kid, and I had no idea, we were still talking about Exxon Valdez. And I just felt really angry like, why didn't I learn this in science class? Why don't I know this? I'm 31 now, and *now* I'm learning about it. And it's just like, our students should not be lied to, they need to know what's going on…

Pranjali juxtaposed two corporation-caused environmental crises that occurred when she was a student: the smaller-scale Exxon Valdez oil spill in 1989 and Chevron's decades-long dumping of billions of gallons of toxic oil waste in Ecuadorian rainforests. She emphasized feeling angry and deceived that conversations in school focused solely on Exxon Valdez and failed to inform her about larger-scale ecological catastrophes. In specifically questioning why these events were not discussed in science class, Pranjali linked children's right to know about serious environmental harms to science educators' professional and pedagogical obligations.

Pranjali explicitly made this connection to the cultivation of scientific literacy in a later conversation, asserting that "if you're teaching STEM and science and you're not talking about climate justice, you're not actually teaching, you're not promoting STEM literacy, which is students being able to actually engage in the world." This definition of STEM literacy includes not just scientific practices and concepts but the ability for children to actively participate in and shape their worlds. Pranjali clarified that this includes not just preparation for future engagement with "the world that's out there," but navigation of their *present* realities and "the world that they're a part of." This represents an important shift from dominant beliefs that science learning should equip children for their *eventual* entry into civic participation and its accompanying responsibilities. This transformation of the purpose of education, and specifically of science learning, requires educators to honestly address "issues that are real" and support learners in wrestling with complex social, environmental, and climate challenges.

This pedagogical and intergenerational obligation is not only related to the project of STEM literacy, but also to young learners' emotional and psychological well-being. A central dimension of

supporting children to navigate their current realities is honoring and responding to the environment- and climate-related emotions that young people are experiencing, including anxiety, despair, rage, fear, and grief. As Meredith highlighted in our individual interview, "kids already know about climate change!" Youth are exposed to these realities through direct or familial experiences, emergency alerts during extreme weather events, news coverage and social media, peer conversation, and other sources. If many children are already aware of environmental and climate issues, refusing to engage with their concerns can heighten their emotional distress. Pranjali shared that "it goes to the idea of gaslighting where if the children are feeling that normal response to bad things happening, you wanna help them to talk through it, understand..."

If educators don't validate students' emotional realities, children may experience dissonance between their own firsthand perceptions and the messages they receive from authoritative sources like adults, school curriculum, and educational institutions. Stacy compared young learners' understandings of environmental and climate injustices to their emerging perspectives on race and racism. In her previous work as an elementary teacher, Stacy noticed that students, including white children and children of color, often repeated narratives they were taught about racism no longer existing in the U.S. after the civil rights movement. Stacy emphasized that these stories may not align with students' own experiences of racialization:

> And it's the same kind of thing of like, it's then helping them like… I'm sure many of those kids have experienced racial injustice, and have felt it, and have witnessed it, and then to be living in this world where they also think 'And yet I'm being told that that's not what's happening in the world anymore.'

In response, Pranjali clarified how this denial of children's realities causes psychological harm:

> It's like internalized oppression, it's like you internalize it to the point where you become… it's hard, I totally understand what you're saying, it's gaslighting the kids too, it's just like totally, *totally* dismissing their reality that they live in, you know? And that in itself can cause so many

> psychological problems, right? Identity development issues and… [...] You know, if you're gaslighting them and you're not acknowledging what they've gone through and what they continue to go through, and what strength they have…

With racial issues as with environmental and climate topics, the messages that adults provide are often barriers to young learners' ability to authentically make sense of socio-scientific challenges. These misleading messages might include dismissal of ecological and climate crises as "not that bad," or assurances that adults are taking care of the issues, or the silences when adults avoid discussions about these topics altogether. These narratives are a manifestation of *intergenerational gaslighting*, in which adults prioritize their own comfort rather than children's psychological and emotional well-being and emerging understandings of complex socio-ecological topics. Intergenerational gaslighting may lead young people to mistrust adults' values, judgment, and leadership — an impact that has been clearly conveyed in the statements of youth climate activists like Greta Thunberg and Xiye Bastida who critique adults' non-committal efforts at social transformation (Guardian News, 2019; TED, 2020). This form of gaslighting also forecloses on the possibility of multigenerational and collective political action toward more just socio-ecological futures that is rooted in adult allies' sustenance and amplification of youth leadership.

In several conversations with Stacy and Pranjali, they emphasized that young people have a "right to know." This right, and adults' corresponding responsibilities, seem to align with the concepts of *intergenerational equity* (Mbeva, 2014) and *intergenerational solidarity* (Mary Robinson Foundation, 2013). Intergenerational equity refers to "fairness between generations" and the idea that "all generations are partners caring for and using the Earth" (Weiss, 2008, p. 616). This framing has become increasingly prevalent in international climate change litigation, especially in cases involving youth climate activists (Slobodian, 2020). Importantly, many advocates for intergenerational equity highlight the crucial role of youth involvement and leadership in climate-related decision-making in order to ensure fairness across generations. These articulations of youth rights resonate with pedagogical commitments to meaningful

participation, educational dignity, social dreaming of just futures, and humanization within and through learning interactions "that recognize and cultivate one's mind, humanity, and potential" (Espinoza et al., 2020, p. 343).

For educators, the principles of intergenerational solidarity and educational dignity suggest an important set of ethical responsibilities. Intergenerational equity involves not just creating a livable world for future generations, but actively preparing young people to live in the worlds they currently inhabit and will inherit. Meredith introduced this framing in a research co-writing meeting, connecting it to the idea of children's rights and asking "If this is the planet that children are inheriting, don't they have a right to know?" She continued:

> I mean, I think it starts with [within-generation] privilege in not confronting these issues, and that is true. And I think, you know, you could also say it's actually a fundamental right to understand that… I wanna say, like… older generations have really fucked things up for you. I mean, you know, it's not pretty on a Friday, but it's just like, don't kids deserve to be prepared? I mean, all kids?

Meredith leveraged the concept of fundamental rights to describe children's access to accurate knowledge and adults' obligations to facilitate their understanding. By comparing this responsibility to the existence of privilege within generations, Meredith highlighted that dynamics of power, privilege, and inequity are in play intergenerationally as well. Whereas (some) adults can (to some extent) choose to avoid the realities of climate change, *all* young people will be forced to navigate increasingly severe climate impacts. Therefore, a crucial aspect of moving toward justice and dignity is designing educational systems in which current and future generations of children and youth are equipped to live and thrive in changing ecological and climate contexts. Realizing this vision of intergenerational equity and solidarity requires adults, especially educators, to move beyond the tendencies of intergenerational gaslighting.

The critiques and counter-stories offered here aim to problematize how settled expectations about developmental appropriateness work to invisibilize and oppress non-dominant cultural communities

(cultural gaslighting), intersectionally marginalized frontline communities (racialized gaslighting), and any young people who are wondering about environmental and climate impacts (intergenerational gaslighting) (see *Figure 3*). Given the heightened pace and effects of climate change in recent decades and the increase in children's access to information about socio-ecological issues, mainstream assumptions about ecophobia and age-appropriateness seem extremely outdated. These changing dynamics require us to create spaces of expansive onto-epistemic possibility in which children's heterogeneous culturally situated ecological relationships, stories, and practices are truly embraced and honored. They also invite us to reconsider and transform our axiological assumptions about the purpose of science learning and how it can center the experiences, expertise, and thriving of students and communities who are already navigating shifting environmental and climate realities and will continue to do so.

Moving Beyond the Tensions and Binaries of Developmental Progression Logics

Frameworks of developmentally appropriate practice — including "developmental trajectories" and "progressions," assertions about young children's "readiness" at different "stages," and recommendations of "best practice" — have long informed pedagogical approaches and standards in early childhood education, environmental education, and science education. Many scholars critically analyze how these frameworks implicitly or explicitly claim to be neutral and universal but are grounded in child development research conducted primarily with Western, highly educated, industrialized, rich, and democratic (WEIRD) populations (Henrich et al., 2010; Souto-Manning et al., 2019). By centering white, Euro-Western communities, developmentally appropriate practice dismisses the socially and culturally situated nature of children's learning and development, erases the dynamic influences of inter- and intra-cultural heterogeneity, and invisibilizes non-dominant cultural ways of learning, knowing, and being (Bang, 2015; Souto-Manning & Rabadi-Raol, 2018). As a result, the logic of normative developmental stages has often been used to perpetuate colonial "epistemic superiority" ideologies about marginalized racial and cultural communities and their ways of knowing and being — for example, Vygotsky proposed

that Indigenous children are supposedly incapable of abstract conceptual reasoning and are therefore less sophisticated than Euro-Western children (Bang, 2017, p. 125). For these reasons, Souto-Manning and colleagues (2019) urge early childhood education to "more fully interrogate the theoretical centrality of Whiteness to its conceptualizations of developmental appropriateness or quality teaching practices" (p. 264).

These shortcomings of developmentalism are reflected in the tensions of early childhood and elementary environmental and climate learning described at the beginning of this chapter. In many ways, what underlies these tensions are deficit-based underestimations of children's abilities rooted in the over-generalized developmental theories of researchers like Piaget and Vygotsky. For example, Sobel (1999) asserts that young children are not yet able to enact abstract reasoning and should not be asked to learn about global issues beyond their scopes of cognitive ability and control because "asking young students to study ecological problems before they have developed the power of abstract thinking invites them to draw oversimplified conclusions" (p. 28). This pedagogical stance was echoed by some ClimeTime participants in the network convenings and individual interviews. Similarly, the tension between individual responsibility and systemic change seems to presume that young children are not ready to understand and take action within complex systems. However, dominant developmental progressions fail to account for cultural variation in children's onto-epistemic practices and more recent research about young learners' ability to engage in complex socio-ecological reasoning, especially when intentionally supported by adults or peers (Bang et al., 2020; Learning in Places Collaborative, 2018; 2020).

In addition, as I demonstrated in the previous sections, developmental logic is often used to curtail students' learning opportunities, gaslight their lived realities, and reinscribe interconnected systems of oppression. Through cultural, racialized, and intergenerational gaslighting, developmental appropriateness discourses re-establish boundaries around what is considered normal and normative and exclude individuals, communities, and experiences that are positioned beyond these boundaries (Nxumalo

& Adair, 2019). This form of othering occurs in environmental and climate education contexts through assumptions about what counts as "normal" and "appropriate" relationships with the natural world (Nxumalo, 2019; Nxumalo & ross, 2019). For students with marginalized identities and experiences in particular, this adds the harm of erasure to the existing harms that students and their communities are often experiencing due to systemic inequities and injustices. As educators, we need to disrupt the ways that settled expectations about age-appropriateness regard young children through deficit lenses and place learners in "untenable epistemological positions" (Bang et al., 2013, p. 304) in which their lived experiences are dismissed and invisibilized in learning environments.

Centering Non-Innocent Caring Relationships and Practices

As environmental and climate educators, we must move beyond developmental logics and the tensions, either-or binaries, and restrictive progressions they create (e.g., "children must *first* see the value in local places… *then* take action to solve problems"). Current frameworks within environmental and climate education often emphasize the cultivation of young children's caring relationships with their local places, a pedagogical aim that I resonate with and recognize as deeply important for our collective socio-ecological well-being. However, in this section I suggest that we should reframe and transform our understandings of care and relationality in order to honor children's complex and non-innocent lived realities.

Researchers and practitioners often discuss the central importance of social-emotional dimensions of environmental education in the early childhood and elementary years. For example, Sobel (1999) urges educators to prioritize the affective relationships that children build with local environments, beings, and ecosystems, worrying that "we are trying to invoke knowledge, and responsibility, before we have allowed a loving relationship to flourish" (p. 10). For Sobel and other environmental educators, ecological commitment should begin close to home and gradually expand in scope during later childhood and adolescence. They emphasize that early exposure to the natural world is necessary for future nature-connectedness and environmental stewardship (Barrable, 2019; Mayer & Frantz, 2004). The

primacy of care and empathy was a focus in conversations with ClimeTime participants as well. For example, they emphasized the importance of children "understanding their inner connection with the ecosystem that they're in the middle of" (Dylan) and "falling in love with nature" and "coupling SEL with connection to nature and place" (Meredith).

In one of our research co-design meetings, Stacy reflected on how care is not just a pedagogical aim, but a strength of young children's ways of learning, knowing, and being:

> I think about young students, in particular, they care so deeply and their emotional connection to what they're learning is also a form of that engagement, right? And it's a real strength, I think, of working with young students. I think older students learn a little bit how to filter their care. There becomes this period where when you care really deeply about something, it makes you vulnerable to a certain degree, but young students don't yet have that filter. But still in our academic approach to teaching, we sometimes think that teaching should be objective and not connected to the heart and that caring. But by flipping that around and using that as a strength and an asset, you're creating that deep engagement for students.

Stacy emphasized that young learners are unique in their depth of emotional connection, which can be leveraged as an asset in learning. Pranjali agreed and shared how her six-year-old son often expresses this kind of intimate relationality with living beings and the natural world:

> When I tell him something, or he sees something bad, he feels hurt by it, like if he sees deforested trees that have been chopped off, he feels genuinely upset about it, it's like he's been hurt because the forest has been hurt…

These examples of young children's profound empathy and care resonate with broader pedagogical understandings and practices within environmental education.

I agree that it is absolutely crucial for young children to connect with their local places and ecological systems through firsthand experiences and to nurture their powerful capacity for loving relationality. However, I suggest that these emotional bonding experiences can be more authentic and

multidimensional when we as educators recognize that relationality is not pure, innocent, or always positive. Nxumalo (2016) clarifies how inviting children to connect with local places without honestly addressing the environmental damage, settler-colonial histories, and societal inequities that might be at play in those places is deceptive and privileges learners who have access to more “pristine” outdoor environments. These approaches can also implicitly reinscribe the assumption that some places — including more urbanized contexts or those that have experienced ecological harm — do not qualify as “nature” and are less worthy of our wonder, inquiry, and love. Instead, Nxumalo (2016, 2018b) proposes the pedagogical orientation of “refiguring presences” to support more non-innocent, holistic, and curious forms of child-nature relationality. For young learners, building a sense of care and awe does not need to be mutually exclusive with noticing challenges and harms, learning to understand them in nuanced and systemic ways, and taking action to create more thriving socio-ecological communities. When we as educators acknowledge that caring is not necessarily innocent, we are more able to attune to what children are actually experiencing, feeling, and wondering about, and to validate and respond to their concerns.

Young children have the capacity to engage thoughtfully with complex socio-ecological issues rather than with the simplistic and misleading positive messages that they often encounter in science learning contexts. In a co-design meeting, Pranjali shared about her experiences talking about social, environmental, and climate challenges with her son:

> I feel like people don't understand how deeply young children can engage in really deep and meaningful conversations about issues that are really serious. And you know, I don't even know if I would have really understood that, but I have a kindergartener right now, and we can go very deep, we can go for very long talking about things. And he can handle it, you know, he can handle it, and if he's getting that opportunity, then, to be able to talk through some of this stuff, all of our children should be given the opportunity to talk through some of this stuff.

Young learners carry rich and distinct lived experiences as well as culturally situated stories, ecological relationships, knowledges, and sense-making practices from their own family and community contexts.

Shifting our pedagogies to cultivate non-innocent care, liberatory environmental and climate learning, and the true brilliance of young learners requires us to critically rethink entrenched assumptions about children's abilities and transform how these assumptions shape our practice. When we desettle and disrupt the tendencies of cultural, racialized, and intergenerational gaslighting, we as educators are better equipped to honor young children's experiences and expertise and trust their ability to engage with complex socio-ecological challenges.

Although I disagree with the tendency to avoid serious topics to "protect children's innocence," I recognize the reality that children may experience intense emotional responses like anxiety, fear, and despair when learning about environmental and climate issues. For systemically marginalized communities in particular, emphasizing harms can reinscribe trauma- and damage-centered narratives if learning experiences do not also foreground resistance and liberation (Tuck, 2009). In other words, inquiry into ecological topics can be disempowering and oppressive for youth, rather than emancipatory, if not cultivated with care. As such, educators, educational leaders, and caregivers need targeted support in order to navigate these challenging conversations with young people and hold space for their emotionality. These learning and capacity-building processes should be deeply informed by the perspectives of youth leaders and should include opportunities for adult allies to process their own ecological emotions and experiences. Intentional framing, design, and facilitation of learning is critical for centering the thriving of learners and their communities and moving toward intersectionally just and justice-centered forms of environmental and climate education.

Counteracting cultural, racialized, and intergenerational gaslighting in learning environments requires critical reflection and concerted action to dismantle hegemonic structures and transform every aspect of our educational systems. For example, standards and professional guidelines in environmental, climate, and science education should be expansively reimagined to center onto-epistemic heterogeneity, intersectional environmentalism, learners' lifeworlds, non-innocent caring, and multigenerational socio-ecological thriving rather than the narrow prescriptions of developmental appropriateness. As

indicated by the ethnographic account of recent conversations within the ClimeTime network, problematizing dominant discourses and reshaping educational structures also necessitates creating spaces for educators and educational leaders to engage in sustained sense-making regarding these questions. In addition, curricular and instructional supports for educators are crucial leverage points to shift the moment-to-moment dynamics of learning interactions. In the next chapter, I explore how curriculum design can be a form of counter-storytelling that refuses the everyday enactments of harm and oppression that occur in classrooms and envisions more liberatory possibilities for shared meaning-making and collective action.

CHAPTER 3: DESIGNING INTERSECTIONALLY JUST AND JUSTICE-CENTERED ENVIRONMENTAL AND CLIMATE LEARNING WITH ELEMENTARY LEARNERS

In the previous chapter, I proposed that moving toward intersectionally just and justice-centered environmental and climate learning requires educators, educational leaders, and other adult allies to desettle our normative assumptions about developmental appropriateness in order to support young learners in engaging meaningfully with complex socio-ecological issues and cultivating non-innocent caring relationships in their local places. In this chapter, I build on these ideas by continuing to share counter-stories that suggest expansive, liberatory ways of understanding and learning alongside young children. At the same time, I explore the possibilities of curriculum design as another form of counter-storytelling that is necessary for dismantling the everyday ways that injustices occur within our educational systems, particularly during the early childhood and elementary years. Confronting the influence of historically entrenched power imbalances and systems of oppression in environmental and climate learning is crucial for authentically honoring and uplifting children's voices, experiences, and expertise, especially for learners with racially, culturally, and intersectionally marginalized identities.[14]

Science education is a site of inequity and erasure for many students, including through curriculum design. For example, science curriculum materials can be oppressive in how they position students as passive consumers of information rather than active agents, and in their insufficient level of intellectual challenge and relevance (NASEM, 2021). In addition, curricular choices can establish and maintain inequitable power dynamics between learners and teachers and exclude non-dominant knowledge systems, ways of knowing, and community-held expertise from school-based learning (Kumashiro, 2001; Medin & Bang, 2014). However, curriculum design can also be a context for supporting learner agency and a form of counter-storytelling in action — a leverage point where dominant tendencies are desettled and intersectional justice commitments are enacted.

[14] Some of the stories, examples, and themes in this chapter were previously shared in a practitioner-facing article co-authored by Pranjali and myself (Upadhyay & Han, 2021). The ideas have been iteratively and collectively refined through the research check-in and writing meetings within the case study collaboration.

Throughout this chapter, counter-storytelling toward more emancipatory teaching and learning practices is informed by multiple lineages of asset- and strength-based frameworks. Descriptions of robust learning through participation in everyday, familial, community, cultural, and other social contexts challenge deficit logics of education — for example, by highlighting cultural *repertoires of practice* (K. D. Gutiérrez & Rogoff, 2003; Rogoff et al., 2007) and *everyday cognition* (Rogoff & Lave, 1984). Asset-based models also include foundational work emphasizing *culturally relevant* teaching practices (Ladson-Billings, 1995), recognizing learners' *funds of knowledge* (Moll et al., 1992), and honoring multiple forms of *community cultural wealth* (Jiménez, 2020; Yosso, 2005), as well as recent articulations and embodiments of *culturally sustaining pedagogies* (Paris & Alim, 2017) and *culturally revitalizing pedagogies* (McCarty & Lee, 2014). Paris (2021a) reflects that "all work in these traditions seeks to dismantle deficit approaches so pervasive in the education of our young people and to instead critically center our strengths, our assets, our communities in teaching and learning" (p. 365). Though they illuminate different dimensions of what it means to center students' assets and strengths, these pedagogies are united by the urgent responsibility to respect and sustain learners' culturally- and community-grounded ways of knowing and being in and through learning environments. In parallel with these asset-based theories and practices, science education researchers and practitioners have also developed expansive pedagogies that aim to create continuity between classroom and community learning contexts, honor the culturally situated sense-making resources that students bring to science learning, and design learning that is transformative and liberatory for learners and their communities (e.g., Bang et al., 2017; P. Bell et al., 2012; Stromholt & Bell, 2018). These asset-based approaches to teaching and learning that value and uplift learners' and communities' brilliance are at the heart of the counter-stories and critical design moves described in this chapter.

Such intentional curricular and pedagogical practices are needed to enable young students to make sense of complex environmental and climate topics and practice taking action in their communities. In this chapter, I focus my analyses on the STEM Storylines, a collection of K-5 instructional resources

centering transdisciplinary sense-making and authentic problem-solving focused on real-world phenomena. The storyline approach to curriculum design prioritizes scientific inquiry that is coherent and purposeful from students' perspectives (Reiser et al., 2021). In southwest Washington, Pranjali engages in collaborative design and iterative feedback processes with elementary educators to create resources that adapt and augment the publisher-provided science kits that are utilized in the region. The Storylines are designed to support educators in navigating and dismantling the oppressive forces that often constrain early childhood and elementary science learning. Through emancipatory design principles and pedagogical approaches, curriculum resources can serve as an intervention and invitation for teachers to engage differently with environmental and climate learning in their classroom contexts. Importantly, these resources are complemented by sustained, responsive support of teachers in the region to enable these shifts in thinking and practice.

These curriculum development efforts emerged within the context of ClimeTime as a statewide initiative strengthening climate education and standards implementation. Although the project began prior to the legislative proviso, funding support through ClimeTime contributed to significant developments in the structure and content of the STEM Storylines. Specifically, whereas the early Storylines were narrowly focused kit adaptations, the ClimeTime-funded Storylines were a more substantial repurposing of kit materials into standalone curricular resources. In addition, Pranjali and the co-design teams began focusing more intentionally on connecting the Storylines to climate change phenomena. In these ways, the ClimeTime network opened up opportunities for the transformative design work that I will describe in this chapter. At the same time, this embeddedness within a state-level implementation context also enabled Pranjali and her collaborators to share justice-centered insights from the project more broadly and push on the thinking and practices of other educational leaders in the network, as outlined in chapter 2.

In addition to this implementation context, Pranjali's own dynamically shifting critical consciousness has shaped the creation of new STEM Storylines over time. Informed by her personal experiences and positionalities as well as by her engagement with critical education scholarship, Pranjali

identifies herself as a "social justice educator" and works to foreground equity and justice in her curriculum development and relational engagement with teachers. In several of our conversations, Pranjali reflected on her learning process of becoming less cautious about potentially provoking backlash, overcoming her fears of "framing things incorrectly" by deepening her own understandings about justice issues, and being more intentional in incorporating critical perspectives in the Storylines. Although her equity and justice commitments have always influenced her approaches to Storyline design, Pranjali shared that these commitments are a more explicit focus in the two new Storylines released in summer 2021, "Becoming Protectors of the Earth" (5th grade) and "We Are Wondrous" (2nd grade). In this chapter, I highlight the "Becoming Protectors of the Earth" Storyline as a focal example because it centers environmental and climate phenomena related to changing lands and waters, foregrounds the stewardship and care practiced by human communities, and reflects Pranjali's recent thinking, learning, and strategizing about intersectionally just and justice-centered teaching and learning.

In the following sections, I focus on three axes of oppression that often shape environmental and climate learning for young children: deficit logic, colonialism and white supremacy, and ageism and adult-centrism. These foci were selected based on themes that emerged during research check-in conversations, but are certainly interconnected with other dimensions of harm and violence including cisheteropatriarchy, ableism, linguistic supremacy, neoliberalism, capitalism, and more. For each of these structuring forces, I share stories from Stacy and Pranjali about how these inequities show up in their work supporting educators and learners and situate these stories within historic and systemic tendencies. I then suggest more emancipatory and just possibilities for each dimension, again clarified through excerpts from research co-design conversations, and exemplify these possibilities using examples from the STEM Storylines. In particular, I closely analyze the fifth-grade Storyline "Becoming Protectors of the Earth" and draw upon insights from a collaborative sense-making conversation with Pranjali focused on this Storyline. In addition, this chapter incorporates stories from three teachers in southwest Washington who have co-designed and implemented STEM Storylines, and who participated in a focus group in February

2021. These testimonies and reflections from educators start to pull into focus how counter-storytelling through curriculum design can shift the everyday experiences of teachers and students in elementary classrooms.

Counter-Storytelling Against Deficit Logic About Young Learners in Educational Systems

In chapter 2, I discussed how assumptions about age-appropriateness and developmental appropriateness are pervasive within early childhood and elementary environmental and climate learning contexts and critiqued how these assumptions can gaslight global majority learners and learners with other marginalized identities. In some ways, these discourses of appropriateness are just one example of broader, deeply entrenched deficit logics in our educational systems that position students with non-dominant identities as insufficient and incapable. Although this logic has shifted over time from explicit assertions of biological inferiority to more subtle assessments of cultural deficiency and difference, these claims remain common within popular discourse as well as educational practice and policy (Souto-Manning & Rabadi-Raol, 2018). For example, deficit-based judgments of children and families of color, multilingual families, and immigrant families begin in the earliest years with beliefs about word and language "gaps" and concerns about school "readiness" (Nxumalo & Adair, 2019). Nxumalo and Adair describe how these evaluations of young learners of color as under-prepared are associated with limitations on children's access to engaging and dynamic learning experiences in school that honor and nurture their brilliance.

In the next section, I demonstrate how deficit logic harms students, particularly those most marginalized by our educational systems, by restricting their access to intellectually challenging science learning opportunities. I then highlight how the STEM Storylines offer a counter-story against these tendencies by desettling the power dynamics in classrooms, reimagining the potential of students as intellectual agents, and centering authentic learning about scientific phenomena.

Naming how Deficit Logic Prevents Equitable Access to Intellectually Challenging and Meaningful Science Learning Experiences

Deficit-based thinking prevents young learners from equitably accessing intellectually challenging and meaningful learning in a number of ways: through deprioritization and over-simplification of science learning, through institutional-level disparities in resource allocation and science-related expectations, and through the tracking and exclusion of learners with marginalized identities. Although these forms of deficit logic may be subtle, they remain a salient source of oppression in children's schooling experiences.

Substantial research demonstrates children's ability to engage in complex scientific and socio-ecological reasoning from a young age (Bang et al., 2020; Learning in Places, 2018, 2020; NASEM, 2007, 2021). Despite these findings, persistent deficit logic and skepticism about young children's cognitive abilities that stem from maturational age-based frameworks of development (e.g., Piagetian stage theory) continue to be barriers to meaningful science learning in schools. Paired with the pressure to meet English Language Arts (ELA) and math standards in elementary contexts, these assumptions lead to deprioritization of science and, in many cases, a lack of coherent and challenging science learning experiences (NASEM, 2021). When science *is* included in early childhood and elementary classrooms, it often takes the form of decontextualized facts and activities rather than substantial opportunities for inquiry into real-world phenomena (NRC, 2000, 2018), thus falling short of the vision for science learning outlined in the *Framework* (NRC, 2012) and Next Generation Science Standards (NGSS Lead States, 2013). During a research co-design meeting, Pranjali shared how these tendencies show up in classrooms in southwest Washington:

> A lot of STEM and science is really… it's cutesy, it's like we're gonna do fairytale STEM, and we're gonna do little toothpick towers, we're gonna build… and so that's kind of a lot of the STEM that we see, but there's just this whole element of education that our kids are deprived of because they're not being engaged in the actual thinking about what's going on around them.

Pranjali reflected that STEM learning activities in early childhood and elementary classrooms are often hands-on and fun but contrived and disassociated from the real world and students' own lives. In another conversation, she described how teachers in her region of Washington often express resistance to the level of scientific complexity in the STEM Storylines by saying, for example, "My third graders can't do this, this is too hard for them." or "They can't do project-based science learning, they can't even read and do math." These concerns indicate how deficit mindsets about young learners are normalized and embedded within educational systems. While students are capable of deep, sustained scientific inquiry, they are often not afforded these opportunities due to both structural and ideological barriers.

In addition, systemic inequities and injustices exacerbate the insufficient instructional focus on science learning for students with marginalized identities. At the institutional level, schools that serve more Black, Indigenous, Latinx, Asian, and Pacific Islander children and more students experiencing poverty are less likely to prioritize science and have sufficient financial and material resources to support intellectually challenging science learning (Madkins & Morton, 2021; NASEM, 2021). In our meetings, Pranjali shared deep concerns about these problems of inequitable access for children of color, low-income students, and other learners with non-dominant identities. She described how districts that serve predominantly White middle-class families tend to provide ample time and resources for science learning because parents demand these opportunities and because students with privileged identities are less subject to deficit rhetoric, remedial pedagogies, and the pressure to narrowly focus on ELA and math learning. On the other hand, districts serving more children of color and low-income families tend to impose more rigid demands on teachers and students that restrict access to meaningful science learning experiences.

Pranjali emphasized that many teachers in these districts advocate tirelessly for their students and work to incorporate science into their classrooms despite these barriers. However, these teachers are forced to navigate structures and policies that de-emphasize science learning and, in doing so, reinscribe racialized and classist inequities. In our process interview conversation, Pranjali reflected on this issue of

educational injustice:

> It's a really serious justice issue. Places where there's students from marginalized populations, and places where there's generational poverty, it's just… the expectations are different, the rigor is different. If my kid can look at a bar graph of the temperature changing over time… it took him maybe three seconds to tell me what was happening in that graph. He gets a lot of support from me, I'm a huge resource for him, but I don't think there's any reason why kids can't get to that point with support from the teacher, you know? There's no reason why they shouldn't be able to get there. So I think that I really push back against deficit mentality and so it's hard for me because I don't think everybody is necessarily ready to hear that, and I think deficit ideology and deficit perspective has really, really really deep roots in a lot of our educational systems.

Pranjali clarified how young learners with socially and educationally marginalized identities encounter the consequences of deficit thinking in the form of lowered expectations about their intellectual capacities. These assumptions limit children's access to challenging learning opportunities and the scaffolding that would enable them to thrive within these meaningful forms of science learning. Importantly, Pranjali's belief in young learners' extensive capabilities is grounded in her own experiences as a parent, supporting her young child in complex scientific sense-making practices.

Along with institutional barriers, deficit-based logic also shapes student experiences at an individual level. Research indicates that children who receive academic support services tend to be removed from their classrooms during science learning activities (NASEM, 2021). This includes students with disabilities who receive services through their Individualized Education Programs as well as emerging multilingual students who have been designated as in need of language support. This pull-out tendency, though well-intentioned, reflects Nxumalo and Adair's (2019) characterization of how deficit-based assumptions about students' "readiness" can often constrain access to meaningful learning for children who are already marginalized within educational systems. Pranjali's understandings of how educational practices informally and formally track students and deny some learners access to scientific

inquiry are informed by her personal experiences in formal educational spaces. In co-design meetings, she shared how being labeled as an "English Language Learner" when she entered the California public school system prevented her from taking advanced math and science courses and eventually affected her ability to apply to particular colleges. Pranjali described how inequitable student experiences and outcomes stem from:

> ...people not understanding that if there's a kid that comes from a background that's different from theirs and has an experience that's different, there's just huge funds of knowledge there that we need to actually tap into instead of thinking of how that child is just not gonna get it and is not where they should be.

In this reflection, Pranjali highlighted the need to reframe students' perceived deficits as powerful assets for science learning rather than restricting their access to intellectually challenging educational experiences.

These overlapping factors of deprioritization, unequal resource distribution, and exclusionary practices result in disparate science learning expectations and support for students who are intersectionally marginalized. In critically analyzing these oppressive tendencies, Pranjali identified how educational systems are *designed* to prevent equitable access to authentic learning, engagement, and thriving. The deficit logic that underlies these policies, processes, and practices is deeply entrenched and pervasive. Pranjali reflected on how these discourses are normalized in the ways that educators and educational leaders think and talk about children, families, and communities. She described this deficit mindset as "the number one most difficult barrier to overcome" in her work because "it's so a part of the way we think about [learners], and historically thought about them, and continue to think about them." Deficit logic about young learners, especially learners with non-dominant identities, is a settled expectation within science learning and in our educational systems more broadly. Given the persistent barriers to meaningful learning that are created and maintained using deficit framings, we need to be

vigilant in naming, desettling, and dismantling these framings and moving toward more socially and educationally just understandings and practices.

Through her curriculum design and relational engagement with educators in the STEM Storylines project, Pranjali enacts counter-storytelling against these dominant narratives and practices to ensure all elementary learners have access to intellectually challenging science learning experiences. This involves directly confronting deficit logic and classroom power dynamics in order to recognize and position young learners as brilliant knowers and doers of science. In the following sections, I describe how the Storylines are an exemplar of elementary environmental and climate learning that is student-centered, asset-based, and authentic. These qualities contribute to caring and empowering learning contexts that nurture learner engagement, interest, and identity.

Designing Standards-Aligned Science Learning in the STEM Storylines

In a process interview early in our research collaboration, Pranjali emphasized the importance of access to NGSS-aligned learning as an issue of educational equity and justice and a priority in her creation of STEM Storylines. In describing her guiding principles for curriculum design, Pranjali shared:

> I think it's rigor connected to the Next Generation Science Standards. That's something that we try to not dismiss. So when I'm developing this, I look really really carefully at the NGSS, all of the performance expectations and then all of the evidence statements and really digging into the standards and really trying to make a concrete alignment to them. So I think that's a priority.

This design priority is reflected in clearly outlined connections to science and engineering practices, disciplinary core ideas, and crosscutting concepts at the end of each lesson, as well as suggestions for standards alignment and three-dimensional learning that are woven throughout the text of the Storylines. This clear and intentional focus on standards alignment in the Storylines is motivated by Pranjali's concerns about unequal opportunities for science learning experienced by children with marginalized identities. She emphasized:

> And the reason behind the rigor is, of course, all kids deserve and have the right to high quality

> three-dimensional NGSS-aligned STEM experiences. They have a right to that. As schools, we owe them that. It's our responsibility to provide that experience for them. So that's just a really simple issue of equity, making sure that all kids have access to this.

By evoking language of rights and responsibilities, Pranjali highlighted the urgency of ensuring NGSS-aligned science experiences for all students as a professional and ethical imperative for educators. Importantly, she clarified during co-design meetings that the standards are not objectively determined "best practices" or the end-all-be-all of meaningful science learning. Rather, they are and should be open to dynamic interpretation, critique, and expansion to more explicitly center equitable and just forms of science learning (e.g., Rodriguez, 2015). However, given the deprioritization of science learning for young learners, particularly those who are systemically marginalized and excluded in educational systems, broadening access to high-quality science learning is crucial. In reflecting on Storyline design processes, Pranjali expressed a clear purpose of shifting away from still-common approaches to classroom elementary science instruction that consist of decontextualized activities or step-by-step protocols by instead supporting educators to facilitate sustained, coherent, engaging, and adaptable learning experiences.

Engaging Authentically with Real-World Phenomena

In the STEM Storylines, Pranjali leverages Project-Based Learning (PBL) as a pedagogical model, including its crucial design elements of authenticity, exploration of a challenging problem or question, and sustained inquiry (Lucas Education Research, 2021). Importantly, the STEM Storylines focus science learning on real-world topics that are highly relevant to young learners. Pranjali highlighted how this remains an uncommon approach in elementary science curriculum, describing how other curriculum designers tend to use contrived problems:

> When they think early elementary STEM, they think fairy tales and gingerbread man and teddy bears and that type of topic. I mean, it's awesome and it's fun and it gets the teachers excited and it probably gets the kids excited too, but I have a really different approach to the Storylines that's

not, it's not so much like... juvenile, it's actually serious.

These dominant tendencies reflect the deficit logic that young learners are not ready to learn about authentic phenomena and respond to real-world challenges, a belief that continues to shape elementary science education despite decades of advocacy for contextual pedagogies. However, research continues to document how students are capable of complex scientific and socio-ecological thinking and practice rooted in community contexts, and that these forms of *consequential learning* are more meaningful for learners (Birmingham et al., 2017; N. R. Davis & Schaeffer, 2019; Hall & Jurow, 2015; Metz, 2008). In centering learning on consequential real-world problems in each STEM Storyline, Pranjali offers a counter-story for this settled expectation in elementary curriculum design and implementation.

Focusing on issues that are authentic and highly relevant to learners and their communities is especially crucial in environmental and climate learning. In a research co-design meeting, Pranjali emphasized the need to build young learners' foundational understandings of socioscientific phenomena, as opposed to waiting until middle and high school to suddenly introduce concepts like climate change. This pedagogical commitment is evident in the STEM Storylines, which scaffold learners' scientific knowledges and practices through focusing on local case studies of sea level rise, wildfires and air quality, and deforestation and habitat loss. The "Becoming Protectors" Storyline directly addresses questions about ecological harms, environmental stewardship, and adapting to climate change.

In addition to authentic topics of inquiry, the STEM Storylines support students to identify as scientists by learning from science professionals as well as sharing their learning with authentic audiences of peers, community members, and STEM practitioners. One of the second grade Storylines, "Why Won't Our Blueberries Grow?" features Shanelle Donaldson West, who is a Black agriculturist, food justice advocate, and co-founder of Percussion Farms. The Storyline invites learners to investigate genuine challenges that Shanelle encounters in her work as an urban farmer. In response to students' enthusiastic interest in engaging further, Pranjali connected educators in one school with Shanelle to host a video conference conversation with all of the second grade students. In many cases, Pranjali works in similar

ways to connect teachers with local community partners who can provide insights and feedback relevant to students' learning. In a research meeting, Pranjali reflected on the importance of building these relationships:

> One of the goals is to try to create more of a bridge between the STEM that's happening in the classroom and the STEM that's happening in the real world, and sometimes that is actually a connection, where we're helping to connect the students with someone who's doing the work that is similar to what they're doing in their project.

Building these connections between young learners and science experts enables students to recognize the relevance and importance of their inquiry, deepen their understanding of the central problem, and cultivate identities as members of a broader scientific community (Brown & Campione, 1994; L. M. Gomez et al., 1998; Stromholt & Bell, 2018).

Teachers who incorporate the Storylines in their work with elementary learners shared that the authenticity of the learning experiences in both content and pedagogical approach greatly supports student engagement. Esther, a third-grade teacher who co-designs and utilizes the STEM Storylines, described her students' response to the Storylines:

> Yeah they've just been... they're really engaging. I am really big on making work authentic, and so I think the Storylines do a really good way of showing kids where the things that they're learning will come into play in their lives, or where they can see it happening now, and they really like that.

Esther highlighted how connecting learning with real issues that students are experiencing is important for students to feel that science learning matters in their lives. Samantha, an elementary teacher who has co-designed and used the Storylines for several years, shared how her students often want to continue working on their projects during recess and at home with their families. She described how learners find these experiences deeply impactful and memorable, saying that "the real-world experiences that they get in school are what they remember." Teachers also shared during the focus group about how authentic

learning experiences in the Storylines support students' identity development as science learners and doers. Hannah, a fifth-grade teacher who has implemented several STEM Storylines, shared:

> There was a shift about mid-unit where kids started to, they would call themselves the scientists, like they started to see themselves in that role a little more, and I don't think I've seen that so quickly in the fifth grade year, where I'm training them in PBL and giving them that autonomy and pumping them up of "You know what, your voice matters. You can make a difference and this matters." And the buy-in seemed to be quicker with the Storyline, and maybe it was just this year, maybe it was this group of kids, I'm not sure, but it did seem like the buy-in was more natural than when I'm like "Okay, read pages 17 through 30, how does this apply to your daily life?" You know? So it just seemed like a truer path.

These reflections from elementary educators indicate how empowering approaches to learning about authentic topics can support students in identifying as scientists and powerful intellectual agents (Stromholt & Bell, 2018). Designing for authenticity in curriculum development and implementation is necessary for confronting the deficit-based tendency to restrict elementary science learning to decontextualized, shallow activities.

Transforming Power in Science Learning by Centering Learner Voice, Choice, and Agency

Facilitating learning that moves beyond deficit logic also requires us to attune to and rethink issues of power, control, and agency within science learning contexts. Power imbalances remain pervasive in classroom learning despite years of science education reform that aim to position learners as authentic scientific practitioners. In many cases, teachers continue to possess authority in classrooms as the experts and givers of knowledge, while learners are positioned as passive receivers rather than active participants — a dynamic that aligns with the *banking model* of education (Freire, 2018). Especially at the elementary level, mandated science curricula are often heavily scripted, thus perpetuating the deprofessionalization of educators and disempowering both teachers and learners. A growing body of science education scholarship emphasizes the need to challenge these patterns of epistemic control and create space for

learners to practice *epistemic agency* by shaping the processes of sense-making and knowledge construction as well as by making decisions about *how* to move forward in their shared learning (Calabrese Barton & Tan, 2010; Keifert et al., 2018; Ko & Krist, 2019; Scardamalia, 2002; Varelas et al., 2015). While educators can work to center epistemic agency in classroom learning in spite of the power-laden structures of schooling, intentional curriculum design is also needed to support these cultural and axiological shifts in learning communities.

The PBL model utilized in the STEM Storylines supports educators to transform classroom power dynamics and incorporate instructional practices that affirm young learners as active and creative intellectual agents. In particular, project-based approaches center student voice and choice in determining how the learning process should proceed in order to deepen collective understandings of a driving question — as opposed to the linear and prescriptive approaches that are common in elementary science curricula. In our process interview, Pranjali described her understanding of how PBL practices support student voice:

> Voice is really important to me, and I think that's why the PBL structure works really well. I think that there needs to be a shift in power in the classroom. I think that that's really an oppressive thing that needs... There's a lot of oppression that happens in a classroom from students' voices not being valued. So I think this is one way for me to push on teachers to give more spaces where their kids' voices can be heard.

Here, Pranjali clearly highlighted how student voice — whether it is honored or silenced — is related to manifestations of power in the classroom. She also emphasized that uplifting student voices can be scaffolded through curricular design choices. Pranjali continued by explaining how the STEM Storylines include protocols that create space for learners to ask questions and to decide how to engage with the phenomenon of interest, which results in a student-centered learning experience:

> So that means students asking questions, and it seems like that hasn't really been a priority in our education system if you look back decades, you know? Teachers were doing all the asking of

> questions and providing that to students, they weren't necessarily the ones that were encouraged to ask a lot of questions that are relevant to them. So that's something we've been working on developing is supporting students with that. And it's helpful because then throughout the unit, the questions and the wonderings that they have are guiding their learning. So that's something that stays alive throughout the course of the unit and sustains the students' interest throughout the course of the unit. So, a lot more of a focus on students asking questions, which I think has been helpful in just changing the structure of the discourse in the classroom, if students are asking more questions or taking more of a role in their learning. A lot of what we do is attempting to change the power dynamics in the classroom, where instead of the teacher knowing everything and passing on that information to the students, the students are the ones that are able to decide how they wanna do the learning and how they want to construct their understanding of things.

Pranjali called attention to the traditional, settled ways that teachers and students are positioned relative to each other that result in the suppression of students' intellectual voice and agency. In contrast, the STEM Storylines center learner interest and curiosity as the throughline of shared inquiry, thus redistributing power more equitably in classroom learning contexts (Ko & Krist, 2019).

Pranjali shared that from the beginning of each unit, when a focal problem is introduced, students determine "what direction do they wanna take, to dig deeper, to understand the problem better, and then to create a solution and answer the driving question." Many sessions within the "Becoming Protectors" Storyline wrap up by inviting learners to consider what insights they have gained and what they would like to investigate further to make sense of the driving question. For example, an activity about air pollution and extreme heat ends by asking students to share "What do they feel they still need to learn more about in order to protect the air on the earth?" (Lesson 3, Session 1). Similarly, a later lesson in the Storyline poses the questions: "Discuss reflections with students. What have they learned about the Climate Change Crisis? What are things they still need to know? How can they connect with the driving question?" (Lesson 3, Session 10). These reflective moments position students as active participants who

are responsible for and capable of shaping their own learning experiences.

Pranjali also described that for teachers, facilitating student-centered learning requires "stepping down from the stage" and relinquishing some authority. Moving away from predetermined step-by-step science procedures to create space for learners to practice epistemic agency diminishes teachers' control of the learning process. Supporting science learning as an iterative, emergent, and open-ended process necessitates supporting teachers' tolerance for uncertainty, which is especially challenging within educational systems that prioritize predictability and standardization (Ko & Krist, 2019; Manz & Suárez, 2018). Hannah reflected during our focus group conversation:

> We seem to rely on our teacher guides a lot. So then this more free form, you don't have a textbook and an answer key, you are having to look at the meaning and the meat of what the children are doing, and there's a different angle to look at that. And I think a lot of more traditional-minded teachers or teachers who are not comfortable or haven't been exposed to PBL feel really insecure in that, and that can cause some barriers to collaboration or barriers to innovation.

Sustained support is needed for educators to enact these transformations of their roles, practices, and identities in order to move toward more student-centered forms of science learning that foster epistemic agency — particularly as teachers navigate institutional pressures and mandates that are not conducive to shifting power dynamics (Ko & Krist, 2019). Transforming classroom power dynamics to foreground students' own sense-making processes and desires for future engagement is needed to challenge the deficit-based assumptions that elementary learners are not ready for complex scientific thinking and practice (Brown & Campione, 1994; Scardamalia & Bereiter, 2006).

Honoring Learners' Existing and Growing Expertise Through Shared Sense-Making

In addition, holding space for learners' epistemic agency also requires educators to practice epistemic humility and dismantle the notion that the teacher is the sole or primary source of expertise in a classroom. Esther shared:

> Going off of what [Hannah] said too, I think that idea of, as teachers, being okay with not knowing everything, and admitting that they don't know everything, is something that I really actively try to do in all areas of my practice because, again, I really believe in authenticity, and as an adult, do you know how many times I Google things a day cause I don't know them? I'm not the keeper of all knowledge, and part of my identity is not being the keeper of all knowledge. And I think that's also part of it is like learning with kids and showing kids that you don't, as an adult, you're not gonna know everything, and that's totally fine. And guess what, there are ways that we can figure it out, so let's go do that!

Esther described how she adopts a humble stance, acknowledging the limits of her knowledge and committing to learning *with* students. This pedagogical orientation resonates with the shifting of power dynamics within project-based approaches by decentering teacher expertise and centering collective sense-making (Brown et al., 1993).

In research co-design meetings, Pranjali clarified the importance of recognizing students as knowledge-holders who each bring relevant experiences and expertise. For example, every Storyline begins with a "notice, wonder, know" activity that invites learners to share their initial ideas about the driving question in a Scientists' Circle. By rooting the inquiry in what students already know rather than beginning with top-down instruction by the teacher, the STEM Storylines position learners as emergent experts and build inquiry upon their prior knowledge (NRC, 2000). Attuning to what students are already aware of and are curious about also creates openings for onto-epistemic heterogeneity by validating ideas emerging from different worldviews and sense-making repertoires (Bang et al., 2017). In the following section of this chapter, I elaborate on how the Storylines directly attend to marginalized onto-epistemic perspectives.

Throughout the Storyline learning activities, students are supported in broadening and deepening their expertise through complex scientific investigations. As they grow their understandings related to the guiding question, learners are frequently affirmed as experts and positioned to share their insights with

their peers. For example, in Lesson 4 of "Becoming Protectors," students collaborate in Expert Groups and modeling teams to co-construct shared models of earth's spheres: the biosphere, atmosphere, geosphere, and hydrosphere. In these kinds of learning experiences, the focus is on shared sense-making through dialogue, discussion, and iterative modeling based on peer feedback. Samantha described how her students thrive within the processes of co-constructing ideas together:

> They want that feedback, they get excited about improving and, "Oh, look at how I did this now," and getting that peer feedback. [...] We do the, is it the Charrette protocol, I think is what it's called, where they have one minute and they can only talk about… My kids really like that, they get so much from that and to see their revision process and I'm like, "Wow this is what real scientists do," and they get that feeling like they're in charge, they have a voice.

Pranjali reflected that this emphasis on collaborative sense-making equalizes the relationship between teachers and students and reframes them as co-learners:

> I don't have a lot of places where the teacher gives the students definitions. It's kind of a side thing, it's not the focus of the unit. The focus of the unit is just dialogue, between students, between the teacher and the students. And by dialogue… I think dialogue is an important word, it means that both parties are there to learn together. So, there's a lot that students will bring to that conversation that teachers might not know, and vice versa, so that's something I don't see enough of in elementary school, and that's why throughout the Storyline we do a lot of that…

By highlighting how learning is bidirectional between teachers and students, Pranjali identified a substantial shift away from traditional practices in elementary science education. Contrary to the persistent skepticism about young children's intellectual capabilities, the Storylines use asset-based approaches to position learners as brilliant contributors to the shared endeavor of understanding a complex scientific problem (Brown & Campione, 1994). These strategies give rise to opportunities for learners to engage in more creative, complex, and meaningful forms of scientific reasoning and practice.

Fostering Learners' Identities as Scientific Thinkers and Doers

These interconnected curricular counter-stories — authentic learning about real-world phenomena, student-centered processes that honor youth voice, choice, and agency, and deep respect for learners' emergent expertise — contribute to empowering science learning experiences that desettle dominant deficit assumptions about elementary learners and instead position students as scientific thinkers and doers. Fostering science identity development for young learners, especially those who are often marginalized in educational systems, is a clear priority in Pranjali's work on the STEM Storylines. This emphasis is perhaps most visible in the explicit affirmations of students' genius that frame the learning experiences. In the second session of the "Becoming Protectors" Storyline, for example, learners engage in the following activity:

> Read the "You Matter Manifesto" to students (Angela Maiers, 2011) which is linked on teacher slides. After each line, ask students to repeat as a class. This affirmation is intended to help students feel that they have power and influence to make a change to solve problems in their world. It is an opportunity for you to shift the deficit or fixed-mindsets that students may have internalized over their years of schooling. Assure students that you believe that each and every one of them matters.

Using this kind of facilitation guidance, Pranjali ensures that learners are reminded about the importance of their voice and about their intellectual power. At the same time, educators are invited to become critically aware of the oppressive logics of schooling, act as co-conspirators in desettling deficit-based expectations about young learners, and move toward justice-centered teaching practices in their classrooms.

Counter-Storytelling Against Whiteness and Coloniality in Environmental and Climate Education

Closely related to and entangled with deficit logics, whiteness and coloniality continue to dominate U.S. educational systems in terms of the ontologies, epistemologies, and axiologies that are positioned as normative and desirable (Paris, 2021a). In invisibilizing the histories, lifeways, worldviews,

and futures of non-dominant racial and cultural communities, schooling is both informed by and perpetuates the Eurocentrism, white supremacy, colonialism, and settler-colonialism that persist in society more broadly (Alim et al., 2020). For example, these systems of oppression are reflected in school curriculum through the erasure — or selective, flattened representation — of global majority peoples and the silences about historical and ongoing atrocities against marginalized communities (Calderón, 2014; Sabzalian, 2019; Templeton & Cheruvu, 2020).

These forms of whiteness and coloniality are salient in science, place-based, and environmental education as well — for example, in the dominance of Euro-Western conceptions of nature and human-nature relationality; the lack of critical inquiry into how white supremacy and settler colonialism have shaped particular places, lands, and communities; and the marginalization of non-dominant communities' longstanding, evolving, and ongoing ecological relationships and practices (K. L. Gomez, 2020; Nxumalo & ross, 2019; Tuck et al., 2014). Intentional reflection, counter-storytelling, and shifts in curricular and pedagogical practice are necessary to disrupt these exclusionary practices and center intersectional justice in environmental and climate learning.

In the following sections, I focus on two particular dimensions of whiteness and coloniality and how storytelling and curriculum design can suggest more emancipatory alternatives. First, I highlight how colonialism and white supremacy manifest in how environmental and climate learning are structured around dominant onto-epistemic norms. I share stories from Pranjali's experiences and my own, as well as examples from the "Becoming Protectors" and "Why Won't Our Blueberries Grow?" Storylines, to suggest ways that environmental and climate learning can instead center pluralism and heterogeneity in onto-epistemologies, axiologies, and ecological relationalities. Secondly, I highlight the white supremacist and colonial logics that underpin how challenges and solutions are framed in curricula and learning experiences. To confront the dynamics of superiority and saviorism that are common in environmental and climate education, I demonstrate how the "Becoming Protectors" Storyline offers a reframing and relocating of expertise by learning *with* the perspectives and leadership of global majority communities.

While there are of course other manifestations of white supremacy and colonialism in environmental and climate learning, I hope that these specific examples will prompt consideration of how settled expectations are enacted in learning environments and how desettling these expectations can open space for more liberatory and just possibilities.

Naming Onto-Epistemic Supremacy in Environmental and Climate Learning

Onto-epistemic supremacy structures learning environments by dictating what knowledges are deemed "correct" and which ways of knowing and being are considered valid (Warren et al., 2020). These narrow, prescriptive views contribute to the continued marginalization of learners from non-dominant cultural communities and their heterogeneous knowledge systems. In U.S. science, environmental, and climate education, Euro-Western understandings of the natural world and positionings of humans are explicitly or implicitly imposed upon learners through curriculum design and pedagogical practice. These include beliefs — many of which can be traced back to the Enlightenment era — that humans are separate from and superior to other living beings, that human agency is the primary force shaping ecosystems, and that scientific understandings of our socio-ecological contexts can and should be "neutral" and "objective" (McKittrick, 2021; Nxumalo, 2019).

These entrenched conceptualizations exclude the onto-epistemologies and ecological practices of non-dominant communities, many of which are rooted in more holistic understandings of human-nature relationality. For example, many Indigenous communities regard more-than-human beings as actively participating agents in the webs of influence, reciprocity, and responsibility that make up socio-ecological worlds — as opposed to passive targets of human agency (Bang et al., 2014; Bang et al., 2018; Bang et al., 2015). Commitments to humility, embeddedness, and interdependence stand in contrast with the anthropocentrism and human supremacy that characterizes Euro-Western understandings of ecosystems (Medin & Bang, 2014). In addition, Indigenous onto-epistemologies regard identity, cultural practice, spirituality, ethics, and scientific knowledge as deeply interwoven rather than separable aspects of knowing and being (Kimmerer, 2013). Reflecting on their own relationships with the natural world that

are situated in Taiwanese cultural worldviews, Ho and Chang (2021) similarly emphasize the interconnectedness of social, spiritual, emotional, and ecological dimensions of relationships with places, lands, and living beings.

Intersectional environmentalist perspectives highlight the need to confront the erasure in mainstream environmentalism of non-dominant peoples and ways of knowing and being (L. Thomas, 2022). In the next sections, I share how these kinds of liberatory counter-storytelling can happen on a personal and interpersonal level as well as through curriculum design and professional support that work to expand what is recognized, honored, and sustained as ecological relationality in learning environments.

Remembering and Honoring Ancestral Ecological Relationships and Practices

The invisibilization of global majority onto-epistemologies, practices, and cultural experiences in environmentalism and environmental education can lead to internalized colonialism. In a research check-in meeting, Pranjali shared about how she noticed shifts throughout her childhood visits to India from sustainable practices like eating from leaf plates and drinking from clay pots to the use of plastics imported from Western countries. She reflected on how she internalized negative judgments of her own cultural community:

> And then plastic was introduced, you know, by the Western world and that pretty much has destroyed so much, so much, and oh gosh, breaks my heart. But I was just thinking about my own life and going back as a teenager and seeing “Oh my gosh, there's plastic everywhere, this is not what it used to look like when I was a kid.” So, I dunno, Rae, you’ve inspired me to think more about that, and I think I internalized this judgment of my own culture, seeing all that plastic and being like, “Oh India, disgusting, now there's plastic everywhere,” not understanding the source of who brought that there and plastic is a creation of the Western world.

Pranjali’s reflections indicate how the whitewashing and onto-epistemic narrowness of mainstream environmentalism in the U.S. led her to internalize beliefs about a lack of environmental relationships and practices in India, despite the long histories of ecological care that exist there as well as in other global

majority communities. In this conversation, I described a similar set of experiences visiting China as a child and teenager: seeing large quantities of disposable plastics and reporting back to my friends in the U.S. that Chinese people don't know how to recycle. In doing so, I condemned my cultural community without contextualizing these encounters within the capitalist global systems that promote plastic dependency and exploit global majority communities. I also reflected on how I had criticized my parents for using plastic water bottles and "not caring about the environment," while failing to acknowledge their ecological knowledge and relationships grounded in years of subsistence living in rural China — and their current diasporic practices of growing culturally significant foods in their garden to maintain a connection with their homelands.

Pranjali described how learning about the intersectional environmentalism movement has inspired her to critically analyze these kinds of colonial assumptions, reject individualistic and Euro-Western definitions of environmentalism (e.g., recycling), and reclaim the traditional ecological practices of her cultural community.

> It also got me thinking about how spiritual practices are tied to environmental practices, and I was thinking about my own childhood and how we have an earth goddess, like we have a legit goddess of the earth and we pray to her. Any Hindu temple you'll go to where there's a lot of representations of a lot of gods, there's gonna be an earth goddess, and we actually pray to her. And I remember as a kid being told "You don't litter, you don't do that, she's a goddess, that's disrespectful to litter or to even hurt plants for no reason." so it's something I've been telling my son since he was born, like "Pick that piece of trash up, you don't litter on Mother Earth." So it's interesting that this new intersectional environmentalism movement, I think it's really wonderful cause I think it really is decolonializing our thought in so many ways, even those of us that have really internalized some of those negative views that colonialism has pushed onto us. So, yeah, anyway, I was just thinking about that, I was like "We have an earth goddess, environmentalism is a part of who we are!"

Pranjali highlighted the interconnectedness of spiritual, ethical, and ecological dimensions in her cultural community's environmentalism. Stewardship is grounded in emotional bonds with the Earth as a mother and cosmological understandings of the Earth as a goddess. She described the intergenerational power of these teachings in terms of how they shaped her own culturally situated upbringing and how they now influence her parenting practices. In later conversations, Pranjali shared about a sense of sadness and loss at not having learned more about these aspects of Hindu culture during her childhood spent mostly in the U.S. — and her current commitment to learning more about these ancestral belief systems, relationships, and practices. In doing so, Pranjali emphasized her personal resonance with the broader intersectional environmentalism movement as a powerful invitation to decolonize our definitions of environmentalism and reclaim and deepen our culturally specific ecological knowledges and practices.

Troubling Epistemic Normativity by Centering Heterogeneity and Pluralism

These processes of critically rethinking internalized colonialism and making space for heterogeneous culturally situated ecological relationships also shape Pranjali's approach to curriculum design as counter-storytelling in the STEM Storylines. In our sense-making conversation about the "Becoming Protectors" Storyline, she described her commitment to connecting students with multiple worldviews, particularly Indigenous onto-epistemologies, through science learning:

> I think that there's *always* a need for Indigenous perspectives, there's *always* a need for multiple perspectives, especially when some of the problems we're talking about were created by the Western world, and the Indigenous people have been fighting and advocating and working towards stewardship, protection, and restoration of all the damage.

Pranjali insisted on the importance of always centering onto-epistemic heterogeneity and cultural pluralism and framed this as a particularly urgent necessity in responding collectively to socio-ecological challenges. She shared about the resistance she encounters from white educators and educational leaders in her region when she works to create space for multiple perspectives — for example, concerns that these approaches are not relevant because all their students are white, or that their white students cannot relate

to Storyline protagonists from global majority communities, or that Indigenous perspectives do not need to always be part of the conversation in science education. In navigating these forms of pushback, Pranjali described how she works to desettle these beliefs and viewpoints:

> I'm hoping to shift that perspective of like, "Oh, well you don't always need to…" Yeah, actually, we do, that's a part of culturally sustaining curriculum is that it gives space for multiple perspectives and voices, specifically those that have been silenced in the past.

Pranjali highlighted how some educators and educational leaders believe that supporting onto-epistemic heterogeneity is a conditional need, to be considered only in specific discussions or when working with learners from marginalized communities. In contrast, she elaborated on the need to *constantly* work to address the silences within curricula:

> Training white students to be race-evasive where they're not even able to talk about race… I think it stems from them not seeing people of color having such a huge and positive impact in the world. And that's the whitewashing of the curriculum and that's happened for a while now, and I think it's time to un-whitewash things. And so, I think everybody benefits from a curriculum that's culturally sustaining and not anchored around whiteness.

Pranjali clarified how continuing to use whitewashed curricula is a disservice to white students as well as students of color. Referencing Paolo Freire's ideas about how oppression harms oppressors in addition to the oppressed, she expressed concerns about how the narrowness of school-based curricula fails to prepare white children for the increasingly complex, interconnected, and pluralistic world. These insights resonate with the core rationale underlying decades of scholarship and practice within multicultural education (Banks, 1990, 2019).

Given the necessity of culturally sustaining curriculum to "un-whitewash" science learning, Pranjali centers non-dominant onto-epistemic perspectives in the "Becoming Protectors" Storyline while engaging learners with the driving question, "How can we learn to be better protectors of the Earth?" The Storyline is introduced with a video of Jessica Matsaw (Shoshone-Bannock) and Dr. Sammy Matsaw

(Shoshone-Bannock and Oglala Lakota) sharing what it means to be salmon people and highlighting the interconnectedness of social, cultural, spiritual, and ecological harms and injustices to their community (NRDCflix, 2021). Jessica and Sammy also describe how they, along with their community, are working to protect and restore salmon populations by advocating for dam removal, reframing dominant understandings of interspecies relationships, and nurturing younger generations' relationships with their ancestral homelands, knowledges, and practices. In the opening of the fifth and final lesson in the Storyline, students watch a video poem called "Rise: From One Island to Another" written and performed by Indigenous poets and activists Kathy Jetñil-Kijiner (Marshall Islands) and Aka Niviâna (Greenland Inuk) (Lin, 2018). The poets convey how they are connected as "sister of ice and snow" and "sister of ocean and sand," while weaving together traditional stories, ancestral cultural practices, condemnations of historic and ongoing violence committed by Western countries, and calls to action to address the impacts of environmental degradation and the climate crisis.

Importantly, framing the "Becoming Protectors" Storyline around Indigenous leadership and worldviews emphasizes the interconnectedness of multiple ways of knowing and being that is present in many Indigenous and other non-dominant onto-epistemologies: spirituality, culture, scientific knowledge, and the ethics of ecological care are interdependent, not separable. In this way, desettling onto-epistemic supremacy and holding space for marginalized communities and knowledge systems within environmental and climate curriculum disrupts the colonial separations of knowledge domains and claims to objectivity in Euro-Western science learning.

In addition to incorporating multiple perspectives directly into environmental and climate curriculum, the Storylines also create openings to connect young learners with professional scientists and experts who bring non-dominant onto-epistemologies to their work. As mentioned previously, the "Why Won't Our Blueberries Grow?" Storyline is designed around the scientific inquiry and practices of Shanelle, a Black urban farmer and food justice advocate. When second graders who used this Storyline were able to have a video conversation with Shanelle, they were further exposed to ways of knowing and

being as scientists beyond dominant Euro-Western perspectives. Pranjali described how Shanelle introduced herself, then welcomed students to ask questions:

> Pranjali: I think one kid asked a question, "Do plants have feelings?"
>
> Rae: Oh, how did she respond?
>
> Pranjali: I was holding my breath, I'm like I don't know how she's gonna answer this but I'm so interested. So she says, she's like "I think they *do* have feelings." And I was really happy when I heard her say that. I think it just shows more of an awareness of cultural understandings of plants and that relationship that we have with agriculture that's not [a] super Eurocentric type of an understanding. So she said, "Yeah, I think that they have feelings, and I talk to my plants a lot and I think they grow better when I really care for them. And you know, when I'm planting the seeds, I like to say nice things to them, and positive things to them, because it makes me feel like they will hear me and they'll grow more and be happier." It warmed my heart to hear a farmer say that to them.

In this encounter, young learners are able to engage with affective, relational, and reciprocal ways of knowing and being in ecological relationships, which are often de-emphasized in Euro-Western scientific practices and in simplistic models of "the scientific method" that remain common in school-based science. Pranjali highlighted here, and in a later conversation, how hearing these perspectives from a farmer who is "a super successful professional in the field" was a powerful example of introducing counter-narratives that disrupt onto-epistemic supremacy in classroom science learning. Centering the plurality of culturally situated relationships with the earth in curricula is critical for students with non-dominant identities to feel affirmed in their lifeways and knowledge systems; for white students to recognize the validity and beauty of heterogeneous ways of knowing and being, and for all students and educators to honor and learn from the environmental stewardship, leadership, and expertise of global majority communities.

Naming Whiteness and White Saviorism in Environmental and Climate Learning

A second dimension of how white supremacy and colonialism are perpetuated in environmentalism and environmental learning is through the continual recentering of whiteness, white stewardship, white innocence, and white saviorism (Curnow & Helferty, 2018; Whyte, 2018a, 2018d). As McLean (2013) writes in her critical analysis of whiteness and coloniality in environmental education, "whiteness as dominance is maintained within local and global environmental movements, normalizing white subjectivities as the only legitimate caretakers of the land" (p. 361). This takes place, in part, by erasing Indigenous histories and ongoing presence from the lands and waters where environmental education takes place, which pedagogically reinscribes the *terra nullius* ("nobody's land") logic that justified European colonization of Indigenous lands and displacement of Indigenous communities in the U.S. (Nxumalo, 2019). It occurs also by positioning marginalized learners and communities as endangered by the environmental challenges they face without attending to the sociopolitical contexts that give rise to the injustices or community members' own perspectives and agency in navigating their environmental realities (Tzou & Bell, 2012). La Paperson (2014) describes these discourses of danger and suffering as *pain curriculum*, which then creates an opening for *rescue curriculum* in the form of externally imposed assistance and solutions. These dynamics of locating damage and deficiency in marginalized communities and locating the possibility of salvation in dominant white communities were a driving force in historical processes of colonialism and white supremacy and perpetuate the power imbalances and erasures that persist today (Corces-Zimmerman et al., 2020; Hamad, 2020; Syed & Ali, 2011).

In our research co-design meetings, Stacy and Pranjali highlighted two inter-related dimensions of how invisibilization of global majority communities and recentering of whiteness occurs in environmental and climate learning. Firstly, they described how curriculum can distance learners in the U.S. from the global impacts of environmental degradation and climate change and the opportunities to learn from global majority perspectives. This form of distancing is often rationalized through the

importance of focusing on local phenomena and connections to place rather than faraway topics, as described in chapter 2. In the topical webinar on elementary climate learning, Pranjali reflected on the potential harm and deception imposed on students when the interconnectedness of global systems is not acknowledged in environmental and climate curriculum. In particular, she emphasized that while the U.S. has contributed disproportionately to greenhouse gas emissions, it is not one of the countries most impacted by climate change. Pranjali described how focusing solely on localized learning fails to address these forms of injustice:

> When I think about local and global, I think the local's really important and I like that you're bringing up how we need to anchor some of those early experiences in local-based learning to get kids connected with nature. But I think those global issues are really important also, cause I think that it's important for students to understand at an early age that the choices we're making are actually impacting ecosystems and communities across the world. Like, I look at Bangladesh, that's an example of a country that's pretty much underwater, like 60% of their country is underwater, during certain times of the year of course, not all the time. But there's millions of people that are going to be displaced from Bangladesh, and have been displaced, because of some of the actions of some of the countries that are emitting a lot of greenhouse gasses into the environment. So, I think that local is important, but I also think there's a real importance in taking responsibility for some of the ways that our actions are impacting global communities, because of how interconnected we are. So, I guess I'm pushing back a little bit on that idea of not bringing in those global issues, cause I think we're in doing so maybe sheltering our students from a reality of what their, our actions are actually having impact on, at a global scale.

Pranjali highlighted the importance of learning about global issues in addition to local places in order to support students in understanding complex global systems and the impacts of our individual and collective actions on interconnected communities and ecosystems. Failing to incorporate global environmental and climate connections reinscribes U.S.-centrism, whiteness, and coloniality by avoiding

responsibility for the harms inflicted upon other countries through Western societies' industrialization, colonization, and imposition of extractive capitalism and "development." At the same time, focusing solely on local phenomena in the Global North forecloses on the possibility of learning from and with the experiences of Global South communities.

Although global majority communities are often excluded entirely from U.S. environmental and climate curricula, the ways that they are portrayed when they *are* included can also perpetuate colonial and white supremacist dynamics. In research check-in meetings, Stacy and Pranjali reflected on the tendency to locate environmental and climate challenges solely in global majority countries. Stacy shared about teachers in the Climate Justice League wrestling with these tensions as they worked to design a climate justice Storyline focused on water scarcity. The educators were aware of how mainstream examples of water scarcity are often located in African countries and were concerned about how to navigate conversations with students in order not to give falsely limited impressions of where and how such challenges are experienced. Pranjali and Stacy described how associating global majority communities with environmental and climate problems may lead to students holding negative assumptions about these communities. Such curriculum materials also often position students as problem-solvers who can create solutions for communities that are experiencing harms, implicitly operating on presumptions of superiority and inferiority that are especially problematic in majority-white classrooms. Stacy and Pranjali identified this as a form of white saviorism:

> Pranjali: It goes back to the saviorism, right? Like portraying people of color, communities of color across the world as being...
>
> Stacy: In need?
>
> Pranjali: Very dire need and not having the… there's an implication [that] there's not enough resources, whether intellectual, or physical, technological, to actually solve that problem and that's kind of a problematic thing to build an entire unit on, right?
>
> Stacy: It is. [...] I'm even thinking about some of the books that I've seen people use to engage in

> these kinds of conversations are often from the frame of like… well, there was this fifth grader from Montana who cared about the environment and so he learned about a community and helped build some wells. And now there's fresh drinking water in this community! And there's so many examples that are shared exactly like that, that this fifth grader knew more than the community about how to solve their problem.

Positioning white students to save global majority communities from the challenges created by white-dominated, Western countries is a clear manifestation of paternalistic colonialism in environmental and climate curriculum. These two patterns of distancing and erasure (a form of invisibilization) and saviorism (related to hyper-visibility) may seem contradictory, but both result from oppressive white supremacist and colonial logics that are only able to see marginalized communities as needing to be helped and rescued. As such, dominant forms of environmental and climate education fail to address the need for climate reparations and other tangible forms of accountability from Global North countries given their histories of climate colonialism and ongoing global power imbalances (Táíwò, 2021). These curricular tendencies echo the denial of responsibility and imposition of self-serving policy and programmatic initiatives that currently shape international climate discourse (D. Z. Jackson, 2021).

Learning from Global Majority Expertise, Perspectives, and Leadership from a Stance of Humility

In the "Becoming Protectors" Storyline, Pranjali works to intentionally disrupt these white supremacist and colonial settled expectations in environmental and climate curricula by centering the expertise and leadership of global majority communities and positioning young learners to learn from and with global majority leaders from a place of humility. Reflecting on how this Storyline diverges from her previous units, Pranjali shared:

> There's a lot of savioristic-type problems that we present, even myself, when I think about one of the first Storylines I wrote, the one about the kiddo in India who doesn't have light. And that's a part of the problem, isn't it? When it's like, we're white society, and we have all the answers for you, and we have the brilliant fifth graders that are gonna solve a problem for India. So I shifted

> my perspective a little bit, I think… I've grown a little bit too, and that's awesome. So [I've] shifted my perspective, we're thinking about stepping away from that savior attitude and more towards… How can we learn from these different communities?

In leveraging PBL approaches, the units typically ask students to address a problem by designing a solution or sharing their knowledge with their communities. The "Waves and Energy" unit that Pranjali mentioned invites learners to investigate: "How can we create a lighting device to help a friend who lives in a place in the world where there are daily power outages?" Pranjali highlighted how some of these past Storylines may have been complicit in the colonial logics of saviorism. The driving question of the recent "Becoming Protectors" Storyline about human impacts, environmental stewardship, and climate justice, however, demonstrates her current critical perspectives on and desettling of these dynamics: "How can we *learn to be* better protectors of the Earth?" Across multiple conversations, Pranjali emphasized the need to recognize and uplift the long histories of ecological care, protection, restoration, and activism in global majority communities — rather than asking students to invent their own solutions to environmental and climate challenges. Although this language shift is subtle, Pranjali expressed hopes that "we can really incorporate [students] wanting to reach out to learn about other communities."

In alignment with the overall framing of the "Becoming Protectors" Storyline, Pranjali intentionally scaffolded the learning activities in ways that encourage students to engage with a humble stance. In our sense-making conversation about the Storyline, Pranjali shared that designing this Storyline was a long, deliberate process for her, both to identify resources from global majority perspectives and interweave them throughout the Storyline, and to design the facilitation guidance "in a way where students would really be able to learn from them" as opposed to settling for mere representation of multiple perspectives. For example, after watching the "Rise" video poem, learners are invited to discuss:

> What did you learn from the video/poem that you didn't already know? How did Kathy and Aka's message make you feel? How are Kathy and Aka using their voice and their poetry? How are

> Kathy and Aka using their voice to make a positive change in the world? How did their message inspire you?

Importantly, the Storyline asks students to consider how the insights from climate activists and environmental leaders can inform their thinking about ecological protection and advocacy in their own communities. Pranjali clarified this aspect of bridging from global examples to learners' local contexts:

> And then the kids think about that, and they discuss *how* is this community actually protecting the environment, what are the challenges that they're facing from greedy corporate people that are coming in their lands and trying to take, destroy their land. And then, what can you learn from them? What can you learn from them, and think about how you could support them, and how you can use that to think about your own community, what's going on in your own community?

Acknowledging the interconnectedness of climate challenges and responses across local and global scales can help us move beyond the U.S.-centrism and the either-or binary between localized learning and global systems thinking that are common in U.S. environmental and climate education. Stacy and Pranjali discussed how a hyper-local phenomena approach, which they often use in their own curriculum design and professional support work, has its strengths as well as limitations:

> Stacy: I think that there's some good purpose behind that. But it does limit your scope, right? And it limits your students' scope and experiences and what they're learning from… [...]
>
> Pranjali: [...] I remember talking to [name of colleague] about this years ago when I started, and she was like "There's a local, but there's an analogous global problem that's similar to that, or there's analogous problems that have been happening in other places that you can then connect to, to broaden the scope." And I remember that just stuck with me, when she said that, it wasn't like we have to choose between one or the other. So maybe there is a local, but maybe there's people around the world that have had a similar problem that've solved it differently, [we can] learn from that.

In these reflections, Stacy and Pranjali clarified the importance of building connections between local and

global contexts, while recognizing differences and incommensurabilities of how challenges arise across settings. These interweavings are especially necessary for supporting students' understanding of global sociopolitical and socioscientific systems like climate change, capitalism, and colonialism. Broadening the scope of students' experiences and inviting them to learn from the experiences, activism, and leadership of global majority communities are crucial for students to think creatively and critically about complex topics and recognize their own responsibilities for sociopolitical action based on their positionalities. These forms of curricular counter-storytelling are also necessary for confronting and dismantling the pervasive whiteness and white saviorism of environmental and climate curriculum and designing for more intersectionally just and justice-centered forms of learning.

Counter-Storytelling Against Ageism in Environmental and Climate Learning

In this section, I aim to desettle the deeply embedded assumptions in our educational systems about young people's capabilities, or lack thereof, as community leaders and agents of change. The settled expectations of ageism and adult-centrism that shape environmental and climate learning, and school-based learning more generally, are closely related to the oppressive forms of developmental appropriateness discourses, deficit logic, and whiteness and coloniality highlighted in chapter 2 and in the prior sections of this chapter. Through sharing personal and curricular counter-stories in this section, I hope to invite educators and educational leaders to recognize how young people *already are* emerging sociopolitical actors and to work to strengthen learners' critical consciousness and agency through opportunities to take action in their communities.

Naming How Ageism and Adult-Centrism Constrain Environmental and Climate Learning

Ageism and adult-centrism can manifest in many ways in school-based learning spaces — for example, dismissing or downplaying the concerns raised by young learners, underestimating their capacities for collective action, or framing the purpose of education solely as preparation for civic and community participation in the future. Young learners with intersectionally marginalized identities are especially likely to experience classroom learning that is rigid and compliance-focused rather than

offering opportunities for youth leadership (Nxumalo & Adair, 2019).

In research co-design meetings, Pranjali often shared how her experiences as a parent have influenced her belief in her own children and other children's abilities to engage with serious issues and take action — and how the ageism imposed through schooling is a form of oppression for young people. She described an interaction with her young son in which he noticed an image in a book of a bulldozer cutting down trees in a forest and wanted to do something to stop the ecological harm. When her son asked what he could do to help, Pranjali first mentioned the possibility of pursuing a career pathway in which he could protect the forests as an adult. Pranjali said that this prospect of future action was not a satisfactory option for her son:

> And then he's like "But I don't wanna wait till I'm grown up, I wanna do something *now*." And then he said, "But I'm just a kid, no one's gonna listen to me." And I was like "Your voice is important and there's ways that we can try to get people to hear your message, so maybe we're gonna make a video about this and I'll share it out for you." When I hear him talking about stuff like that, I feel like they have so much potential, and I feel like they have that passion in them, and we really do beat it out of them in school. And it's just, it's so sad to me, you know? Like the passion he had in his eyes was like, it was just amazing.

Importantly, this conversation emphasized the importance of respecting and supporting children as changemakers in the present moment, not just as future agents of change (Espinoza et al., 2020). Pranjali shared this story in reflecting on a learning theory course she was taking and her "visceral reaction" to seeing how traditional developmental theories present young children through a disempowering lens whereas she believes and has personally experienced that "children are capable of so much more." In an earlier check-in, Pranjali told a similar story about her son learning about poaching of rhinos and other animals, feeling very angry and upset, and creating a picture and message to tell other people not to hurt animals. Encounters like this demonstrate to Pranjali that young children "have that passion and they have that *want* to change things, starting as early as kindergarten, they have that." In this way, Pranjali's

experiences as a parent to a young child are a counter-story to the dominant theories, narratives, and educational practices that suppress young children's incredible passion and potential as agents of change.

These parenting experiences have shaped Pranjali's approach to designing STEM Storylines, particularly in the recent "Becoming Protectors" Storyline. During our sense-making conversation about the Storyline, Pranjali explicitly made this connection:

> Honestly a lot of it was affected by my son talking to me like, "Yeah I'm a kid, but who's gonna listen to me? No one's gonna listen to me." And I'm just like "No, people will listen to you. You have to believe that people will listen to you, and you have to use your voice, you have to use your *voice*, you have to advocate for yourself, I'm not always gonna be there with you, all the time, wherever you go, advocating for you, I want to but I can't, you have to use your voice." I think it's sad though because I think at this level, at fifth grade, I feel like a lot of them have already stopped speaking up. I think they have. You know, it's easier with kindergarteners cause they're very outspoken until school kinda trains them not to be. But yeah, with fifth grade I think it will be helpful to students to see that and experience something a little different.

In highlighting how schooling experiences train students not to speak up, Pranjali framed the fifth grade Storyline as a curricular counter-story, something "a little different" from the ageism and adult-centrism that children typically experience in classroom learning. Her belief in young people's power to create transformative changes in their communities and the need to affirm learners' voice and confidence in learning environments is informed by her interactions with her son and her identity as a mother. Disrupting narratives of powerlessness that young people often experience in school and in society more broadly, Pranjali's curriculum design work invites us as educators and adult allies to recognize, honor, and uplift youth leadership.

Making Visible Youth Leadership and Science for Collective Uplift

In addition to the centering of global majority perspectives in the "Becoming Protectors" Storyline, Pranjali intentionally amplifies the perspectives of youth activists and leaders from global

majority communities. In our sense-making conversation, she framed this as a form of role modeling to disrupt the power imbalances in classrooms:

> I just realized that I'm trying to help teachers to create more liberatory and empowering spaces for their students, but what opportunity do students have to actually see that their voices have an impact, like aside from the [action] project? I feel like they need to see an example, students need to see examples of children making a difference. And I think teachers need to see examples, and teachers need to learn from youth, and so the idea is to deconstruct some of the power structures within that space in the classroom, and I think that the videos serve as an instigator of, or like a catalyst, to help teachers realize that students *do* have power, children *do* have power.

Reflecting on the incorporation of youth voices into the Storyline, Pranjali emphasized the need for both learners and teachers to see tangible examples of young people taking action and demonstrating their power. Testimonies and insights from youth activists are woven throughout the "Becoming Protectors" Storyline. In lesson 2, students watch a video of Xiye Bastida (Otomi-Toltec), who invites them to imagine a socio-ecologically thriving future as a starting point for working toward climate justice (Mission 2020, 2020). In the third lesson, they watch Maxine Jimenez (Filipinx) share a story about their experiences as a high school student confronting heat waves and air pollution in Los Angeles (Action for the Climate Emergency, 2021). Students also engage with the Stories for the Climate Crisis Mixer activity as well as the Our Climate, Our Future storytelling map, both of which include a variety of perspectives from young global majority climate activists.

For young people, these examples serve as inspiration by showcasing the influence they themselves can hold and their ability to contribute to addressing environmental and climate challenges. As Pranjali reflected, "How can students see that their voices are powerful if they don't see other kids having a powerful voice that's making a huge change?" For teachers, who may not have consciously considered the potential of youth leadership, these resources can prompt a crucial shift in thinking that is needed to design and facilitate liberatory learning spaces. The desettling of power structures is scaffolded

through discussion prompts that ask teachers and students to reflect together about what they can learn from the youth activists' messages. Pranjali clarified how this activity structure "equalizes that relationship a little bit" and "puts the teacher in a spot of being a co-creator of sense-making and learning versus being the person at the top." This form of collective sense-making directly disrupts ageism and adult-centrism by positioning teachers to learn from and alongside young people.

Sharing these examples of how youth activists and leaders interweave scientific concepts with their lived experiences to advocate for more just socio-ecological futures also demonstrates the possibilities of leveraging scientific understandings and practices for community uplift and collective liberation. In research co-design meetings, Stacy and Pranjali often discussed how the purpose of STEM education should be supporting students' personal and community well-being. For example, Stacy shared:

> What does it mean to have [a] scientifically literate community, like what does it mean when students understand how they can use their knowledge and skills to solve problems that they see in their world that's impacting their families? And that is just as important, right? It's not about the career that they have, it's about giving them agency in their lives and in their community, and science and STEM play such an important role in that.

In this way, centering the perspectives of youth leaders is crucial for highlighting how science learning can be consequential for responding to the real challenges that learners and their communities might be navigating. As educators, we are responsible for creating opportunities for students to draw connections between their scientific inquiry and their experiences in family and community contexts. In other words, science education can strengthen the synergistic relationship between individual science literacy and *community science literacy*, contributing to the "collective capability and action" of communities (NRC, 2016, p. 6).

Importantly, this centering of youth activists and their multiple forms of civic engagement broadens and reframes how we define leadership. Rather than focusing on individual achievement and success, the examples shared in the "Becoming Protectors" Storyline demonstrate more collectivist,

emancipatory understandings of leadership. Pranjali reflected on this distinction in our sense-making conversation:

> Leadership is often seen as being like, oh this person did this because of their initiative and because they're a go-getter, and that's kinda like this Western individualistic idea of like, I achieve because of my own passion for things. And I feel like leadership is also very selfish sometimes. People that are leaders are there because they've pursued power, and the thing with the youth activists that we're highlighting in this unit is that they're leaders and activists for the community, and it's a very different type of leadership and activism that we're highlighting versus the folks that we used to highlight sometimes in previous units, which is like, okay this person made it here in this position now.

Pranjali highlighted how typical conceptions of leadership tend to celebrate individual advancement within a neoliberal system, whereas the youth activists featured in the Storyline are practicing more community-centered forms of leadership that aim to fundamentally transform systems to be more just.

Strengthening Learners' Critical Awareness and Sociopolitical Consciousness

A key aspect of supporting youth to build their leadership capacity is cultivating their critical awareness through explicit analysis of inequities and injustices (N. R. Davis & Schaeffer, 2019). As Ladson-Billings (1995) advocates for in her framing of culturally relevant teaching, educators should "help students to recognize, understand, and critique current social inequities" (p. 476). As highlighted in the previous section, this consciousness is not limited to school-based learning but also involves "the ability to take learning beyond the confines of the classroom using school knowledge and skills to identify, analyze, and solve real-world problems" (Ladson-Billings, 2014, p. 75). These dimensions of critical awareness and community-engaged problem-solving are echoed in the Social Justice Standards' domains of justice and action (Learning for Justice, 2018), which are based on the framework of *anti-bias education* (Derman-Sparks & Edwards, 2020).

Learners' critical awareness and sociopolitical consciousness are supported in the "Becoming

Protectors" Storyline through scaffolded discussions of fairness and unfairness. In Lesson 3, students learn about youth climate activist Maxine Jimenez's experiences with heat waves and air pollution in Los Angeles. After watching the video of Maxine sharing their story, students are invited to discuss:

> Allow students to share what they notice, wonder, and relate to in Maxine's story. Is there pollution of this kind in their community? Why do some communities have to deal with more pollution than others? Is it fair that some people live in environments that are becoming more and more polluted than others?

Through these discussion prompts, learners are asked to draw comparisons between their own experiences and Maxine's experiences. In the facilitation guidance for this activity, Pranjali clarified that this story may be a mirror for students who are familiar with similar air quality issues, or a window for students who live in areas that don't encounter these challenges. In either case, students and teachers work together to critically consider the inequitable distribution of these harms. The infusion of social justice conversations into the Storyline encourages young learners to attune to justice concerns in their own and other communities and to understand how sociopolitical issues are connected with scientific topics. In a research meeting, Pranjali reflected on the importance of these opportunities to develop critical awareness:

> Students are able to actually learn about the truth of what's going on around them, cause I feel like especially in STEM a lot's just really hidden from them and hidden from us about what's actually going on in our communities and what we can be doing. And I think to me it's more than recycling more and more than just being a little bit more mindful what you eat, even though that is a critical part of it. But I really feel like what's been happening through this work is students having that flame being ignited in their hearts, that's gonna help them ask a lot of questions and be really critical of everything that's going [on] around them, so I just really appreciate that and I think that does lead to change at a bigger level, which is really exciting.

In supporting students to become conscious of the realities of their socio-ecological worlds, educators can

nurture young people's sense of curiosity, passion, and desire for change. Honoring learners' capacity for and interest in engaging with these topics is a crucial way to desettle the persistent ageism, adult-centrism, and belittlement that make school-based learning experiences oppressive rather than liberatory.

Supporting Learners to Recognize Their Political Agency as Changemakers

In addition to showcasing models of youth leadership and cultivating learners' sociopolitical consciousness, the Storylines support students to recognize and practice their own agency as changemakers in their communities. In particular, the fifth and final lesson of each Storyline is an action project in which students share their learning with the broader community. In the "Becoming Protectors" Storyline, students work in teams to deepen their expertise on one dimension of environmental and climate justice, such as impacts on forests, access to water, and drought-related challenges. They research how activists and leaders are taking action to respond to these issues, then create a public-facing product tailored to a particular audience. This open-ended exploration within a small-group engagement structure generates a multifaceted collective understanding of the driving question. Throughout the research and production processes, learners have opportunities to choose their area of emergent expertise, their target audience, and the format of their product. They work collaboratively to develop their projects, incorporating insights from teacher guidance and peer coaching. Before the final share-out of their collective learning, teachers are asked to affirm students' brilliance: "Remind students how valuable and powerful their voices are and tell students that they are now 5th grade experts on their topic and should feel proud to share their knowledge with their community/audience!"

Importantly, action and activism are defined broadly within the resources and activities in the Storyline. In the examples featured in the Storyline, leaders and activists shared their messages through poetry, visual art, storytelling, video production, protests and marches, educational programs, and more. Students are invited to consider multiple forms of action as well in their final projects, including creating a short film or podcast, designing digital or print media, writing a letter to a policymaker or other decision-maker, or other ideas that they think would be appropriate for the audience they have in mind.

This breadth of opportunities validates students' unique voice and agency as community leaders and their ability to have an impact in many different ways and across different spaces.

This example of the action project in "Becoming Protectors" indicates how uplifting young learners' power as changemakers is dependent on the liberatory pedagogical practices described in the first section of this chapter. The project-based learning instructional framework, with its emphasis on student voice and choice, sustained and authentic real-world learning, collaborative sense-making, and community-engaged inquiry, is especially well-suited to supporting youth action and activism. In other words, reframing how we think about and engage with young people as brilliant science learners and practitioners is deeply related to how we encourage and celebrate them as agents of transformative change (Stromholt & Bell, 2018). Through showcasing examples and strategies of youth leadership, cultivating students' critical awareness, and scaffolding opportunities for community action, project-based approaches can simultaneously honor young people's existing strengths *and* provide apprenticeship opportunities that deepen their ability to mobilize for effective sociopolitical engagement (Tivaringe & Kirshner, 2021).

Project-based learning is also inherently solution-centered, enabling students to see how they can contribute to ongoing problem-solving efforts, which can help address environmental- and climate-related emotions like anxiety, fear, and grief. Concern about these emotional responses can lead educators to avoid discussing complex environmental and climate topics with young learners, as described in chapter 2. However, this chapter seeks to demonstrate how we can instead act as adult allies and support young people's social-emotional wellbeing by engaging in shared learning and collective action through classroom experiences. As Pranjali said, focusing on learners' sense of sociopolitical agency can give rise to "initiative and empowerment as a part of that, versus despair and loss of hope." More just, creative, caring, and liberatory forms of learning are possible when we desettle ageism and adult-centrism in environmental and climate learning and instead invest in the power and ingenuity of young learners.

Intersectionally Just and Justice-Centered Learning for Possible Socio-Ecological Futures

In this chapter, I have described three interconnected dimensions of injustice that are often imposed on young learners in school-based learning environments and constrain their engagement in environmental and climate learning. For each of these — deficit logic, white supremacy and colonialism, and ageism and adult-centrism, I have shared personal and curricular counter-stories from collaborative and critical sense-making with Stacy and Pranjali. These dimensions and counter-stories are summarized in the table below (see *Table 2*). Although I have addressed the three dimensions separately in this chapter, they are of course intersecting, interrelated, and inflected by other systems of oppression and harm that were not discussed here, such as capitalism and neoliberalism, ableism, xenophobia, cisheteropatriarchy, linguistic injustice, and more.

In many cases, these oppressive forces are perpetuated through the moment-to-moment decisions and actions of educators, educational leaders, curriculum designers, and other adults. In this chapter, I demonstrated how the design of curricular resources and pedagogical supports can disrupt these ingrained assumptions and practices and catalyze more liberatory praxis. I offer these counter-narratives as an invitation into critical reflection, sustained justice-centered learning, and shifts in practice across all levels of our educational systems — from everyday classroom interactions to professional support to dialogue among educational leaders within state-wide implementation initiatives like ClimeTime. As adults allies who are invested in the thriving of young people and their communities, I hope we will continue to desettle the settled expectations that shape our practices and to imagine more intersectionally just and justice-centered forms of learning. Youth leaders and activists are already envisioning and demanding these transformations of teaching and learning (e.g., Jimenez, 2018) and are creating their own spaces of sustenance, collective learning, expertise-sharing, and intersectional organizing (e.g., Margolin, 2020). It is time for us to listen to young people, learn from their calls for systemic change, and align ourselves with the just socio-ecological futures they are dreaming and building.

Table 2

Desettling Settled Expectations Through Curricular Counter-Stories

Dimension of injustice	**Settled expectations in school-based environmental and climate learning**	**Counter-storytelling more liberatory possibilities through curriculum design**
Deficit logic	Under-estimation of young learners' capabilities as knowers and doers of science, which restricts access to meaningful science learning, especially for children with marginalized identities	Positioning young learners as: ● Capable of authentic scientific inquiry about real-world phenomena ● Active intellectual agents who make decisions about their learning ● Already possessing expertise and as developing experts
White supremacy and colonialism	Onto-epistemic supremacy in how environmentalism and ecological relationality are conceptualized through white Euro-Western lenses	Making visible and sustaining global majority onto-epistemologies and ecological relationships and practices
	Invisibilization of environmental and climate challenges in global majority communities OR White saviorism and positioning challenges solely in global majority communities	Centering global majority leadership and expertise in responding to challenges, highlighting the interconnectedness of local and global climate challenges, and positioning young learners with humility to learn from and with global majority leaders
Ageism and adult-centrism	Belittlement and dismissal of young people and their concerns, belief that the purpose of education is preparation for *later* civic and community participation	Lifting up youth leadership by: ● Amplifying models of youth leadership and the possibilities of science as a tool for collective liberation ● Supporting young people's sociopolitical consciousness ● Recognizing, honoring, and supporting young people as already being agents of change in their communities and creating further opportunities for youth action and leadership

SECOND THEORETICAL INTERLUDE

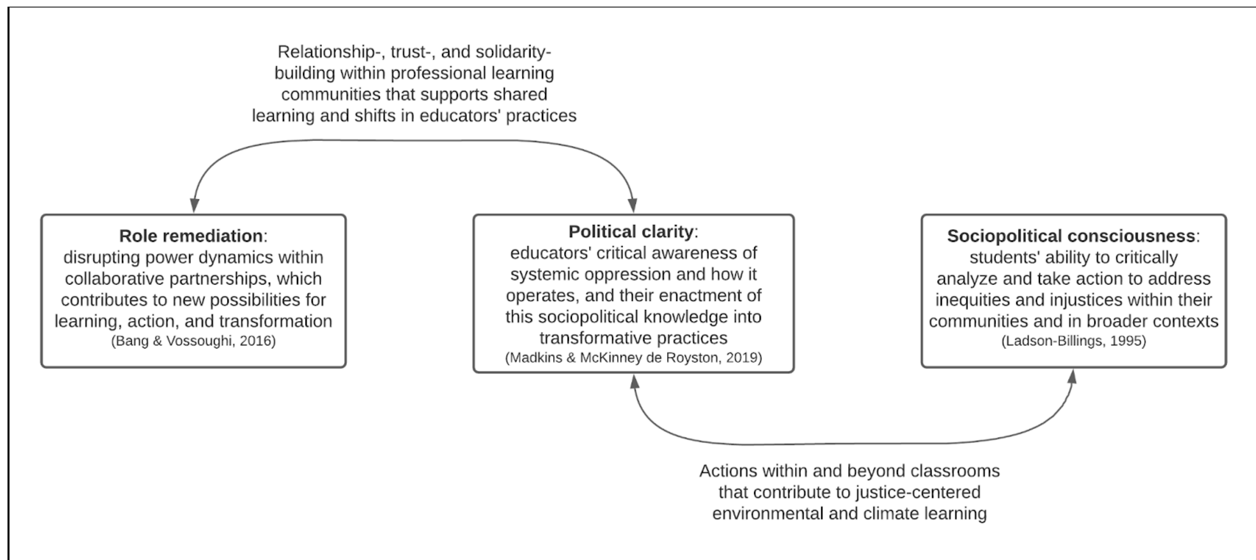
In this second theoretical interlude, I share additional concepts to frame the stories and analyses in the following two chapters. In chapters 2 and 3, I described how desettling dominant discourses, assumptions, and curricular and instructional practices is crucial for intersectionally just and justice-centered forms of environmental and climate learning. I also demonstrated how personal and curricular counter-stories offer paths toward emancipatory experiences for global majority learners and their communities. In the following two chapters, I focus on other dimensions that can enable or constrain these possibilities for liberatory learning — specifically, the changing axiological, ideological, and political commitments of educators and educational leaders that guide their engagement with learners and with the structures of educational systems. Chapter 4 explores processes of justice-related sensemaking among educational leaders within the ClimeTime network, including learning moments prior to their participation in the network as well as shifts in thinking and practice that emerged through collective engagement in network activities. Then, chapter 5 provides an in-depth portrayal of how the Climate Justice League is intentionally designed to support educators' learning about intersecting justice concerns and their facilitation of justice-centered learning within and beyond their classrooms.

In investigating these lines of inquiry, I leverage several concepts related to critical awareness and sociopolitical action. Specifically, I draw upon the idea of *sociopolitical consciousness* (Ladson-Billings, 1995) to describe students' learning and development processes, and I use the framing of *political clarity* (Madkins & McKinney de Royston, 2019) to analyze the justice-related pathways of educators and educational leaders. In addition, I think with the concept of *role remediation* (Bang & Vossoughi, 2016) to understand how professional learning spaces that are attuned to power dynamics and relationality can contribute to liberatory praxis and social transformation. In this interlude, I offer a brief overview of each concept, indicate how they are taken up in the context of the subsequent chapters, and consider how the interplay between these concepts can be generative in informing the design of educational systems that

contribute to socio-ecological wellbeing (see *Figure 4* for a representation of how these concepts work together).

Figure 4

Conceptual Constellation for Chapters 4 and 5



Sociopolitical Consciousness

As discussed in chapter 3, cultivating learners' critical awareness of systemic injustices and their sense of agency as changemakers in their communities is central to justice-centered environmental and climate learning. In her introduction of culturally relevant pedagogy (CRP) as a theoretical and practice-based framework, Ladson-Billings (1995) describes the principle of *sociopolitical consciousness* by highlighting the need for teachers to "help students to recognize, understand, and critique current social inequities" (p. 476). She explains how teachers that she observed implementing culturally relevant approaches "were not reluctant to identify political underpinnings of the students' community and social world" (p. 477); for example, by facilitating shared investigations of the social, economic, environmental, educational, and other inequities that students experience. Culturally relevant educators create opportunities for learners to connect their experiential knowledge to classroom learning, and vice versa, by taking action to address challenges and solve problems in their communities (Ladson-Billings, 2014).

Socio-political consciousness is closely connected with the idea of *critical consciousness* as conceptualized within Paolo Freire's (2018) *critical pedagogy*, which similarly involves awareness and analyses of oppressive forces as well as engagement in transformative social action through the processes of education. These concepts also resonate with bell hooks' (1994) descriptions of *critical awareness and engagement* as crucial aspects of *engaged pedagogy*, which builds upon Freire's work.

Ladson-Billings (1995, 2014) clearly conveys that this aspect of CRP is of equal importance as the other two tenets, academic success and cultural competence. However, as interest in and implementation of CRP has spread in recent decades, the tenet of sociopolitical consciousness has been generally overlooked by researchers and practitioners. While attention to learners' intellectual growth and their heterogeneous cultural identities has become more common, albeit often enacted at a superficial level, incorporation of political critique and social action remains rare, thus "dulling [CRP's] critical edge or omitting it altogether" (Ladson-Billings, 2014, p. 77). Jones and Donaldson (2021) identify this discrepancy in pre-service science educators' descriptions of their teaching practices and attribute it to incomplete understandings of the CRP framework as well as teachers' own limited sociopolitical consciousness.

Political Clarity

Educators' ability to support learners' development of sociopolitical consciousness is dependent upon their attunement to and analyses of societal injustices and their underlying causes (Ladson-Billings, 1995). Teachers' ideological commitments, political stances, and past experiences all inform their perceptions of learners and their approaches to classroom learning. Educators with deeper awareness of systemic inequities are more equipped and likely to emphasize the sociopolitical dimensions of culturally responsive teaching and embed them within their pedagogical practice (Jones & Donaldson, 2021).

Madkins and McKinney de Royston (2019) describe educators' critical consciousness using the concept of *political clarity* and present a case study of how a science teacher's sociopolitical knowledge and priorities are translated into classroom interactions and learning activities that support learners'

sociopolitical consciousness. The authors highlight several dimensions of political clarity through this portrayal, including critiques of pervasive injustices and power imbalances; recognition of how oppression shapes students' lives within and beyond school, particularly through the invisibilization or subordination of heterogeneous ways of knowing and being; validation of marginalized learners' multiple identities, interests, experiences, and expertise; and understanding of science teaching and learning as political rather than neutral acts. Similarly, Madkins and Morton (2021) define political clarity as "understanding of the sociopolitical and classed realities that shape our learners' lived experiences, and how structural and school inequalities work to (re)produce differential learning experiences for minoritized learners" (p. 241). These framings are grounded in Bartolomé's (1994) and Beauboeuf-Lafontant's (1999) assertions that educators with political clarity feel a sense of personal and professional responsibility for actively disrupting the status quo of oppressive structures within educational institutions in order to support the learning, becoming, and thriving of students with non-dominant identities.

As described above, educators' political clarity is crucial for their capacity to promote learners' sociopolitical consciousness through learning experiences. More broadly, these pedagogical philosophies and commitments are necessary for moving toward the intersectionally just and justice-centered forms of teaching and learning described in the previous chapters — for example, by understanding and challenging the settled expectations of developmental discourses, deficit logics, white supremacy and colonialism, and ageism and adult-centrism that continue to harm and marginalize learners. Importantly, scholars and practitioners demonstrate how political clarity often permeates *and* extends beyond classroom practice, broadly informing how educators advocate for the well-being of learners and touching all aspects of how they act within their personal, professional, and political worlds (Beauboeuf-Lafontant, 1999; Kohli et al., 2019; Madkins & McKinney de Royston, 2019).

Although it is essential for all educators to develop these pedagogical orientations, many do not have sustained opportunities to cultivate a robust critical consciousness — especially educators who hold

positions of power and privilege and may be shielded from direct exposure to intersecting injustices. Despite this potential lack of experiential knowledge, educators with dominant identities can and should hone their political awareness and ability to implement justice-centered practices (Beauboeuf-Lafontant, 1999; Madkins & McKinney de Royston, 2019). In contrast, educators with marginalized identities often express how their teaching practices are rooted in personal histories of navigating systems of power, privilege, and oppression; participation in resistance movements; and insights absorbed from their family and community members (I. Jackson & Knight-Manuel, 2019; Kohli et al., 2019; Morales-Doyle, 2017). However, educators who hold political clarity shaped by their lived experiences do not consistently translate these critical understandings into engagement with learners (I. Jackson & Knight-Manuel, 2019). Research in teacher education indicates that educators' processes of recognizing how racial and intersecting injustices manifest in classroom learning are often uneven, emotionally fraught, and nonlinear (Jones & Donaldson, 2021; Ladson-Billings, 1995; Larkin et al., 2016; Philip, 2011; Shah & Coles, 2020). In order to deepen their sociopolitical analyses and strengthen their critical pedagogical approaches, all educators need continual support through preservice and in-service professional learning that is specifically focused on ideological transformation and implementation of these commitments into action (Jones & Donaldson, 2021).

In the following chapters, I aim to leverage and expand upon this prior literature in several ways. In addition to the importance of political clarity for educators who work directly with learners, I suggest that leaders and teacher educators within educational systems also need to cultivate their critical consciousness in order to advocate for the transformative learning and thriving of the teachers, students, and communities they serve. As individuals who design and implement professional learning experiences and who can create supportive structures for educators, educational leaders hold significant power to catalyze or inhibit intersectionally just and justice-centered learning (Jones & Donaldson, 2021; Madkins & Morton, 2021). As such, it is necessary to understand how leaders articulate their sociopolitical and ideological commitments and reflect on their journeys toward political clarity. In chapter 4, I describe the

justice-related learning processes of educational leaders within the ClimeTime network, highlighting pivotal experiences that give rise to axiological change, deepening awareness, felt responsibilities, and a greater sense of agency as equity- and justice-minded changemakers.

Secondly, descriptions of sociopolitical consciousness and political clarity tend to focus primarily on how racialized identities and socioeconomic status influence learners' experiences of schooling. In thinking with these concepts within the context of environmental and climate education, I suggest that they can be applied more broadly to include ecological and climate justice as well as social, economic, and educational justice. In chapter 4, I share stories of educational leaders' ideological sensemaking that demonstrate how critical awareness of inequities and injustices can develop in the complex interplay of social, political, environmental, educational, and relational encounters. These understandings and justice commitments are interconnected, expansive, and not easily compartmentalized.

In addition, much of the literature on supporting educators' development of political clarity is situated within formal learning experiences, particularly activities in teacher education programs (Jones & Donaldson, 2021; Madkins & Morton, 2021). Given that learning is lifelong and constantly unfolding across contexts, I offer stories of justice-related sensemaking from participants' lived experiences both within and beyond formal educational spaces (Banks et al., 2007). Understanding which learning moments contribute to greater political clarity, and how, can inform the design of teacher education and professional learning programs that recognize and build upon these prior experiences. Educational leaders can also intentionally leverage the kinds of learning activities that appear to be highly conducive to the development of political clarity into the programs that they facilitate.

Finally, given that ideological transformation is a gradual and ongoing process — and not all teacher education programs currently ensure that educators acquire a robust critical consciousness — more attention to how in-service professional learning can scaffold teachers' deepening of political clarity is necessary (Jones & Donaldson, 2021). Just as learners benefit from opportunities to cultivate their critical awareness and power as changemakers, educators need access to supportive communities of

shared inquiry and reflection in order to promote social transformation through their engagement with students. In chapter 5, I describe how the design and facilitation of the Climate Justice League create space for educators to engage in individual and collective sensemaking about intersecting injustices, thus fostering their political clarity and ability to take justice-centered action in their classrooms and beyond.

Role Remediation

To analyze how the Climate Justice League as a professional learning community enables educators to become agents of change, I also draw upon the concept of *role remediation*. Bang and Vossoughi (2016) define role remediation as "qualitative shifts in subject-subject relations that emerge within processes of partnering and afford new social and educational possibilities" (p. 176). They describe how historically entrenched power imbalances often arise within participatory projects in which university-based researchers, learners, educators, family members, and community leaders collaborate to design educational activities. They leverage Gutiérrez and Vossoughi's (2010) conceptualization of remediation as "reorganization of the entire ecology for learning" (p. 102), asserting that centering justice in partnerships requires explicitly attending to and disrupting the inequitable interaction patterns between collaborators with different social positions. Role remediation refers to the creative emergence of new, more liberatory ways of engaging, contributing, relationship-building, and decision-making within shared activity — which necessarily involves honoring the heterogeneous forms of expertise that each collaborator provides. These shifting roles and relations among all partners enable the co-construction of expansive forms of learning, design, agency, and sociopolitical action (Tzou et al., 2020). Bang and Vossoughi emphasize that role remediation is essential for moving toward more just futures:

> …transformative social change involves the interweaving of structural critiques with the enactment of alternative forms of here-and-now activity that open up qualitatively distinct social relations, forms of learning and knowledge development, and contribute to the intellectual thriving and well-being of students, teachers, families, and communities. (p. 175)

In the context of the Climate Justice League, the concept of role remediation helps to clarify how the

design of the learning experience, the strategic positioning of educators and their expertise, and the relationships formed between participants support teachers' development of political clarity and transformative agency. In chapter 5, I share details about the relational engagement of educators in the Climate Justice League and how this community serves as a crucial catalyst for intersectionally just and justice-centered learning as well as broader forms of community action and sociopolitical changemaking.

CHAPTER 4: PATHWAYS, PROCESSES, AND PRACTICES OF POLITICAL CLARITY

In this chapter, I offer a thematic analysis of multiple processes that contribute to educational leaders' critical consciousness and political clarity. First, I share stories from participants' personal histories, focusing on transformative experiences and relationships that informed their understandings of justice issues and sense of responsibility to take action. Next, I describe how a commitment to intersectional justice and thriving as a central principle can deepen over time, inflecting how educational leaders engage across contexts. Lastly, I offer examples of how political clarity can be refined and elaborated through participation in professional communities of practice. I briefly touch on relational spaces outside of ClimeTime as well as the shared learning opportunities within the ClimeTime network that participants mentioned. However, I focus primarily on the specific example of how the Climate Justice League project spread across several regions within Washington State, indicating how opportunities for cross-pollination and collaboration can generate shifts in educational leaders' priorities and practices. These descriptions provide insight into participants' dynamic and non-linear justice-related learning pathways, which can support the design of learning environments that cultivate educators' and educational leaders' political clarity and transformative agency.

Throughout the chapter, I utilize a variety of data sources to analyze educational leaders' individual journeys as well as the collective sensemaking that occurs within network activities. Insights are drawn primarily from the one-on-one semi-structured interviews conducted with the thirteen educational leaders who agreed to participate in the research project (see chapter 1 for a description of this group of participants). The interview series consisted of three conversations: the first focused on past learning experiences, the second on current personal and professional practices, and the third on visions and desires for future learning and practice (see *Appendices A*, *B*, and *C* for the interview protocols, which were created based on co-design meetings with participants). In addition to this interview data, I incorporate stories and reflections from research check-in meetings with Stacy and Pranjali, as well as the process interview conducted with Stacy about the Climate Justice League. Insights from these

conversations are supplemented by fieldnotes from participant-observation of full-network events and case study project gatherings, as well as artifacts generated during these activities.

Importantly, although I asked separate questions about their working definitions of social, environmental, and climate justice, many of the participants emphasized the complexity and interconnectedness of these and other forms of justice. Several described how the adoption of more intersectional analyses of inequities and injustices has been a crucial dimension of their development of political clarity. For example, Riley shared how her definition of social justice has expanded over time:

> I think that it definitely has expanded in terms of what it takes to achieve social justice. I think that an earlier iteration of that understanding for me saw it as one thing, like the transformation of racist systems, or the transformation of sexist systems. I thought of these isms, systems of oppression, in silos, and I think over time I've expanded that to understand that social justice really requires an intersection of the dismantling of many different systems of oppression. So I think that there was a time where I would have said that environmental justice is separate from social justice, whereas now where I stand, it all is connected and I don't think that one can be achieved without the other. So I think that's the biggest change in my thinking about social justice.

In this reflection, Riley clarified her shift from siloed understandings of oppression and liberation to the more recent awareness that these axes of systemic transformation are mutually dependent and inseparable. Similarly, Julia said:

> There's something wrong with us as humans separating social justice from environmental justice. So for me, in the last year, I've been really trying to articulate better my thinking in terms of that. Until humans acknowledge that social justice and environmental justice are interlinked because humans and the rest of the planet are intricately linked, we're still dividing and we're still siloing and we're still doing that work of separating things into parts when they're not.

Julia elaborated that human decision-making must take into consideration the rights and well-being of more-than-humans and ecosystems. She explained that "social justice for me includes justice for non-human species" and respect for the interdependent ecological and climate systems that humans are part of. Thus, Julia shared an interwoven conceptualization of environmental, climate, and social justices that account for the thriving of all beings rather than focusing solely on impacts on human communities.

Some educational leaders also highlighted the entanglement of economic systems with historical and ongoing forms of environmental, climate, and social injustices. Matthew discussed how "most of the things in our society are economically driven" and structural disparities in voice and power result in inequitable access to economic and environmental health within our shifting climate systems. These impacts are especially heavily felt by individuals who are deeply connected to and dependent on lands and waters — for example, those who work in agriculture, fisheries, and forestry. He reflected that concerns of economic viability, identity and community affiliation, and connection to local places are often interwoven for marginalized communities, making them less mobile in the face of environmental damage and climate change. Similarly, Casey shared about her growing critical awareness about the negative impacts of capitalism and "how capitalism as a system has stopped social justice from evolving. It's in the way of climate justice." She reported examining who benefits from extractive capitalism and who is harmed, as well as learning more about how corporate influence on political systems prevents socio-ecological transformation and justice. Matthew and Casey's analyses reveal their attentiveness to how systems of oppression overlap and compound to affect some communities in distinct and more severe ways.

Participants' articulations of complex interconnections between sociopolitical, economic, environmental, climate, and other forms of structural injustice resonate with definitions of political clarity as attunement to how systems of subordination impact marginalized learners' and communities' lived experiences (Madkins & McKinney de Royston, 2019; Madkins & Morton, 2021). Given the emphasis on race and class in existing literature on political clarity, a conceptual framing of *intersectional political*

clarity may be useful to describe critical consciousness pertaining specifically to how multiple axes of power and oppression interact. In this text, I focus especially on socio-ecological dimensions of these intersections. This kind of awareness is related to the construct of *intersectional competence*, which describes how educators interpret the realities that “students, families, and colleagues have multiple sociocultural markers that intersect in nuanced and unique ways” (Boveda, 2016, p. 17). However, intersectional political clarity extends beyond classrooms and schools into broader analyses of societal dynamics. In addition, it accounts not just for social identity markers held by individuals but also addresses harm and healing in collective, ecological, and planetary contexts.

Histories of Developing Political Clarity Through Learning Experiences and Relationships

Given the fluidity and interrelatedness of social, environmental, climate, and other forms of oppression and transformation in how many participants described them, I will weave together stories pertaining to these multiple dimensions of justice in the following sections. In other words, I share narratives about the development of intersectional political clarity among this group of participants, broadly conceptualized. However, this is certainly not intended to suggest uniformity in educational leaders’ definitions of justice or their trajectories of justice-related learning. In addition, the learning processes and themes described below are not neatly bounded, but instead overlap and blur, informing each other in organically emerging ways. These stories take place throughout individuals’ lives, from early childhood to the months immediately preceding the interviews, and many participants adopted a stance of humility and curiosity in reflecting on their ongoing justice journeys.

Moments of Exposure and Dissonance as Catalysts of Political Clarity

Many educational leaders shared stories about moments of exposure and dissonance that raised their awareness of intersecting injustices. These pivotal learning experiences emerged from a variety of contexts, including social movements, storytelling and story-listening, interpersonal relationships, and professional practice.

My conversations with participants took place during the fall of 2020, after years of Black Lives Matter movement-building and organizing led to a summer of nationwide protests against police violence and state-sanctioned anti-Blackness. The increased salience of this ongoing social movement prompted critical reflection for many of the educational leaders. For example, Natalie shared about recent changes in her awareness of social justice:

> And especially very recently, because this term obviously is becoming forefront right now in our political climate, social justice. And with the protests that started in May... I don't know that it has changed since May, but the thinking around it has become more forefront for me.

For Natalie, public discourse around Black Lives Matter and related justice movements have made these sociopolitical issues a more pressing priority. Several other participants, including Casey, Julia, Morgan, and Sara, also specifically mentioned Black Lives Matter as a factor shaping their understanding of justice. Others referred to a growth in collective consciousness of racial injustices, particularly for white individuals who were previously less aware of these realities. For instance, Danielle emphasized that "things started really heating up around racial issues" in the past six months, while Sage described how "the veil has been lifted" regarding power, privilege, and identity in the U.S. Julia reflected that the Black Lives Matter movement has activated her awareness of racism, but also of other oppressive systems, including ableism, sexism, religious discrimination, and classism. Danielle and Sara also referenced the Trump presidency and the blatant injustices that were committed or exacerbated during his administration. For these educational leaders, understanding of justice issues and a sense of urgency to address these issues emerged in part as a response to the current sociopolitical moment. Although the seeds of political clarity were already planted for many of the participants, contemporary social movements shed light on the longstanding systems of oppression experienced by marginalized communities within the U.S.

The awareness prompted by social movements and broader public discourse can mobilize individuals to engage in intentional learning. For example, Morgan shared in our first interview:

> I think I've just become more aware of the great disparities that exist for different populations. And I've always been a very empathetic person, but you don't know what you don't know. So I think I've just been more exposed to the reality of different people's lived experiences in different places. And certainly, the Black Lives Matter movement has really catalyzed me to start learning more about what's happening for and to and with Black people, Indigenous people, and people of color.

Morgan positioned the Black Lives Matter movement as a catalyst for her personal learning about racialized disparities and other sociopolitical realities. Later in our conversation, Morgan explained further:

> I started realizing, with all of the civic action happening in the wake of so many deaths of people of color recently at the hands of police, that I just have so much learning to do and so much work to do. And I've made it a priority in my personal life to start reading books by people of color and listening to podcasts that helped me deepen my understanding of, for example, what anti-racism even is.

Witnessing the political uprising made clear to Morgan that she needed to find ways to extend her personal knowledge and critical consciousness.

At the same time, Morgan also identified connections to her professional roles and responsibilities as a leader within educational systems. Morgan reflected that her growing recognition of racialized violence includes specific connections with inequities and injustices in environmental fields. Morgan highlighted the confrontation that occurred between Amy Cooper (a white woman walking her dog) and Christian Cooper (a Black man and birdwatcher) in Central Park in May 2020, on the same day that George Floyd was murdered by police officers. Video recordings captured Amy Cooper calling 911 and falsely accusing Christian Cooper of threatening her safety. Given Morgan's professional context of environmental and climate education, this example of white supremacy and anti-Blackness manifesting in

an outdoor space was an especially salient aspect of the broader sociopolitical agitation about racial injustice.

For Morgan, the event clarified her existing awareness of racialized experiences of nature, which was initially sparked when she watched a presentation by Black writer and photographer Dudley Edmondson on his book *Black and Brown Faces in America's Wild Places*. Edmondson shared historical and contemporary examples of global majority communities' deep connection with the natural world as well as their persistent experiences of marginalization and alienation within white-dominated environmental fields and public spaces. In our conversation, Morgan identified a thread connecting Edmondson's presentation, the Central Park incident, and the calls for social transformation generated by Black Lives Matter activists. Morgan reflected on her expanding consciousness of these issues:

> It just really brought home the reality that this is an ongoing and systemic problem in our society. And it's an ongoing and systemic problem that is contributing to lack of diversity in the field of environmental and sustainability education.

Morgan's experiences suggest that political clarity can be cultivated when sociopolitical contexts prompt learning that elaborates upon previous understandings. Morgan's stories indicate her growing analysis of how racialized representation and storytelling regarding Black communities' ecological relationships perpetuate stereotyped assumptions and ideologies that translate to lived realities and systemic disparities (Finney, 2014). In some cases, learning from social movements involves acknowledging how injustices coincide with our own personal and professional contexts. This process aligns with characterizations of ideological sensemaking as gradually strengthening our ability to coordinate key concepts related to racialization across different contexts over time (Philip, 2011).

Morgan's recollection of Dudley Edmondson's presentation also indicates the impact that storytelling can have on individuals' justice-related sense-making. Whereas the reflections above demonstrate how educational leaders were affected by the overall social moment and public discourse about justice, participants also highlighted how specific encounters with storytellers exposed them to

lived experiences that differed from their own and deepened their critical awareness. Riley shared about attending an environmental conference where the keynote speaker ceded most of her allotted time to participants, many of whom held intersectionally marginalized identities, to tell their own stories. Riley reported the transformative effect of hearing these stories:

> At the time, I was working in environmental education, and I was thinking about environmental education as connecting my students to the natural world, connecting them to place and their environment. And this woman talked about how coming from inner city LA, where her neighborhood is built around a factory that is incredibly polluting of the air and the water, and how connection to place for her means something really different and is no less rich and meaningful. But her story brought my attention to environmental racism. It also brought my attention to the diverse ways that we connect to place. She said something to the effect of, "How dare you call my community not outdoorsy when going outside is dangerous to my health, how do you judge me for that?"

For Riley, witnessing this firsthand account made apparent to her the existence and consequences of environmental injustice, the many different ways that individuals and communities can cultivate relationships with place, and the implications of these realities for her practices as an environmental educator. Riley continued, recounting another story that was shared during the keynote presentation:

> There was another person who talked about her mother immigrating to the United States from Mexico and crossing the desert, spending three weeks hiking through the desert to get to the border. "How dare you call my mother not outdoorsy? She hiked three weeks through the desert to bring her family to another country."

Here, Riley again emphasized her realization that global majority communities hold distinct and powerful histories, experiences, and connections with the environment that are often not legible within dominant understandings of environmentalism. These insights resonate with the principles of the intersectional environmentalism movement, which centers the socio-ecological expertise and lifeways of marginalized

peoples (L. Thomas, 2022). Next, Riley reflected on how listening to these testimonials shaped her critical consciousness:

> So I think those stories are representative of my understanding that environmental justice… I would say the "environmental movement," like the mainstream environmental movement in our country, really really really excludes and reduces the beautiful diversity of ways that folks engage with the environment. And I think it also really tries to silo environment from social, and environment from political, and environment from built and human, which I think is an illusion. And so that's kind of where I'm at now is environmental justice requires this social element to understand the full complexity of even just how we think of what environment is.

Exposure to the compelling stories of conference participants with non-dominant identities guided Riley toward more intersectional understandings of environmentalism and environmental justice, a crucial form of political clarity. Riley's experiences exemplify the power of storytelling and sharing experiential knowledge as a catalyst for critical reflection and the development of political clarity (Madkins & Morton, 2021). In addition, they demonstrate the importance of counter-storytelling from the margins as a strategy for disrupting dominant narratives in fields like environmental education (Solórzano & Yosso, 2002).

Although Riley's learning encounter occurred in the non-formal learning context of a conference, moments of exposure to unfamiliar lived experiences and worldviews can also take place within more formalized educational spaces. For example, Casey shared that her undergraduate coursework played a significant role in raising her awareness of sociopolitical injustices after her childhood spent in relatively conservative and majority-white areas. She specifically mentioned a program about the history of childhood and schooling in the U.S., in which she learned about child labor and the ramifications of capitalism in children's and families' lives. Following this program that initially directed her attention to justice issues, Casey joined a multicultural literature course in which she was introduced to and captivated by the writing of James Baldwin. Casey reflected that repeatedly reading Baldwin's work highlighted her

own limited experiences and further exposed her to racialized and intersectional injustices in the U.S. For Casey, the content of her undergraduate courses directly addressed issues of historical and ongoing marginalization through exposure to multiple viewpoints. Casey emphasized that these aspects of her educational journey cultivated commitments to equity and justice that persisted and became further elaborated through her later professional activities.

Sara also shared stories about her formal educational experiences, particularly her interactions with a faculty member in graduate school. Sara described how her emerging interest in the topic of wildlife tourism became crystallized through discussions with a professor focused on a National Geographic article that she stumbled upon early in her graduate studies. For Sara, the stories shared in the article called her attention to the intersecting injustices that shape tourism industries, including local community members' economic desperation and survival within global capitalism; power imbalances between host countries and visiting tourists; harms caused to animals involved in tourism activities; the possibility of disease transmission from close proximity to wildlife; environmental degradation in the form of biodiversity loss and deforestation; and the compounding impacts of the climate crisis on ecosystems and communities. Sara reflected that the conversations with her professor were deeply influential in clarifying her interest, prompting her to analyze issues intersectionally, and providing academic language to organize and extend her critical inquiry. This graduate school experience continues to guide Sara's thinking, learning, and practice in her recent professional contexts and her priorities as an educational leader. In this example, Sara's sustained engagement with socio-ecological challenges was scaffolded by mentorship within a formal learning space that supported her development of intersectional political clarity. Sara and Casey's discussion of the importance of formal learning environments for their critical consciousness resonates with Kohli et al.'s (2019) findings, although their positionalities as white women differed from the women of color educators described in that study.

For both Casey and Sara, these justice-related learning experiences centered on exploration of articles, books, and other texts that shifted their understanding. Several other educational leaders also

mentioned the impacts of key books on their critical consciousness. For example, Morgan shared that reading Robin Wall Kimmerer's *Braiding Sweetgrass*, especially the chapter entitled "Learning the Grammar of Animacy," desettled her ideas of human-nature relationality. Morgan explained that Kimmerer's storytelling expanded her awareness of Indigenous worldviews and the existence of heterogeneous culturally situated conceptualizations of "living" and "non-living." This insight prompted Morgan to reconsider the concepts and practices of empathy and reciprocity, which are salient within her role as an educational leader who supports environmental and climate learning. For many of the participants, intentional reading practices are an important way to grow their political clarity. For instance, Meredith mentioned that she constantly seeks out books and articles to further her learning about race, racism, and racialization and the intersections of social justice with environmental and climate issues. These examples indicate that multiple forms of storytelling and story-listening can powerfully shape the political clarity of educational leaders, including witnessing the oral sharing of personal testimonials, investigating historical events and patterns, and reading text-based narratives that provide exposure to a broader array of experiences and perspectives.

In the examples recounted above, educational leaders are influenced by relatively indirect sources of sociopolitical commentary (e.g., news coverage) and storytelling (e.g., presentations to a large audience, reading texts). In addition, participants also described how their direct social interactions within personal and professional relationships introduced them to heterogeneous viewpoints and lived realities. For instance, Natalie reflected about her expanding social circles:

> I grew up in a very rural setting, like a town of 600, I was related to everybody. It was in the Midwest, a very white community, and I've always lived in rural settings, I've never lived in a city of any kind. And so, as I've gotten older, and just become more exposed, through news and the internet and the people that I meet, especially in this new role that I have [...] where I'm working with people across the state and outside of my small little rural community, I think those things have changed, obviously, the way I feel about the terminology of social justice over time.

Natalie characterized her early life as “pretty sheltered” and shared how conversations with colleagues about recent civic unrest made her aware of her own limited experiences and exposed her to the variety of experiences that her peers carry, which differently shape their understandings of social and educational justice. Encountering a broader range of worldviews through interpersonal relationships contributed to Natalie’s critical consciousness and ability to engage in more nuanced analysis of sociopolitical issues.

Several other educational leaders similarly highlighted significant relationships that provide different ways of seeing and engaging with inequities and injustices. For example, Danielle described how conversations with a close friend who identifies as Latino and gay made clear to her how she is protected from racialized aggression as a white woman — and that this open dialogue strengthened her commitments to practice anti-racism in personal and professional contexts. Julia, Morgan, Casey, Meredith, Riley, and Sage, who all identify as white, also referenced relationships with individuals with racial and cultural identities that differ from their own — including friends, professional colleagues, and extended family. These intimate social relationships, and the honest discourse that is possible within them, challenge participants’ onto-epistemic and axiological perspectives, expand their awareness of sociopolitical issues, and deepen their understanding of their own positionalities and responsibilities. Importantly, some of these interactions seemed to be harmonious learning experiences, whereas others were impactful specifically due to the dissonance and emotional discomfort that arose. In both cases, educational leaders developed their political clarity through meaningful engagement within relationships that exposed them to unfamiliar ideas, personal histories, and worldviews.

Among these educational leaders who cited social relationships as a source of political clarity, several emphasized that they intentionally seek out heterogeneity and exposure in their personal and professional circles. Meredith shared how her justice-related learning emerges in part from “who I choose to spend time with and the things we talk about.” She provided examples of one close friend with Indian heritage and another who is Korean American, both of whom hold perspectives that are very different from her own. Meredith emphasized the importance for her of intentionally exchanging and examining

these divergent viewpoints through dialogue and "seeking out those conversations that help me see things differently."

Similarly, though in a professional context, Casey and Riley both shared that their decisions about which higher education institutions and programs to enroll in were consciously guided by the desire to challenge their own thinking and assumptions. Geography was a key factor in this deliberation, as Casey and Riley chose to move away from the sociopolitical constraints of living in majority-white and culturally homogeneous places. Riley also reflected that she was considering multiple fields in which to pursue graduate studies and ultimately selected one where it seemed that "diverse ways of knowing were the most centered" and "a critical lens on the world is encouraged." More generally, Riley described her increasing critical reflexivity about her social circles and her tendency to gravitate toward "vacuums of whiteness or white-passing-ness." She shared how "especially recently, I think I have more intentionally exposed myself to spaces where I'm interacting with fewer white people, and I think that has really jump started a learning journey for me." Indeed, Riley expressed that the program — and especially the students of color within the cohort — pushed her forward in understanding justice and taking action to address inequities. These intentional choices can become amplified over time: for Riley, connections with peers within her graduate program led to participation within spaces of grassroots organizing and activism that have further supported her political clarity.

These stories indicate educational leaders' recognition of the need to disrupt the normativity of whiteness by centering pluralism in their personal and professional relationships. Participants demonstrated their understanding that these forms of exposure are crucial for their ongoing development of critical consciousness. In some of the participants' experiences, exposure to heterogeneous lifeways, perspectives, and knowledge systems was impactful because it produced dissonance. Several educational leaders shared stories of the tensions that arose in professional settings when dominant ways of knowing and being came into conflict with the experiences of non-dominant communities. Julia described one such

unsettling encounter that occurred early in her career, when she worked as a biologist in collaboration with the Yup'ik peoples in Alaska:

> I went in with all this "book knowledge" on endangered species and what that means and what the issues around an endangered species [are], and then you meet this whole other culture, people who have lived for thousands of years on this landscape. And the book learning is saying they're responsible for the endangerment, because they collect eggs in the example that I had. That's just incongruous because they've been there for thousands and thousands of years, collecting eggs. So, you can't tell me that this is the problem. Plus being out there and living with them and seeing their lifestyle and their commitment to the natural world and their understanding of the importance of that world to their livelihood. And then you look at California that's developing all the wetlands that the migratory birds need in order to do what they do, moving from the Northern hemisphere to the Southern hemisphere, depending on the time of the year. And it's just interesting, that whole cultural message about what's happening in the world.

Julia reflected on the disconnect between her own school-based knowledge, which was rooted in Euro-Western scientific perspectives about the causes of ecological damage, and her witnessing of the Yup'ik community's profound relationships with their homelands. For Julia, recognizing these limitations of her formal education impacted her political clarity and future endeavors in environmental and educational fields. She explained further during our conversation:

> And so that pulled me into education because… well that, and some of the Native youth that I worked with out there were "failing" in the education system, and yet they knew every single plant and they knew the medicinal and the food uses of that plant. I was 23, 24 years old when I was out there doing that. And that really has guided my career and my interest and what I do with my professional time ever since, because I think the huge disconnect… We get so many messages that are incorrect.

Julia drew a connection between the misleading framings of Indigenous communities' ecological practices and the deficit-based judgments of Indigenous youth's intellectual abilities and potential that she noticed during her field work. In both cases, there was a failure to desettle inaccurate, negative assumptions and acknowledge Indigenous brilliance, expertise, and stewardship. Specifically, abstracted principles of Euro-Western knowledge systems were privileged over the profoundly place-attuned, culturally and historically situated ways of knowing and being practiced in the Yup'ik community. Julia emphasized that these two examples of power differentials between dominant and marginalized cultural communities shaped her subsequent commitments and actions as an educator, educational leader, and environmental advocate.

Several other educational leaders also highlighted experiences of tension and dissonance as catalysts for their attunement to disparate lived experiences and their critical consciousness regarding inequities and injustices. Riley shared about helping to coordinate a conference intended to "bring together diverse stakeholders in the environment" to imagine and co-generate ways to respond to the climate crisis. Riley recounted how, despite the positive intentions of the conference organizer (a cis white man residing in a predominantly white town), the experience was problematic and harmful for many conference participants with marginalized identities. Riley reflected on the insights that emerged for her from listening to attendees' critiques:

> And I think those individuals, the way that they brought to my attention how you can have the best intentions and if you don't have learned experience and a deep sense of humility and compassion, that social justice can become a buzzword, or it can become a corporate ploy, and that real true deep social justice requires a much more relational and humble approach. So that was a really big [influence]… And particularly the intersection of environmental and social justice and different forms of justice really came to a head for me with that group of individuals who really identified for me, "This is why I don't feel like I'm in a socially just world until my

> environment is similarly in a space of justice orientation." They brought that intersectional piece to my attention.

Riley's story of learning about intersectional justice issues resonates with Julia's example of gaining deeper political clarity from on-the-ground engagement in professional contexts with community members who experience systems of oppression and marginalization. For Riley, the misalignment of the purpose of the conference and its unintended outcomes, and the dissonance this created, opened up a learning opportunity that has shaped her ways of engaging with communities and in justice work.

Dylan and Matthew, who are both white, shared similar narratives of encountering dissonance while facilitating place-based learning experiences with students who did not share their social identities — specifically, with Black and Brown students, including emerging multilingual learners. Matthew told a story from early in his career in outdoor education, when he led programs about California state history with elementary students. He shared about working with one school group of Spanish-speaking students who spoke very limited English, and how he realized that the program was not adequately serving them and providing the same value that it offered English-monolingual students. For Matthew, this interaction with learners made him aware of his own limitations as an educator as well as the structural inequities and shortcomings of the educational system, which often fails to ensure that culturally and linguistically marginalized students are able to engage in meaningful and sustaining learning experiences.

Similarly, Dylan described how his early efforts in urban environmental education programs revealed the tensions between his personal outdoor experiences and those of his students. His interactions with youth made apparent the socioeconomic, physical, and social-emotional concerns students held that he initially failed to take into consideration. Dylan's stories resonate with ethnographic research demonstrating how dominant environmental narratives and discourses, often constructed from positions of privilege, can position youth at the margins of learning spaces, limit their possibilities for learning and becoming, and perpetuate a disconnect between environmental education and young people's own understandings of local places (Tzou & Bell, 2012; Tzou et al., 2010). Young people in these accounts

expressed their agency and resistance in different ways, making visible and validating their own identities and lived realities. Dylan reflected that his experiences in urban environmental education catalyzed his learning about his roles and responsibilities as an educator — to meet students where they are and honor the experiences that they bring — as well as his understanding of how social and environmental justice issues impact young people's lives.

Thus, for Julia, Riley, Matthew, and Dylan, encountering dissonance, incongruity, and unanticipated outcomes in facilitation and other professional contexts challenged their existing understandings and heightened their awareness of interconnected sociopolitical, educational, and environmental injustices. These interactions with youth, colleagues, and community members seemed to be a powerful form of exposure and learning because they compelled individuals to directly confront the sources of tension, often through critical questioning and systemic analyses.

More generally, exposure from all of these sources — social movements and current events, oral and text-based story-sharing, personal and professional relationships, and specific dissonant experiences within programs — gave rise to participants' political clarity by broadening their scope of vision. In learning to see from multiple perspectives and recognize realities that are different from their own, educational leaders honed their critical consciousness and commitments to take action in their own communities. These processes of sociopolitical and ideological transformation parallel the practices of ethnographic inquiry, in which engaging deeply with heterogeneous lifeways and subjective experiences gives rise to insights about a phenomenon of interest. These pathways should also be interpreted in the context of the positionalities of educational leaders who participated in this research. As a predominantly white group, many of the educational leaders benefit from white privilege, which presumes the normativity of whiteness and protects white individuals from confronting the realities of race and racism. Thus, their stories focused on their growing awareness of white supremacy and intersecting systems of oppression through encounters and relationships with people who are marginalized by these structures.

This theme of justice-related learning would likely take different forms in groups that include more Black, Indigenous, Latinx, Asian, and Pacific Islander individuals.

Seeing (In)justices in Local and Personal Contexts as a Source of Political Clarity

Whereas this first set of stories focused on participants' awareness of heterogeneous worldviews and lived experiences and the disparate impacts of oppressive systems, the second theme that emerged from educational leaders' reflections was their recognition of how inequities and injustices affect their own lives and communities. In this section, I first share examples of how participants came to see the impacts of environmental damage, climate crisis, and historical and ongoing sociopolitical harms on their local places. Then, I offer narratives of community response to these localized injustices and describe how, for some of the educational leaders, their political clarity was influenced by their witnessing of grassroots organizing and resistance.

Matthew shared how his justice-related understandings and commitments shifted over time. Although he has been aware of and taken action to confront sociopolitical injustices since young adulthood, he has increasingly focused on close-to-home issues in recent years. Matthew reflected:

> I think the locus has become more local to me. So back when I was that age, I'm trying to think of what were the things that… There was the Rodney King verdict, and as students from UC San Diego, we went down and sat on the freeway, because that was clearly an injustice. And then of course there were the wars, thanks to the Bush's. And that was also social justice, but those were not people that we were meeting. These were crimes being committed against sovereign people, but we were never going to know them. Whereas up here, I suppose, right now, maybe it's more now and not necessarily here, but it just seems more pressing that people's lives are being affected. Shellfish industries up here are struggling because of ocean acidification. Salmon are not as plentiful as they were. These are things that people… More people up here depend on that kind of stuff, than down in California, or where I'm from in California, everyone goes to the supermarket for what they need. It's all kind of shipped in.

Matthew described several important changes in the nature of his critical consciousness and political action that have taken place over multiple decades. He highlighted more proximal concerns, such as Washington State's struggling salmon and shellfish populations and their relationships with human communities, in contrast with the national and global atrocities against which he mobilized during his time in college. Matthew attributed this pivot toward more local issues to both geographical and temporal context. Earlier in our conversation, Matthew mentioned that he grew up in a suburban area of California where dependencies on lands and waters were less apparent. In the region of Washington where he currently lives, however, Matthew said that "you're just never more than, it seems, two degrees of separation from someone whose family owns a farm, or whose family works on farms." The immediacy of human-nature relationality in his current community has pulled his attention to the inequities and vulnerabilities that are present in his geographic region. At the same time, Matthew noted that "maybe it's more now and not necessarily here," seemingly alluding to the increasing severe impacts of environmental and climate change over the last several decades. These escalating impacts, and increasing public discourse about them, have also amplified his concerns about urgent issues in his own community.

This interplay of the current socio-ecological moment and his current location also seemingly gave rise to more entangled understandings of justice as highlighted at the beginning of this chapter. The concrete examples Matthew shared in this reflection weave together socioeconomic, environmental, and climate-related challenges, indicating his acknowledgement of how the well-being of places and ecological systems is closely tied to the safety and security of human communities. Casey told a similar story of coming to recognize the implications of a shifting climate system for the physical, social, and cultural sustenance of peoples who are in deep relationship with specific lands and waters. She shared how an Indigenous colleague introduced her to how climate impacts are affecting her community's lifeways:

> [Name of colleague] took me out to harvest nettles and fireweed and cedar, all kinds of different things. So learning about those histories and how those particular plants have changed over time

> due to climate change was really impactful for me. And how that has changed how [she] and the people of her tribe are able to harvest and when they're able to harvest… was just a great connection to a very tangible thing for me, so I appreciated the learning I did with her around that.

In this example, Casey learned about localized plant-human relationships and how climate change is disrupting these ancient practices. Direct experiences within a social relationship raised her awareness of injustices occurring in her immediate vicinity. At other points in our conversation, Casey mentioned further examples of her intentional learning about the impacts of settler-colonialism and the climate crisis on the original inhabitants of Washington State — such as the pressing threat of displacement due to sea level rise. She reflected that these histories and current realities were completely omitted from her formal educational experiences in Washington and emphasized the importance of listening to firsthand testimonials of "how the original stewards of this land have been impacted by climate change." For Casey, hearing these stories made evident to her that justice involves mitigating local effects of climate change and ensuring that Indigenous communities are able to sustain their cultural lifeways, psychological and physical well-being, and sovereignty. These insights resonate with the work of Indigenous scholars and their collaborators who highlight connections between historical and ongoing forms of colonialism and the immense impacts of the climate crisis on Indigenous lifeways (Callison, 2014; Farrell et al., 2021; Whyte, 2018c).

This dimension of Casey's development of political clarity also highlights a crucial connection between current localized injustices and historical harms and violence. For several of the educational leaders, learning more about these place histories was a significant catalyst for understanding inequities in their communities and thus contributed to their critical consciousness. While Matthew and Casey's reflections focused on a regional or state level of local affiliation, other participants discussed learning processes at the smaller scale of cities and institutions. For example, Sage shared:

> [Name of city] has an enormous, *enormous* history of pushing out anybody who is not white, and understanding that and reading more into more of that was really, really surprising. And that was probably a couple years ago that I started looking into that and understanding that.

Sage mentioned this insight as a relatively recent node in a constellation of experiences across her lifetime that activated her critical analysis of sociopolitical injustices. Her awareness of these specific histories of racialized marginalization in the city where she has been a long-time resident clarified her understanding of broader patterns of injustice.

For Matthew, coming to recognize such historical atrocities posed direct implications to his practices and relationships as an educational leader. He highlighted recent learning with his colleagues about how "the educational system, especially in this area" has been complicit with and responsible for physical and cultural genocide. Matthew reflected that these past injustices inflect how he navigates his roles, positionalities, and justice commitments within institutions that have caused immense harm. For example, throughout our conversations, he referred to how these histories constrain his ability to engage in relationship-building with global majority communities as a white man. He also highlighted the importance for him of not replicating colonial patterns of leadership and policy-making. At the time of our interviews, this was a tension that Matthew was actively struggling with and had not determined strategies to navigate. In both Sage and Matthew's stories, their recognition of these localized histories of injustice committed by their own cities and institutions deepened their political clarity and guides their analyses and actions.

For Matthew, direct encounters with the current disparities in his community that resulted in part from historical harms also cultivated his political clarity. He reflected on how he confronted these disparities in his previous work as a middle school teacher:

> I was working at [name of school] up in [name of city], which was about 65% free and reduced lunch. And I'd had these preconceptions in my head about what it was like to be a teacher and sure enough, there were some middle schools in [name of city] where my preconceptions of what

> it meant to be a science teacher were actually happening, like in the wealthy parts of town. But they had on the order of 12% and 14% and 7% free and reduced lunch and we were at 65%. What is going on with that? How can a city as progressive as [name of city] look at itself, and set this up, and not provide any extra support for the school that has high free and reduced numbers, and be okay with it? I mean, it was astounding to me!

By citing these differences in rates of students receiving free and reduced lunch, Matthew described witnessing the impacts of poverty and inequitable resource allocation on students' experiences and his role as a science teacher. He also emphasized the hypocrisy of these socioeconomic and educational injustices existing within a city that claims a progressive identity. These firsthand encounters as an educator contributed to his critical consciousness by localizing and personalizing justice issues within his own community and its educational institutions.

Dylan discussed parallel experiences from his work as an urban environmental educator that made evident "the injustices within those scales of what people do or do not get to do, and what's safe or not safe for them to do, and the opportunities around it." For example, he described learning about a Superfund site on a river in an area of his city inhabited predominantly by Black, Indigenous, Asian, Pacific Islander, and Latinx families. He shared about the years-long efforts of local communities to improve the health of the river and sustain their relationships with the waterway and its ecosystems. In addition to this close-to-home example of socio-ecological injustice, Dylan highlighted racialized inequities in the distribution of parks throughout the city and the disparate amounts of infrastructure and resources found in these parks. He recalled asking critical questions such as, "Which are the 'wilderness parks' where they don't really support people being in and whose homes are those near? And who decides who gets to go there?" Dylan clarified that he had already begun learning about social-environmental inequities through news coverage and professional discourse, but becoming aware of these realities "right here in our city" was an important step in the process of shifting and deepening his justice-related understandings.

The stories shared above all revolve around intersecting racial, cultural, economic, educational, environmental, and climate-related harms and injustices occurring in participants' cities and regions. However, Dylan also mentioned the leadership and collective action by local communities to restore the river's health. For several other educational leaders, seeing and participating in similar resistance movements strengthened their commitments to socio-ecological transformation. Sage recounted a grassroots struggle against the construction of a new coal port in her city. Through the outreach of local activists, Sage became aware of the negative health impacts that the coal port would impose, as well as the violation of the treaty rights of an Indigenous tribe that it would entail. Sage shared "that was the moment of like, 'Seriously? *Seriously?*' and it was like, 'How can we stand by?'" She joined the resistance efforts by petitioning, writing letters, and engaging in other civic actions. Sage described the battle against the coal port as "a time when the whole community came together." For her personally, this local event was also a turning point in her understanding of environmental and interconnected injustices and how individuals and corporations exploit others in their pursuit of profit. At the same time, the coal port battle demonstrated the emancipatory possibilities of mobilizing collective power.

Meredith shared a similar narrative about a fight against environmental injustice in her city led by Yalonda Sinde and the Community Coalition for Environmental Justice:

> This has stuck in my head for all of these years. There was a medical incinerator at the veteran's hospital on Beacon Hill, which is now the Pacific Tower, I don't know if you've been there. But the community, the neighborhood, was experiencing the pollution from the medical waste, and the CCEJ, led by this woman, had it shut down. I remember being so moved by that story. And I guess through my training and understanding of environmental sciences I had learned about places like Cancer Alley in Texas, and places where communities are disproportionately impacted by pollution and environmental hazards. But I don't think I'd ever heard a story of somebody successfully taking it on and winning. So that was really inspiring for me.

In this case, Meredith did not directly participate in the activists' battle against the medical incinerator. However, she emphasized the significant influence of this example of community action on her thinking, particularly in showcasing the possibilities of successful resistance. For both Sage and Meredith, these movements to address localized injustices seemed to catalyze critical awareness, belief in the potential for just transformation, and motivation for personal engagement.

Moments of exposure and dissonance, as described in the first section of this chapter, can spark individuals' recognition of intersecting injustices and pursuit of further learning. In many cases, political clarity becomes more deeply rooted when individuals encounter salient manifestations of injustice in their own localized and personalized contexts. In these more proximal settings, educational leaders were able to investigate how systems of oppression and marginalization translate into lived experiences and witness the tangible impacts of injustice on specific cultural lifeways and community well-being. Their stories indicate how collapsing social distance and reducing the degrees of separation can help strengthen perspective-taking and critical consciousness. For some of the educational leaders, recognizing these close-to-home dynamics prompted broader, sustained inquiry into related justice concerns across local, regional, national, and global scales; for some, these locally situated issues motivated participation in collective action. Cultivating intentional proximity and coming to intimately know our local places, lands, and peoples is crucial for healing historical and ongoing injustices through active restoration of interconnected human and more-than-human communities (Kimmerer, 2013).

Relationalities and Responsibilities as the Roots of Political Clarity

In the two previous sections, I shared a selection of participants' stories about specific moments and experiences throughout their lives that contributed to their critical consciousness. In this next section, I shift my focus toward the expansive forms of relationality that generate a felt sense of care, responsibility, and ethical commitment to justice work. In particular, the educational leaders I interviewed reflected on the centrality of familial, more-than-human, spiritual, and intergenerational relationality as guiding forces in their justice-related learning and action.

Many of the participants mentioned their parents as sources of influence regarding their worldviews, knowledges, and value systems. In several cases, their parents' professional identities, and the ways these were entangled with personal viewpoints and caregiving practices, played a role in shaping their thinking. For example, Meredith connected her mother's work as an educator with her own inherited understanding that "you need to leave the world better than you found it," while Julia described her parents' work as biologists as a reason that she has "always had a really deep connection to nature." Danielle similarly highlighted her father's attunement to ecological systems and his axiological perspectives as a key factor in her own socio-ecological commitments and political clarity:

> When I think about intergenerational, one of the reasons that I value the environment so much is because my father valued it. He was a forester way back when, right around the Depression. And when I was growing up I was taught to value land, value nature. I just remember my father, it was a really big thing to him, you didn't take what you didn't need.

Danielle attributed her own ecological relationality in part to the modeling her father provided and the gratitude and restraint that he embodied through his work as a forester. These values were also explicitly taught to Danielle during her childhood. These learning experiences echo what Kohli et al. (2019) describe as pedagogies of family and community, which often play a pivotal role in the development of critical consciousness and transformative caring practices.

For Emily, parental wisdom also took the form of attentiveness to ecological rhythms and a keen understanding of multispecies interdependence. She reflected on her father's intimate relationality with land and weather patterns:

> I'm a farmer's daughter. My dad is a dryland wheat farmer. So his livelihood depended on Mother Nature, and there were many nights where Dad was up staring and looking at if the hail was going to come because it was going to knock his wheat down and then it would be less productive. If it was too wet of a spring… you needed to have the perfect amount, because you

> needed enough for the wheat to grow but if you got too much, mold could grow on your wheat and then it was worth less. So just in that sense, that would definitely be a part of it.

Emily described how her father's powerful ecological awareness was grounded in his professional identity, and how she inherited these forms of relationality as a farmer's daughter who "grew up in a world of farmers." Emily continued discussing crucial familial influences by sharing about her mother's relationship with plants. Her mother, who is Asian, holds expertise about the medicinal uses of plants that was ever-present in Emily's childhood. Emily recalled that "you have any ailment and there isn't anything that an herb, a plant, or something can't fix." As a mother herself, Emily now uses the same herbal remedies with her own daughters.

Later in our conversation, Emily shared about her identity as "a huge gardener," how she refers to the plants as her friends, and the importance of her garden as a space of socio-ecological connectedness through close observation and nurturance. Emily emphasized that her love of gardening is also a form of inherited relationality. Drawing a comparison to a chapter of Robin Wall Kimmerer's book *Braiding Sweetgrass*, Emily described how gardening is an intergenerational practice learned from and alongside her mother:

> You know the chapter on the wild strawberries? That was my mother, and for us it was raspberries. She grew raspberries on the side of the house and she would tend to them, and she would show us how to prune them so that they… you do this for them, they will bring you this. And she would teach me the colors of the raspberries, and "No that's not [ready] yet. You have to be patient." I was like "Oh my god, this is my mother and raspberries!" when I was reading that chapter. And then fast forward to my children going to visit Grammy, and Grammy teaching them about raspberries and that kind of thing. So, it came from her, definitely.

Emily's stories indicate the key role her mother played in cultivating her socio-ecological attunement. These lessons from her mother include knowledge about the growing processes of the berries as well as

practices of care and reciprocity to help plants thrive. Emily also reflected on the multigenerational sustenance of these relational attachments through her mother's interactions with Emily's own children.

Emily's experiences reflect the confluence of familial relationality and more-than-human relationality that have been nourished over the course of her life. Many participants similarly highlighted the intimate encounters they had with living beings and ecosystems as a source of felt responsibility, kinship, and empathy. For example, Morgan shared:

> I've felt a kinship with trees and animals and rocks and all the earth. So that part I think goes all the way back to childhood experiences in nature, and just being... I don't think I was taught to build relationships, like I don't think I was taught how to build relationship with place, or how to have a more reciprocal relationship with nature. But I think I learned that anyway, just from so, *so* much of my time as a young person spent in the woods right behind our house. There was a creek we explored. I went camping a lot, I went boating a lot, I went swimming a lot.

For Morgan, direct experiences with more-than-humans contributed to her socio-ecological care and commitments. Morgan clarified that her "reciprocal relationship with nature" emerged not through explicit teachings but through prolonged periods of time spent in local outdoor places as a child. Both Natalie and Julia also referenced sustained childhood experiences outdoors — as well as how they have extended these initial ecological relationships into adulthood through their continued prioritization of activities, practices, and living arrangements that strengthen their sense of connectedness and responsibility. For these educational leaders, these forms of care and love guide their critical consciousness and their actions in personal and professional contexts. Cultivating more-than-human relationality and reciprocity is a powerful way to disrupt the extractive and exploitative logics of human supremacy and to contribute to just and thriving socio-ecological worlds (Hanh, 2013; Kimmerer, 2013, 2020).

Danielle described similarly profound ecological connections built in childhood that she carried into adulthood:

> Growing up as a kid, I remember… We owned 100 acres up near [name of city]. My dad used to take me out on that property and I would follow him around. And I remember being very young and knowing the difference between the trees. I could identify almost every tree on our property. And somehow that tied me to that, it tied me to those trees.

Danielle attributed her current axiological commitments and political clarity in part to these early memories of walking the land with her father. Importantly, Danielle's reflections demonstrate how ecological knowledge — in this case, "knowing the difference between the trees" and being able to identify them — can support the development of affective and spiritual bonds. During our conversation, Danielle linked these childhood experiences to her more recent practices as a parent. For example, she shared a story about an enormous chestnut tree in her yard from which she and her daughters frequently gather fallen chestnuts. Danielle recounted a conversation with her daughter in which she described the chestnuts in spiritual language:

> One day, my daughter was doing a project. She's in seventh grade, she's doing a project and she needed to collect chestnuts. And we went out and we're talking about these chestnuts, and I said, "You know, these are like miracles. These seeds, they're like miracles. You don't know how many, how big of a tree can grow from this." I remember one day I'm having… You can imagine, you're having a morning, and you're running late and you've got lunches to pack or whatever, whatever. And I remember running out the door and I'm just stressed, and I'm trying to get my little kids, my two daughters in the car, and my little second grader walks up, she hands me a chestnut and she said, "Hey, Mom, do you want a miracle today?" And that is defining, right? How we present things matters.

These stories from Danielle resonate with the intergenerational thread in Emily's socio-ecological relationality with her mother, their gardens, and medicinal plants. In Danielle's case, the emotional and spiritual associations with trees that she cultivated as a child became an anchor of discourse and a way to convey ecological care and wonder with her own children.

Spiritual knowledge and responsibility were closely woven with critical consciousness and justice-related sense-making for several educational leaders I spoke with. For example, Riley shared about how this dimension of her thinking has expanded over time:

> Something that has transformed for me in my understanding of social justice is as I've gotten older and tapped into my own spirituality, that has been a big part for me is thinking about social justice not only as a political, social action but also as a spiritual imperative. That has come from my relationship with nature, largely, and also in relationship with folks who are working in more religious spaces that I don't necessarily relate to, or I'm not part of those religious spaces, but folks who read religious texts in a way that actually radicalizes our idea of social justice. That was a big turning point for me, being in community with folks with that perspective.

When I prompted Riley to elaborate on these re-readings of spiritual texts, she offered an example of learning from the South African anti-apartheid activist and Methodist minister Alan Storey. In a presentation and workshop that Riley attended, Storey positioned biblical stories within historical context and described Jesus as a radical activist. Riley recounted how Storey shared particular teachings about the practice of communion:

> He talked about the re-configuring of the idea of communion as, the ritual is just a way to stamp it, the ritual is not the thing, the ritual is just the way that you get in touch with the actual thing, which is being in community with your neighbors. And real communion would have us all at the same table and it would have us in conversation with one another, and it would have us feeding one another and bathing one another and all of these things that just seem so radical or like we would never do.

Riley discussed how Storey reframed communion from a potentially exclusionary ritual to an expansive and inclusive practice that is "a representation of your desire to be in community with neighbors." For Riley, this spiritual learning experience profoundly shifted her thinking about justice work:

> It just made me think about all of the ways that we exclude and silo individuals and groups, and the spiritual transformation that can happen when we break that down and when we're interested in another way of being with each other. Yeah, so that was a big… That whole experience with him and his teachings and the discussion we had in community around that was a really big aha moment for me around social justice.

Encounters such as this one, and opportunities for shared sense-making about these radical re-readings, helped to solidify social justice and politicized caring as an imperative for Riley. Importantly, Riley cited spiritual responsibility as an important influence on her political clarity despite not formally holding a religious affiliation. Instead, she drew her spiritual identity from her relationships with human and more-than-human communities.

For Ann, in contrast, spiritual relationality emerged from her long-term participation in a faith community. She shared that she grew up Catholic and attended churches that advocated for socially minded engagement as a central responsibility and value. Ann emphasized that these principles were not framed as "social justice" but as "caring for the poor, caring for the sick. I don't think those two words were used as much as just, 'It's part of being who you are in this faith that you care for people.'" Caring action took many forms for Ann, including financial donations, volunteering at food banks, and supporting unhoused individuals by providing shelter for them in the church. Ann reflected that these experiences laid a foundation for her development of political clarity:

> I'm not a practicing Catholic anymore, but I do think that with all its faults, the social justice, social responsibility nature of… It depends on the church you go to — the actual church, not the denomination. And I was in a Jesuit community a lot, just the call to being socially aware and caring for each other was a grounding. [...] That was the root. It just said you have to be responsible for other people, not just yourself. [...] But it still is a grounding to keep my eyes aware, keep me aware of what's going on in the world and watching.

Ann highlighted how her sense of ethical responsibility to care for others, particularly those who are marginalized within society, is grounded in the teachings of her spiritual community. Ann also described a kind of watchfulness and critical awareness that she learned from her time in evangelical Catholic churches. Later in our conversation, Ann drew a connection between her spirituality and ecological care as well. She shared that this commitment was framed in terms of stewardship and responsibility to protect the land. Synthesizing both social and ecological dimensions, Ann said: "It's all about learning and knowing the world, not ignoring the world." In other words, Ann's experiences within Catholic communities instilled a keen outward gaze, attunement to the well-being of human and more-than-human beings, and an imperative to take action. Ann's experiences of spiritual responsibility resonate with Callison's (2014) analysis of how concern about climate change in evangelical communities is articulated using the language of stewardship, concern for the poor and oppressed, and moral obligation. More generally, Riley and Ann's reflections indicate the potential symbioses of spiritual belief and practice with political understanding and engagement. This theme echoes the powerful teachings of spiritual-political philosophies, including *liberation theology* (hooks, 1999) and *engaged Buddhism* (Hanh, 2008), which advocate for social and ecological thriving through emancipatory struggle rooted in spiritual presence and practice.

Danielle reflected on a similar sense of responsibility to care for and protect our socio-ecological worlds. For her, however, responsibility is deeply rooted within her identity as a mother and grandmother. Danielle shared:

> I look at my grandchildren and I think we need to leave them with a planet that they can survive on. And so when I think about things and being asked to talk about climate justice, every person on this planet deserves a planet that they can live on. [...] So what is that saying that I once heard… We did not inherit this land from our grandparents. We are gifting it to our grandchildren. [...] When I look at my grandchildren, I look at them and think we're only inhabitants for a short time and climate justice is about treating our climate in a manner that we are not taking more

> than… Leave it better than we found it, or at least do no harm. So, I just think about my daughters, and I think about my grandkids, and how their lives are going to be affected by everything we do, every decision we make as a generation or refuse to make as a generation.

Thus, Danielle described her feeling of intergenerational responsibility to ensure her children and grandchildren have a planet they can live well on. This intimate obligation to her descendents also expands to include other members of current and future generations in a broad definition of climate justice as "every person on this planet deserves a planet that they can live on." Danielle's reflections recall the ethical principles of intergenerational equity and practicing collective care for socio-ecological worlds in partnership with past and future generations (Mbeva, 2014; Slobodian, 2020; Weiss, 2008). For Danielle, these responsibilities implicate every action she makes within her own lifetime as either contributing to or detracting from the thriving of future peoples and beings.

In this section, I outlined familial, more-than-human, spiritual, and intergenerational relationships as sources of caring responsibility. These emotionally salient aspects of educational leaders' justice-related learning processes are sustained over time rather than tied to specific events and encounters. They seem to resonate with de la Bellacasa's (2017) conceptualization of care as involving affective sentiments, ethical and political obligations, and material actions aligned with particular contexts. In other words, care is not a universal moral rule but rather a constellation of commitments that guide the practical, everyday activities that participants engage in within their personal and professional worlds. For example, the relational responsibilities that educational leaders carry may influence how they approach the design of professional learning and other pedagogical supports within their various institutional contexts. As such, these forms of care are closely related to political clarity by acting as an impetus for educational leaders to seek out knowledge and become more clear-eyed about justice issues; to transform their practices in tangible ways; and to actively work toward more just possibilities in the current moment and in the future.

Deepening of Political Clarity and Translation into Multifaceted Action

In this chapter thus far, I have focused on themes from the personal histories of the thirteen educational leaders who participated in phenomenological interviews. These stories elucidate how political clarity regarding social, educational, ecological, and climate justices can emerge from the accumulation of experiences and relational responsibilities. Although critical awareness and systemic analyses are crucial, the true significance of educators' political clarity arises from implementation of liberatory actions (Madkins & McKinney de Royston, 2019). In the next two sections, I describe how educational leaders' political clarity is enacted through multiple forms of action that can contribute to the thriving of socio-ecological worlds. I first discuss how the Climate Justice League project emerged from Stacy and Meredith's deepening political clarity, as well as how engagement in such justice-centered work can lead to the spreading of political commitments across other personal and professional contexts. Then, in the final section of this chapter, I demonstrate how transformative action can become amplified within communities of practice by tracing the movement of the Climate Justice League project across Washington State.

For Stacy, inspiration for the Climate Justice League developed from the confluence of many factors, including a desire to build on her existing professional learning efforts within ClimeTime by incorporating an explicit focus on sociopolitical, ecological, and climate justice. She reflected:

> I had been grappling for a while with what was next. I felt really good about some of the work that we had been doing, but it was just so clear to me that we needed to do more and go a little deeper, but I didn't really know what that looked like. And some of what I saw some of my colleagues doing, where it was like "Okay we're going to do four sessions all about climate change," and I was like, "That's not what I mean by going deeper." I want to push teachers' thinking in a slightly different way. And as someone who cares very deeply about issues of climate justice and feel like I had been reading about it personally and also trying to pay attention to what was happening with youth movements and feeling like we were way behind the ball, to be

> frank, and that we needed to be doing more pushing in those directions explicitly around justice issue[s] within education, and within climate change education specifically...

Stacy highlighted several interconnected influences, including her existing justice-related knowledge and commitments as well as the growing momentum of the youth-led climate justice movement. In addition, she mentioned professional connections that shaped her thinking and sense of urgency to translate her political clarity into action — specifically, Dr. Deb Morrison (one of the leaders of the ClimeTime effort) and her network of relationships, Rethinking Schools, and the Portland Public Schools' recent climate justice resolution. The alignment of these personal, professional, and societal contexts led to the co-creation of the Climate Justice League with Meredith and the EarthGen team, with whom Stacy had collaborated previously through the ClimeTime initiative.

For EarthGen as an environmental education organization, the Climate Justice League project is one example of the shifts in purpose and practices that have occurred since its founding ten years ago. In our conversations, Meredith described how EarthGen has always prioritized diversity, access, and inclusion. For example, they worked to ensure that students from marginalized communities have opportunities to engage in programming that aimed at "helping them get out into the local community, and connect with the natural spaces, and understand ecosystems and how humans are connected to those." Although equitable access and diverse participation remain important, in more recent years justice has become a strengthened emphasis for the organization. In particular, Meredith shared that the EarthGen team is intentionally designing the content of the programs themselves to focus on issues of environmental and climate justice, such as the disproportionate impacts of air pollution. They are working to center representative justice, meaning that "the people who we're working with have their priorities addressed through our programs." For Meredith, these pivots reflect her own personal learning and political clarity — coming to recognize that racial equity and social justice can and should be woven into her professional work — as well as critical conversations with colleagues and collaborators and the changing dynamics of broader discourse. For example, Sahar Arbab, who worked for several years as a

program coordinator at EarthGen, holds rich expertise regarding environmental justice that shaped the efforts of the organization and played a crucial role in the conceptualization and development of the Climate Justice League.

These changing priorities are reflected in the rebranding of the organization in early 2021 from Washington Green Schools to EarthGen. Stacy described how the new name indicates how the EarthGen team is conceiving their scope of work more expansively, moving beyond their initial efforts as a school certification program:

> Washington Green Schools from three years ago was a completely different organization — the things that they were working on, where they spent their time — it has very dramatically changed and some of that is symbolized by even just the rebranding and the new name, the way that they have refocused their work.

These shifts in focus are an example of how deepening political clarity can be enacted through tangible changes in professional practice. As described by Meredith and Stacy, EarthGen is working actively to incorporate justice across programs and organizational practices.

Meredith and Stacy's critical consciousness and political clarity are evident within their articulations of the goals for the Climate Justice League. Stacy shared that she hoped to leverage resources provided by the ClimeTime initiative to support science teachers to strengthen their justice-centered practices and to include social, environmental, and climate justice connections in their classrooms. She reflected that much of the initial work around Portland Public School's climate justice resolution and most of the resources within Rethinking Schools' *A People's Curriculum for the Earth* were focused on social studies education. She also noted that science teachers sometimes adopt a stance that science is about neutrality, facts, and evidence — rather than recognizing that science is a social and political endeavor. Stacy wanted to create a learning space for science educators to explore their own roles and responsibilities and consider how science teaching and learning intersect with social justice.

Stacy emphasized that this goal felt particularly urgent in the context of the recent increase in

youth climate activism statewide and globally, which coincided with the beginning of the Climate Justice League project in fall of 2019:

> When you saw *all* of this increased student activism across the state, that just fed my heart, just like this is exactly why we're doing this, this is *exactly* why teachers need to be engaging in these conversations in the science classroom, because the students are demanding it.

The salience of youth walkouts and climate strikes made the professional learning experience feel timely, relevant, and critically necessary. Stacy continued:

> The synergy about having those things happen at the same time as we were having conversations with teachers about why these issues are important just seemed really meaningful to me. And I do think the point about, students are demanding this, and students are *asking* for these conversations and this learning, and they are pushing on their teachers, means that teachers need to pay attention and respond. They need to step up, and having conversations about injustices, it's not easy to do, and many science teachers feel very unprepared to do that. But it doesn't mean that we shouldn't, and we shouldn't support teachers in taking those hard steps.

Thus, for Stacy the aim of the Climate Justice League was to build a community of learning and practice that would enable teachers to respond to students' demands for justice-centered education. This connection with broader social movements highlights young people's power to initiate shifts in systems through their organizing and leadership. Especially for educators and educational leaders as adult allies, youth activists' calls to action can hold a profound impact and motivate new initiatives. Stacy also acknowledged that facilitating these conversations and activities can be complex and that teachers require ongoing, responsive support from their colleagues and from educational leaders. Despite the challenges involved, Stacy felt that this is "work that matters":

> These are things that matter. Like if we're going to spend time teaching about things in the classroom with students, it should be about issues that empower the students, give them agency, give them opportunities to think about themselves as change agents and people who have skills

> and abilities to help build the communities that they want to live in. I feel like anything that's moving in that direction is something I want to be a part of.

Although Stacy clearly recognized the existing power and agency young people hold — as expressed through the youth climate movement and many other forms of youth action — she also understood that classroom learning can either amplify or restrict these forms of sociopolitical engagement. She believed that learning experiences should affirm and strengthen the changemaking potential that students of all ages carry and are already practicing. Ultimately, creating space for educators to sharpen their own critical awareness and pedagogical practices is crucial for engaging students in emancipatory and justice-centered learning in their classrooms and communities.

In our phenomenological interview conversations, Meredith shared very similar goals for the Climate Justice League project:

> My vision is that issues of environmental justice would be woven into classroom teaching and learning in schools throughout the state and beyond. [...] Students have a natural interest and sense of caring about these issues, and they have a place in the science classroom. And I'd love to see that be more… just be the way that science is taught.

Meredith's ideas resonated with Stacy's in her focus on young people's passion for social, environmental, and climate justice, and the necessity of addressing justice issues in and through science learning. Meredith continued, critiquing how consideration of ethical and political topics is often relegated to social studies classes and seen as disconnected from science. She highlighted that drawing these connections in science classrooms can lead to transformative collective action:

> This seems like a perfect opportunity to bring that lens into the science classroom and to build knowledge and action so that we can work toward a more just world. And I do think that young people, if not only given the information about what the issues are, but also the tools and the opportunities to create solutions, I think that they'll make great things happen. And I wish it didn't fall on them. It shouldn't just fall on them. So the good news is that I think that the teachers can

> take action now too, and by training teachers I hope we're influencing votes and community based decision making. So it's nice to be influencing the adults as well as hopefully the next generation. So I guess my vision is that we are working toward a more just and equitable world by giving people educational opportunities around these issues.

Meredith emphasized how professional learning opportunities like the Climate Justice League can contribute to "a more just world" by prompting educators to weave justice throughout the content and practices of classroom learning, catalyzing them to take action as adult community members, and activating youth to be changemakers through their experiences of justice-centered science learning.

The purposes and goals described by Stacy and Meredith align with prior literature on sociopolitical consciousness and political clarity. The Climate Justice League creates a space for educators to develop their own political clarity, including recognizing that science education is a fundamentally political endeavor (Madkins & McKinney de Royston, 2019; Mensah, 2011; Rodriguez, 2015; Vossoughi & Vakil, 2018). The professional learning community provides opportunities for teachers to engage in shared sense-making about overlapping systems of oppression — including social, educational, environmental, and climate injustices — and how they relate to science teaching and learning. In the next chapter, I share stories that exemplify how teachers deepen their critical awareness and take liberatory action in their communities through their participation in the Climate Justice League.

Importantly, both Stacy and Meredith centered youth action and agency in their goals for the professional learning experience. Their rationale is grounded in appreciation of young people's capacity to be community leaders and agents of change — and acknowledgement of the important responsibility of educators to cultivate these capacities through the intentional design and facilitation of classroom learning (Ladson-Billings, 1995, 2014). Similarly, Madkins and McKinney de Royston (2019) assert that teachers' enactments of their political clarity "support the development of students who are intellectually engaged, think critically, and have agency and are equipped to challenge societal inequities in and through science" (p. 1327). Thus, the Climate Justice League aims to support the expansion of educators' political clarity

and the translation of this clarity into emancipatory and justice-centered learning that nurtures students' sociopolitical consciousness.

In addition to these impacts on teachers and students, the Climate Justice League project also influences the facilitators' own political clarity. In multiple research check-in meetings, Stacy reflected that the Climate Justice League work is increasingly informing her work across other projects and that justice has become a consistent priority. She described this spread of critical consciousness in her own thinking:

> When you start working around exploring issues of justice, and for us we've been doing that through the lens of science or STEM content, but when you start unpacking that and opening the door, it just bleeds into everything you're doing. [...] Once you start interrogating, you start to see all of these injustices throughout the system that you're working in. And then once you are recognizing that and you feel like you need to be involved in dismantling that. I'm seeing a lot of that, and I see that in our teachers, I see it in myself and the way that I'm thinking about the work that I'm doing and what I want to put my energy into.

Stacy noted that her heightened sense of sociopolitical responsibility is guiding decision-making across professional contexts in terms of how she embeds justice components within other projects as well as how she allocates time, energy, and financial resources to focus deliberately on justice-centered work. Stacy highlighted how similar learning processes seem to be shaping Pranjali's, Meredith's, and her other collaborators' engagement in environmental and climate education. One example of Stacy and Meredith's spreading political clarity was a new professional learning workshop on COVID and climate change that they hosted in January 2021, which examined ideas of vulnerability, exposure, and risk through the lens of the systemic injustices that underlie both of these interrelated crises.

These experiences demonstrate another important process of political clarity development: lateral expansion of critical analyses, justice-related commitments, and transformative action across different implementation spaces. Political clarity is not a destination to be reached through the accumulation of

significant life experiences, but rather is iteratively refined in and through practice. This spreading of critical consciousness connects with how Kohli et al. (2019) describe educators' critical consciousness as "a way of being" in the world that is continually shaped by familial, community, educational, and professional experiences and becomes "embedded across all domains of their life" (p. 31). Stacy and Meredith's stories exemplify how personal and professional experiences mutually inform one another and how political clarity is sustained, broadened, and translated into multiple forms of liberatory action over time.

Political Clarity and Transformative Agency Within Professional Communities of Practice

In the first two sections of this chapter, I shared stories from participants' personal histories of justice-related learning and described how educational leaders' political clarity can be translated into transformative action across professional contexts. In this final section, I explore how these processes inform how individuals engage in professional *communities of practice* (Wenger, 1998; Wenger et al., 2002), opening up possibilities for shared learning, cross-pollination, and increased sociopolitical agency. Although many individuals and communities played a significant role in participants' justice-related learning journeys, as discussed in previous sections, this analysis focuses specifically on spaces of sustained sense-making and relationship-building directly connected with educational leaders' current professional responsibilities in environmental and climate education.

In our one-on-one conversations, many participants highlighted communities of practice and relationships with colleagues that enable ongoing critical reflection and strengthening of justice-centered practices in professional spheres. They described how working alongside colleagues with shared values provides a sense of accountability and momentum in pushing forward racial justice and decolonization in their work. At the same time, the educational leaders emphasized the importance of hearing stories and ideas from a breadth of perspectives and positionalities. Participants mentioned activities such as racial caucussing, interracial dialogue, and building justice and anti-racism committees within their organizations. Some educational leaders also referenced their participation in professional associations

beyond their own institutions as a source of critical insights. These communities of practice support participants in engaging in challenging conversations: for example, grappling with white supremacy culture and the implications of being a white-led organization, addressing racialized tensions and problems with internal culture, making sense of language and values (e.g., whether environmental justice is central to environmental education), and wrestling with the histories of harm and injustice that educational institutions have established and maintained. Educational leaders shared how these forms of collective learning sustain their curiosity, humility, and commitment to centering justice in their daily work.

For many of the participants, the ClimeTime network served as an additional professional community of practice to expand their thinking and practice. ClimeTime network leaders designed learning opportunities at each convening to deepen shared understandings of equity and justice in science, environmental, and climate education (Morrison & Bell, 2019). For example, at the first design institute gathering in July 2018, network facilitators and Dr. Megan Bang (the keynote presenter) shared about the importance of disrupting whiteness in environmentalism, centering the interests of Indigenous and other marginalized communities, and moving toward environmental justice in project work. These explicitly equity- and justice-focused framings within the ClimeTime initiative held space and cultivated fertile soil for justice-centered practices and projects to emerge, including the Climate Justice League.

Some of the educational leaders I interviewed cited specific network activities — such as hearing from critical education scholars, scientists, and community leaders who were guest speakers; sharing of resources like STEM Teaching Tools and formative assessment protocols that aim to center onto-epistemic heterogeneity; investigating regional examples of climate action; and making sense of current sociopolitical contexts — that strengthened their knowledge and provided new strategies to try in their projects. In addition to these full-network gatherings, some participants mentioned the optional University of Washington-hosted sessions as spaces for further learning, including the monthly topical webinars (with topics determined emergently based on network interests and needs) and the three book

studies (focused on Candis Callison's *How Climate Change Comes to Matter*, Robin Wall Kimmerer's *Braiding Sweetgrass*, and Ayana Elizabeth Johnson and Katharine Wilkinson's edited anthology *All We Can Save*). A few of the educational leaders who engaged regularly in book group meetings reflected that it was helpful to have conversations grounded in specific texts and to discuss ways to incorporate these justice-related insights and perspectives within ClimeTime project work.

Some participants shared that these ClimeTime network activities increased their critical awareness of educational equity issues and justice-related dimensions of environmental and climate learning. For example, Morgan emphasized the importance of holding space "to engage as a team in professional learning to expand our practice and our understanding of different topics as they're coming up," and that this practice within ClimeTime has been "really, really good." She highlighted the expertise of the UW team and noted how the team "being willing to step up and have those conversations and help us lead those conversations has been immensely important and tremendously helpful." Natalie expressed her gratitude for an opportunity to learn about local climate adaptation and mitigation efforts from a guest speaker, sharing "I loved that experience for myself, because it was personal learning for me but also professional learning for me, and I would love to see more of those, actually." Both Dylan and Casey mentioned that conversations within ClimeTime clarified their understandings of how justice connects with their existing professional practices and how they could further extend these aspects of their work. However, the usefulness and relevance of network activities varied for participants based on their prior experiences and perspectives. Some educational leaders offered constructive suggestions for how ClimeTime could be strengthened as a space of collective learning — for example, by inviting students, educators, and community leaders to participate as members of the collective, or by engaging in critical reflection about whiteness within the network itself. It is also important to note that educational leaders who chose not to participate in this research project may have different ideas about the benefits and shortcomings of the community of practice, which are not represented here.

Despite this unevenness and the substantial critiques raised, many participants reflected that the ClimeTime network created powerful opportunities for relationship-building and cross-pollination across the state. Network convenings often included time for educational leaders to share about their project work and hear from their colleagues about the ideas they were trying to implement and the successes and challenges they were encountering. Danielle expressed that "sharing with each other around how things work has been very powerful," while Morgan highlighted how participants are able to "share in and shine where their level of expertise is the strongest." Natalie excitedly described these reciprocal learning processes as "peer pilfering." She continued:

> Seeing those successes and seeing the feedback from teachers that have participated really helps us, like myself, better understand what is it that teachers are looking for, what has been powerful for teachers. It doesn't make sense to reinvent the wheel if there's something that's working and something that's helping teachers, then that's really cool to be able to share those with each other.

Sharing during network gatherings was an important source of insight and inspiration for many participants. Some of the educational leaders also mentioned other ways that they learned from the expertise of their peers within the network, including attending the professional development workshops they facilitate, brainstorming with key thought partners about emerging project ideas, and engaging in informal conversation with their colleagues. Consistent opportunities for trust- and relationship-building were crucial for cultivating these spaces of cross-pollination. Morgan shared:

> I think one of the elements that's been most successful, that I would replicate if I was starting from scratch, is an ongoing and sustained relationship among the practitioners. I think it really takes time to build that trust enough to be vulnerable and willing to share in and to learn from. There's so much ego associated with all that we do. We're so passionate about our work and it's easy to feel like what we're doing is the best thing without really taking into account what other best things might be out there. So, ongoing and sustained relationships is a big piece of it.

Julia expressed similar reflections that the ClimeTime network strengthened professional relationships and increased the level of trust between educational leaders across the state, which supported their ability to learn from each other and collectively transform their practices.

This explicit commitment to building and sustaining a sense of community encouraged educational leaders to adopt more collaborative approaches within their project work. Several of the regional science coordinators (RSCs) shared during our conversations about a shift from a culture of isolation and competition between the educational service districts (ESDs) to what Danielle described as "camaraderie" and "a togetherness model." This mutualistic orientation resulted in part from an intentionally designed structure in which each ESD contributed efforts toward the collective benefit of the network. For example, ESD 112 facilitated website development and other public-facing communications on behalf of all partners within the initiative. This shift toward a cohesive mindset also created space for the RSCs to pool their financial resources and design regional collaborative projects focused on locally salient climate issues. Danielle reflected that "there was a sense of 'Well, if you're doing this and I'm doing this, we don't both need to be doing this. Let's do work statewide.'"

In addition to these synergistic partnerships between regional science coordinators, the ClimeTime community of practice also built strong partnerships between formal and non-formal educational organizations. Initially, tensions and challenges arose as a result of the substantial differences in institutional contexts; however, these dynamics shifted over time through sustained relationship-building. In our interviews, many participants reflected on the need to break down silos between formal and non-formal spaces and collaborate to support community-connected learning and integration of meaningful inquiry across settings. Several educational leaders, including both RSCs and members of community-based organizations (CBOs), shared how collaborations between ESDs and CBOs can leverage the strengths of all those involved. For example, CBO leaders often hold knowledge related to field experiences, place-based education, local community priorities, and learning beyond the classroom, whereas RSCs can offer connections with teachers and school leaders, familiarity with educational

standards and curricula, and skills of navigating the structures of the formal educational system. Ann described how she initially tried to design and facilitate programs by herself, but pivoted to partnering with other organizations who have specialized expertise that can better support teachers. Morgan highlighted how these collaborations have been enabled by and contributed to a sense of mutual trust and respect:

> Just watching how the relationships have changed and improved over time… I mean, I think it's safe to say that overall, representatives from the formal education sector have built a great level of respect for the expertise that the environmental ed sector provides. They may have had some bias coming in about what environmental educators could or couldn't do. Things they have said make me think they are surprised by the level of expertise in the space of environmental education.

These reflections indicate how the ClimeTime network facilitated the building of what Danielle referred to as “connective tissue” between individuals and organizations engaging in climate education efforts statewide. This relational focus was central in the network design strategy and operated in multiple ways: for example, a funding structure that explicitly prioritized coordination between CBOs and ESDs, network-wide gatherings that were required for all partners, and dedicated time during convenings to identify partnering possibilities. Through these and other efforts, the gradual development of trusting relationships opened up possibilities for collective sense-making and learning, cross-pollination of ideas and practices, and collaborative projects that leveraged educational leaders’ different knowledges and skill sets to better support teachers and learners.

One salient example of the power of relational change-making was the spread of justice-related commitments as more of a shared priority within the ClimeTime community of practice. This shift emerged in part from Stacy and Meredith sharing about the Climate Justice League project with colleagues in the network, in full-group gatherings as well as in one-on-one conversations. During our process interview, Stacy reflected that she felt responsible for advocating for a greater focus on justice-centered climate learning in the ClimeTime efforts:

> I do feel a little bit of responsibility to push the envelope a little bit. And I remember feeling that with the Climate Justice League. When this ClimeTime work first started, there were very explicit conversations around calling it “climate science” and not “climate change.” And this idea that the ClimeTime work is really about supporting Next Generation Science Standards and teacher understanding of that. And while I think that's true, I also think that another aspect of it is supporting teachers with climate change education, and you can't ignore that, and it's our job to push into that area a little bit because what a cool opportunity. And so, I think it's always in my mind to try and push those conversations a little, and so the climate justice work was my effort to push those conversations a little.

By pushing the conversation toward the centrality of justice issues in climate change education, the Climate Justice League contributed to the critical consciousness of some members of the network. A few educational leaders noted in documents from 2021 network convenings that there has been a “big shift in the wider community towards justice-centered learning.” Sage and Danielle both highlighted the Climate Justice League project as an important influence on their thinking during our interviews. Danielle described the Climate Justice League as “outside the box” and “powerful work.” She elaborated:

> Yes, people coming together and seeing that climate science was a justice issue. It was a social justice issue. And just the fact that she got a group of people together to start having those conversations is powerful because that's where it starts, so I was really thrilled with that work.

For some educational leaders, awareness of the Climate Justice League project generated excitement and interest in highlighting the interconnections of social justice and science learning in their own ClimeTime work.

In sharing these stories and reflections, my goal is not to argue that Stacy, Meredith, and their collaborators’ efforts led to sweeping transformation toward justice-centered environmental and climate learning within ClimeTime. Responses to the Climate Justice League varied and were shaped by prior histories of personal learning, as described earlier in this chapter, as well as participants’ current

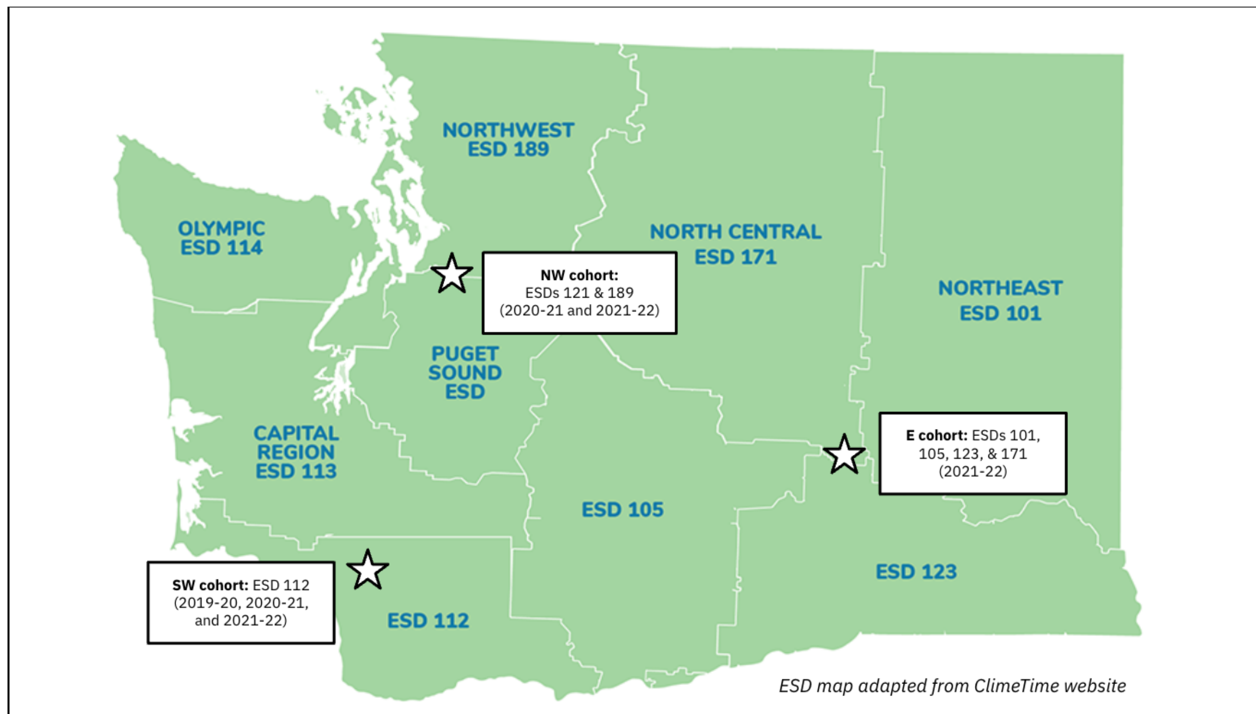
professional contexts and practices. Some educational leaders felt that they could not explicitly incorporate justice dimensions into the climate education work in their regions because there would be pushback from teachers, districts, and community members. Some members of the network were already taking up related aspects of justice-centered learning in their projects, including centering onto-epistemic heterogeneity, investigating locally significant and community-based phenomena, uplifting the voices and expertise of students with marginalized identities, engaging in sustained partnerships with Indigenous collaborators, and supporting transdisciplinary connections. Justice-related threads were woven throughout the network leaders' facilitation of convenings, the resources regularly gathered and shared with project leads, and the design of optional learning opportunities like the book groups. This ongoing dialogue may have contributed to educational leaders' familiarity with discourses of equity and justice and their efforts to implement these foci in their own project work. For others, hearing about the Climate Justice League was an additional source of insight layered upon previous learning experiences outside of ClimeTime. For example, Ann shared how her long-time colleague's work with science district leaders in her region had initially exposed her to issues of environmental justice, climate justice, and how white supremacy and colonialism are related to socio-ecological harms. These conversations and activities with her colleague piqued her interest and laid the groundwork for her understanding, which then deepened as she learned about the Climate Justice League project. While acknowledging participants' different responses and the many factors contributing to their political clarity, the Climate Justice League was a significant model and inspiration for at least some of the educational leaders within ClimeTime.

Perhaps the most concrete example of how political clarity and transformative agency spread through the ClimeTime community of practice is the growth of the Climate Justice League across Washington State. In addition to the expertise-sharing and cross-pollination described above, collaborative partnerships were developed to bring the justice-centered professional learning experience to teachers in multiple regions (see *Figure 5* below for a representation of the cohorts). The first Climate Justice League cohort was facilitated by Stacy, Meredith, and their collaborators in southwest Washington

in 2019-2020. In 2020-2021, there was a new cohort in northwest Washington, in ESDs 121 and 189. Then, in 2021-2022, the project further expanded to four ESDs in eastern Washington.

Figure 5

Map of Climate Justice League Cohorts



As the Climate Justice League spread across different regions of the state, the educational leaders involved were attuned to the need to adapt the learning experience to focus on the sociopolitical, educational, environmental, and climate justice issues that are most salient in each region. These differing priorities were shaped by the demographics of communities as well as the localized histories of oppression that have led to current injustices. Each regional science coordinator held unique goals and motivations for forming this partnership and implementing a Climate Justice League cohort. For Brian, the RSC in ESD 189, one central aim was to shift the representation and decision-making power of teacher-leaders in his region by building authentic relationships with educators of color. He shared how he was dismayed to see that teachers in a local teacher leader group were overwhelmingly white:

> Look at where we are right now, with all the different people who live in Washington State, and yet it's all the white people that are driving the conversations. That doesn't seem right at all. So how can we increase the number of people that are becoming a part of that?

He continued, reflecting that systemic transformation toward equity and justice are only possible through meaningful participation of educators with marginalized identities and addressing the needs and desires of their students and communities. Brian noted that the historical harms inflicted by educational institutions can make global majority teachers feel unwelcome and alienated and emphasized the importance of centering teachers' priorities — for example, who sets the agenda and guides the direction of the conversation?

In addition, Brian highlighted that an additional purpose of the Climate Justice League in his region was to encourage partnerships between science teachers and social studies teachers. He hoped that the professional learning experience would cultivate educators' understandings of transdisciplinary connections in justice-centered environmental and climate education and inspire teachers to plan together with their colleagues across departments. He elaborated on how such collaborations can leverage the teachers' different strengths and skill sets and contribute to more multidimensional, emancipatory learning experiences for students:

> My hope is that that's going to form a really good conversation ground for engaging their students in that same kind of stuff. Like, why does this kind of stuff matter to *me* and *my* family? And how can I make my voice heard? So that's what I'm hoping to come out of this.

Brian reflected that this objective of facilitating dialogue between educators in different disciplines was ultimately intended to support student learning that is relevant, consequential, and contributes to youth voice and agency.

Cheryl, the RSC in ESD 121, described similar priorities of strengthening teachers' abilities to co-create student-centered and liberatory classroom experiences:

> I hope that they, and we, learn how to bring justice issues into the classroom. [...] I would love for teachers to come away with a feeling of success in partnering with students on looking at a regional or local justice issue, and with the skills and support to be able to do it again, to be able to do it thoughtfully and know where to go if they get stuck.

Cheryl clarified how she hoped the Climate Justice League would help work toward her broader goals of science education focused on community phenomena and real-world justice issues. She shared the importance of centering student experiences and interests and shifting classroom power dynamics so that teachers learn alongside students as collaborative partners.

These reflections indicate Brian and Cheryl's critical awareness and their desire to support educators' political clarity and students' sociopolitical consciousness. Within the context of the ClimeTime community of practice, the Climate Justice League was an opportunity to enact these commitments and priorities into concrete engagements with teachers. The EarthGen team played a crucial role as the collaborative partner taking on the facilitation responsibilities — informed by design processes with Stacy and the southwest Washington cohort — while Brian and Cheryl focused on coordinating logistics and recruiting educators to participate. Both RSCs noted that they were taking a learning stance in this project. Cheryl described how EarthGen was driving the work and leveraging their relationships with experts in the region, and that she hoped to learn alongside the teachers. In this way, RSCs were able to lean on the EarthGen team's deep knowledge and statewide cross-institutional connections to support educators in strengthening their political clarity and transforming their practices. This expansion of a complex justice-focused endeavor exemplifies the possibilities of equity-centered scale-making through responding to and reorganizing social relations within a networked approach to implementation (Jurow & Shea, 2015).

In this chapter, I highlighted multiple processes related to educational leaders' development and enactment of political clarity: individuals' personal histories of learning experiences and relational responsibilities that contribute to their awareness and commitments; implementation of deepening

political clarity through professional practice and project design; and the spreading of critical consciousness and sociopolitical agency through professional communities of practice. These stories expand upon existing understandings of political clarity by investigating across scales of educational systems and focusing on how educational leaders translate their justice-related knowledges into their engagements with teachers and students. The narratives shared here also indicate how political clarity involves coming to understand systems of oppression as intersectional and overlapping realities. Complex analyses of injustice and dynamic visions of more just possibilities emerge across spaces and time through concerted efforts of re-interpreting sociopolitical and socio-ecological realities. These sustained, long-term processes are demonstrated here by educational leaders' reflections that span from childhood learning encounters to very recent personal and professional experiences that catalyzed critical reflexivity.

The stories of educational leaders within ClimeTime offer implications for the design of initiatives, programs, and learning spaces to nurture educators' development of political clarity. For example, facilitators can intentionally incorporate different forms of exposure and dissonance, scaffolds for the localization and personalization of justice issues, and connections to the various sources of relational responsibility that educators carry. The narratives shared by educational leaders also indicate the rich expertise that they each hold and the potential to leverage existing perspectives and insights to support collective sense-making about justice concerns within a community of practice. Especially given recent sociopolitical upheaval related to the Black Lives Matter movement, the COVID-19 pandemic, and global climate justice activism, creating space for critical conversations within professional networks to directly address these complex issues is crucial. The emergence and spread of the Climate Justice League in the ClimeTime network, described in the second half of this chapter, demonstrate the importance of supportive structures for sustained relationship-building, reciprocal learning, and partnering across institutional settings. The legislative proviso and ClimeTime initiative served as an enabling context by setting ambitious climate education targets to motivate action, expressing a clear focus on equitable and collaborative approaches, and providing substantial financial resources to support innovative justice-

centered projects. These design features of professional communities encourage participants to bridge across contexts to translate their political clarity into powerful forms of emancipatory action. In the next chapter, I will describe how the design and facilitation of the Climate Justice League — including echoes of some of these principles — supports the critical consciousness and transformative agency of teachers who are involved in the professional learning community.

CHAPTER 5: CRITICAL AND RELATIONAL CHANGE-MAKING WITH TEACHERS

In chapter 4, I introduced how the Climate Justice League (CJL) project emerged as an enactment of Meredith and Stacy's political clarity as educational leaders in environmental and climate education. I also described how the innovative effort was conceptualized within and spread through the ClimeTime network as a statewide community of practice. In this chapter, I share in depth how Meredith, Stacy, and their community partners designed and facilitated the professional learning experience to support teachers' political clarity through justice-focused inquiry, critical reflection, and iterative practice.[15] I first provide an overview of the structure and main activities for the 2019-20 cohort as well as the 2020-21 cohort, highlighting key changes implemented in the second year of the project. Then, I discuss how Stacy and Meredith leveraged a deeply collaborative stance to center global majority experiences and leadership throughout the professional learning series. Next, I outline three dimensions of Stacy and Meredith's relational approach to facilitation — specifically, their responsiveness to educators' needs and contexts, their honoring of teachers' expertise, and their cultivation of spaces of solidarity — that created opportunities for role remediation and contributed to teachers' critical consciousness and transformative agency. Finally, I share examples of how teachers involved in the CJL acted as liberatory and justice-centered change-makers, advocating for systemic shifts within their classrooms and beyond to ensure the thriving of young people and their human and more-than-human communities. In offering this analysis, I demonstrate how sustained and sustaining learning communities are crucial to support educators' strengthening of political clarity through processes such as those described in chapter 4. Ultimately, these forms of learning are necessary for growing teachers' capacity to engage in emancipatory learning and action alongside their students, as described in chapters 2 and 3.

Professional learning experiences that acknowledge and build teachers' power as agents of change are especially important as a refusal of current tendencies of educator deprofessionalization.

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[15] The themes shared in this chapter are informed by the design principles outlined in a practitioner-facing article co-authored by Meredith, Stacy, and Dr. Deb Morrison (Lohr et al., 2021). The ideas have been iteratively and collectively refined through the research check-in and writing meetings within the case study collaboration.

Inequitable power dynamics and structures within educational systems restrict teachers' autonomy, dignity, and creativity. For example, the ongoing policy context of punitive "accountability" and high-stakes testing, the increased adoption of scripted mandatory curricula, and the rigidity of school schedules and narrowing of learning all lead to educator demoralization and deprofessionalization (Milner, 2013; Wronowski & Urick, 2021). Stacy and Pranjali highlighted how the teachers they work with in southwest Washington are forced to navigate these challenges, including districts' desire for "teacher-proof" resources and use of "cookie-cutter curriculum" and administrators' imposition of rigid requirements for math and ELA instructional time. In one conversation, Pranjali reflected that educational leaders' decisions often "[create] another box for the teachers to sit inside of instead of allowing them to actually be creative and create something that's relevant to their students." In addition, teachers frequently encounter professional learning that lacks relevance, positions them as passive recipients of knowledge, and fails to support critical reflection and sociopolitical action — what Kohli et al. (2015) describe as *antidialogical professional development*. The absence of time and substantial support for teachers to engage in justice-centered learning constrains their ability to develop and enact their political clarity. These realities indicate the need to reimagine practices of collective learning, partnering, and liberatory praxis within institutional contexts that are oppressive (Bang & Vossoughi, 2016). In this chapter, I share stories about the Climate Justice league as a space that nurtured powerful relationships, solidarity, and community leadership through shared experiences rooted in profound respect for educators as professionals and as people.

I draw on several data sources to construct this multifaceted narrative. I leverage fieldnotes from participant-observation in CJL sessions with multiple groups of educators, including a subset of the teachers who participated in 2019-20 and continued their collaboration into 2020-21, as well as both the southwest and northwest cohorts from 2020-21.[16] These direct observations are complemented by many

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[16] As mentioned in chapter 4, the Climate Justice League spread further in 2021-22 through the development of an eastern Washington cohort. Since this cohort was facilitated after the focused data gathering period, it is not featured in the narratives of this chapter.

conversations throughout the year with the educational leaders who designed and facilitated these experiences, including research check-ins, writing meetings, the process interview with Stacy, and phenomenological interviews with Meredith. I also incorporate insights from artifacts (e.g., agenda documents, slide decks, Jamboards), student- and teacher-facing surveys, and reflective journaling documents that were utilized during the professional learning series.

Iterative Design of Climate Justice League Learning Experiences

In this section, I share an outline of the key learning experiences that Stacy, Meredith, and their collaborators designed and facilitated for the 2019-20 cohort as well as the two 2020-21 cohorts. The CJL used a *professional learning community* model, in which educators engage in shared learning rooted in their day-to-day professional experiences in order to build their knowledge and shift their practices (Vescio et al., 2008). Many professional learning communities share certain characteristics, including a commitment to shared values, a focus on student learning, opportunities for reflective dialogue, an emphasis on collaboration and deprivatizing practice, and prioritization of trust and mutual support (Bolam et al., 2005). This approach to professional development has become increasingly common in recent decades and is associated with positive changes in pedagogical approaches and student engagement (Vescio et al., 2008). Although research has focused primarily on learning communities within specific schools, the model has also been implemented with cross-institutional cohorts (e.g., do Carmo Galiazzi et al., 2018).

The 2019-20 cohort of CJL included 13 middle and high school teachers from southwest Washington and took place across three full days of in-person learning in fall 2019 (see *Table 3* for a more detailed description of each session). The first day was focused on building teachers' understanding of social justice, environmental justice, and climate justice as interrelated concepts and how these concepts relate to their classroom practice as science teachers. On the second day, teachers explored frameworks and practices of social justice education with facilitators from Learning for Justice (formerly Teaching Tolerance). Teachers were asked to try a justice-centered lesson, activity, or strategy with their students

based on their learning in the Climate Justice League. The third session consisted primarily of educators reflecting with their colleagues about their implementation, including sharing artifacts and student work samples. They also learned about additional ideas and practices for climate justice education, including supporting student voice and action and incorporating real-world stories.

Table 3

Timeline of Climate Justice League Activities 2019-20

Name and timing	Description and purpose of main activities	Modality
Session 1 September 2019	Purpose: understanding social justice, environmental justice, climate justice, and their interconnections as well as connections to classroom practice ● Gallery walk to explore examples of climate and environmental injustice *(facilitated by Sahar Arbab, EarthGen)* ● Meet Today's Climate Justice Activists Mixer activity from the Zinn Education Project Teach Climate Justice Campaign to explore multiple identities and contexts related to climate justice work *(facilitated by Tim Swinehart, Portland Public Schools)* ● Case study of urban heat islands as an example of environmental and climate issues impacting local communities *(facilitated by Sahar Arbab, EarthGen)* ● Overview of practical measures and use of student survey *(facilitated by Dr. Deb Morrison, University of Washington Institute for Science and Math Education)* ● Learning about local climate justice issues and grassroots activism led by communities of color *(facilitated by Tiffany Mendoza, Front and Centered)* ● Learning about social justice and science teaching *(facilitated by Dr. Liza Finkel, Lewis and Clark Graduate School of Education and Counseling)* ● Reflection and planning time *(facilitated by Meredith Lohr, EarthGen and Stacy Meyer, ESD 112)*	In person
Session 2 October 2019	Purpose: exploring frameworks and practices of social justice education and discussing implications for classroom practice *(facilitated by Kimberly Burkhalter, Hoyt J. Phillips III, Sarah-Soonling Blackburn, and Val Brown, Learning for Justice)* ● Critical reflection on social identities and how they	In person

	influence classroom learning ● Critical practices across the categories of instruction, classroom culture, family and community, and teacher leadership ● Application of the Social Justice Standards through essential questions in curriculum design ● Strategies for speaking up against injustice	
Session 3 November 2019	Purpose: sharing and extending practices of incorporating social, environmental, and climate justice connections in science education ● Reflection with colleagues about design process and implementation of practice, including sharing artifacts and student work samples *(facilitated by Stacy Meyer)* ● Connecting to climate change literature to support climate justice learning *(facilitated by Stacy Meyer)* ● Discussion of how educators can support student voice and student action *(facilitated by Sahar Arbab)* ● Example of how to use real world events and stories to plan learning activities *(facilitated by Meredith Lohr)* ● Overview of practical measures and use of student survey *(facilitated by Dr. Deb Morrison)*	In person

Note. For organizations who have changed names since 2019, the current names are listed here (i.e. EarthGen rather than Washington Green Schools; Learning for Justice rather than Teaching Tolerance). For individuals whose professional affiliations have changed since 2019, the affiliations at the time of the session are listed in this table.

Facilitators used practical measures to support teachers' professional learning and shifts in practice. *Practical measures* are a type of formative assessment that can indicate how learners are experiencing the learning context, including how they are interpreting activities, what they find more or less meaningful, and how they perceive their own identities in relation to learning (Fincke et al., 2021). Facilitators can analyze practical measures data to iteratively refine their design approach in response to learners' feedback. In the Climate Justice League, teachers completed a survey prior to the first session and after each of the three sessions to gauge their own learning process and changes in their classroom practices. They were also expected to implement a student survey at least once during the fall and examine the data to better understand their students' learning experiences. Both practical measures posed

a combination of Likert-scale and open-ended questions about definitions of social justice, connections between social justice and science, and engagement in justice-centered learning activities in the science classroom.

In the following year, 2020-21, 12 teachers participated in the southwest cohort and 36 teachers participated in the northwest cohort, representing all grade bands from kindergarten through high school. Due to the COVID-19 pandemic, the professional learning experience took place online and was structured as a combination of asynchronous and synchronous learning activities over the course of the full academic year (see *Table 4* for a more detailed description of each set of activities for the southwest cohort). Each cohort engaged in four synchronous two-hour sessions via the Zoom video conferencing platform — the first three sessions were hosted separately for the two groups, whereas the final session combined both cohorts together. Educators were asked to explore and reflect on additional resources asynchronously between each meeting to supplement their learning. The southwest teachers were also invited to join optional synchronous check-ins to expand further on their learning and address any questions and concerns that arose. As in the first year, teachers were expected to implement a justice-centered learning experience with their students at some point during the year.

Table 4

Timeline of Climate Justice League Activities 2020-21 (Southwest Cohort)

Name and timing	Description and purpose of main activities	Modality
Prep for session 1	Purpose: building the professional learning community by grounding the learning experience in teachers' own school and community contexts ● Create slide including key information about the school and community, issues that are important to the community, how justice and injustice show up in the community, and visual representations of these ideas ● Engage with gallery walk slide deck to explore examples of climate and environmental injustice	Online, asynchronous
Session 1	Purpose: understanding social justice, environmental justice, climate justice, and their interconnections as well as	Online, synchronous

November 2020	connections to classroom practice ● Share stories of school and community contexts in breakout groups *(facilitated by Stacy Meyer, ESD 112)* ● Introduction to environmental justice and climate justice, how risk is determined, and a logic model for analyzing climate impacts *(introduced by Meredith Lohr, EarthGen; facilitated by Dr. Isabel Carrera Zamanillo, University of Washington College of the Environment)* ● Meet Today's Climate Justice Activists Mixer activity from the Zinn Education Project Teach Climate Justice Campaign to explore multiple identities and contexts related to climate justice work *(facilitated by Stacy Meyer)* ● Overview of practical measures and use of surveys *(facilitated by Stacy Meyer)*	via Zoom
Optional check in December 2020	Purpose: learning how justice connections can be incorporated into science education ● Examples of lessons incorporating social justice topics and transdisciplinary learning in a science classroom, and principles for social justice teaching *(facilitated by Gretchen Kraig-Turner, Burlington-Edison High School)*	Online, synchronous via Zoom
Prep for session 2	Purpose: exploring local environmental and climate justice issues impacting communities and how to incorporate local case studies in classroom learning ● Review and reflect on case study of urban heat islands as an example of environmental and climate issues impacting local communities ● Practice applying the climate justice logic model introduced by Dr. Zamanillo in Session 1 ● Reflect on ways to connect a case study into teaching plans, including scientific and social justice dimensions ● Research environmental and climate justice issues impacting own local community	Online, asynchronous
Session 2 January 2021	Purpose: exploring local environmental and climate justice issues impacting communities and how to incorporate local case studies in classroom learning ● Discuss case study of urban heat islands and how interconnected justice issues show up in this phenomenon, and ways to incorporate case studies in classroom learning *(facilitated by Stacy Meyer and Becky Bronstein, EarthGen)* ● Case study on the intersecting social, environmental, and	Online, synchronous via Zoom

	climate justice issues at the Tacoma Detention Center, and strategies for engaging youth in learning and action in communities *(introduced by Meredith Lohr, facilitated by Dr. Megan Ybarra, University of Washington Department of Geography)* ● Discuss emerging ideas for classroom implementation in breakout rooms *(facilitated by Stacy Meyer)*	
Prep for session 3	Purpose: learning how to support youth action, student voice, and community engagement related to climate justice ● Review and reflect on video stories of climate impacts and youth action from Our Climate, Our Future ● Learn about disproportionate impacts of pollution and reflect on how youth can take action on such issues ● Reflect on ways to support student action and community engagement in own teaching context	Online, asynchronous
Session 3 March 2021	Purpose: learning how to support youth action, student voice, and community engagement related to climate justice ● Community asset mapping activity, and example of a phenomenon to engage students in learning about and taking action to address factors that impact community health and well-being *(introduced by Becky Bronstein, facilitated by Terrell Engmann and Jordan Jackson, Basilica Bio)* ● Ideas and resources for supporting youth activism and multi-age mentoring related to environmental and climate issues *(introduced by Stacy Meyer, facilitated by Sanjana Bajaj, Tomorrow Project)* ● Discuss emerging ideas for classroom implementation in breakout rooms *(facilitated by Stacy Meyer)*	Online, synchronous via Zoom
Optional check in March 2021	Purpose: sharing ideas to support implementation of justice-centered learning ● Open-ended conversation about previous or planned activities, resources, and strategies for incorporating justice connections into learning	Online, synchronous via Zoom
Prep for session 4	Purpose: sharing and extending practices of incorporating social, environmental, and climate justice connections in science education ● Create slide to share about the climate justice learning experience, including what was facilitated with students, visual representations and work samples, key insights from the professional learning experience overall, and	Online, asynchronous

	next steps in personal learning journey ● Review student survey responses and reflect on takeaways from the student data	
Session 4 April 2021	Purpose: sharing and extending practices of incorporating social, environmental, and climate justice connections in science education ● Share stories of climate justice learning journey in breakout groups *(facilitated by Stacy Meyer)* ● Resources to extend learning about climate justice *(facilitated by Meredith Lohr)* ● Visioning activity to imagine a climate just future *(facilitated by Becky Bronstein)*	Online, synchronous via Zoom

Note. For clarity, the dates, activities, facilitator information, and modality are included for the southwest cohort only. Learning activities for the northwest cohort were very similar with the exception of regionally specific adaptations of examples and case studies. Meredith Lohr and Becky Bronstein from EarthGen were the primary facilitators of the northwest cohort sessions. For organizations who have changed names since 2019, the current names are listed here (i.e. EarthGen rather than Washington Green Schools). For individuals whose professional affiliations have changed since 2019, the affiliations at the time of the session are listed in this table.

The facilitators made intentional decisions regarding the pacing and format of the Climate Justice League in response to the transition to an online experience. For example, designing learning in smaller increments that occurred more frequently throughout the year was in part out of necessity, given the unavailability of substitute teachers and other constraints on teachers' ability to participate in full-day professional development during COVID-19, as well as the exhaustion of being on Zoom for extended hours. However, Stacy reflected during our process interview that a benefit of this spread-out approach was offering teachers more opportunities to incorporate connections to social justice, environmental justice, and climate justice within curriculum units on a variety of topics. Stacy shared that this might feel more authentic compared to the condensed structure used in 2019-20. In addition, Stacy mentioned that providing more time to learn new ideas and reflect over the course of the year could support more lasting and powerful changes in educators' pedagogical practices. Meredith also emphasized the importance of ensuring sufficient time for teachers to process the intense, challenging content of the professional learning:

> It's this massive topic, which we're trying to do justice, we're trying to do a reasonable job of sharing with teachers. [...] I think last year we brought in a lot of speakers and activities and it was kind of a lot. And what we learned is that you really… and I don't think we did a bad job of this, but people really need time to process and make sense of this content, which is very new for them, and then plus thinking about how to bring it into their classrooms in a way that is engaging and effective. So I think there's a little bit of "less is more" that we're trying to do this year.

In these ways, the pivot to online learning prompted changes to the facilitation strategies that also aimed to make the experience more impactful and supportive for teachers. Similarly, the asynchronous work and optional check-ins were an adaptation to the extenuating circumstances of the pandemic but were also intended to foster a greater sense of coherence, community, and sustained momentum in the collective learning journey. Stacy and Meredith also introduced individual reflective journaling documents (located in a shared Google Drive folder) for the 2020-21 cohorts as a space for teachers to record and deepen their critical insights throughout the year — and for facilitators to understand how teachers are experiencing the professional learning community.

In addition to these adjustments of learning activities and structures, the teacher- and student-facing practical measures for the southwest cohort were also modified in the second year of the project. Over the course of several research check-in conversations, Stacy and I co-developed four interconnected dimensions of climate justice teaching: justice-focused phenomena, community engagement, social and historical perspectives in science, and instructional practices and classroom experiences. We organized the Likert-scale items from the 2019-20 teacher and student surveys into these four clusters. Rather than addressing all of the items in every survey, teachers were asked to select one area to focus on throughout the year and responded only to the questions that were relevant to their specific learning goal. The student surveys were similarly tailored to address each teacher's chosen focus area. Given the frequency of implementation — teachers completed a survey before and after the full series as well as between each session, and were asked to gather student survey data at least three times

— this sharpening of focus made the practical measures more streamlined, targeted, and usable for reflection and iterative design by both teachers and facilitators. This refinement of practical measures was a salient example of how professional learning experiences and supports in the CJL were iteratively strengthened through collaborative, reflective design cycles.

In addition to encouraging teachers to prioritize an area for personal growth, the creation of the focus areas also influenced the facilitation of the learning experience. Stacy shared:

> One of the things that's been really helpful about that survey, too, is it's also helped guide us in thinking about ensuring that we're offering some learning in all four of those categories at the sessions, so that it's not just about how do you choose a climate justice focused phenomenon for your instruction. Because I feel like that was a big emphasis for our work last year and still kind of in our planning, like "Well how do we help teachers come up with a local climate justice issue?" But there's so much more, well there's so much additional important learning around how do you teach, like what does the actual classroom experience look like for your students, how are you connecting with community? So it's been helpful for us to even think about that lens of the teacher survey and how we're using it to guide the actual professional learning.

In later conversations in spring 2021, Stacy reflected that including the focus areas in the practical measures expanded her own understanding of what climate justice education entails and how she can support teachers to strengthen their practice across these interrelated dimensions of justice-centered teaching. Although teachers were invited to select only one area for the year, Stacy emphasized that the structuring of learning around these multiple facets highlighted the importance of "what different aspects of the work can look like and it's not just doing one of those," but that "we need to think about how they all overlap and work together." In this way, the re-design of the practical measures catalyzed a shift toward more complex and nuanced conceptualizations of justice-focused practices.

These design choices — an extended timeline of learning engagement, multimodal supports across the year, and multidimensional practical measures — all indicate that social, environmental, and

climate justice education is long-term work with many possible entry points. Opportunities for *critical professional development* in learning communities like the CJL that directly cultivate collective sociopolitical inquiry and critical consciousness are crucial for supporting teachers' efforts to implement liberatory practices in their classrooms (Kohli et al., 2015, 2019). Justice-related learning and reflective practice are also long-term work for the facilitators, who continually adapt the content, activities, structures, and feedback protocols in order to better support educators' development of political clarity and capacity to translate their justice commitments into transformative action. During our process interview, Stacy reflected that they are always extending their own learning and shifting their strategies based on what went well and what could be improved. Similarly, Meredith described the centrality of ongoing iteration in their design process, sharing that after "trying something once, you get a sense of what worked and what you want to change." This openness to new insights and ideas exemplifies Stacy and Meredith's humility as educational leaders and facilitators of professional learning, a quality that is also evident in other aspects of their approach that I will describe in the following sections.

Practicing a Collaborative Stance and Centering Global Majority and Youth Expertise

Throughout the Climate Justice League project, Stacy and Meredith practiced a collaborative stance that decentered their own expertise in the facilitation of sessions. Rather than presenting information to teachers themselves, they built partnerships with community leaders and experts from a variety of professional contexts. For Meredith, this stance is rooted in her self-awareness of her positionality as a white woman engaging in justice-focused efforts. During a writing meeting, she expressed "concerns around white-led organizations like ours positioning ourselves as climate justice experts and I really am not comfortable with that, I feel like we're more facilitators and conveners." Meredith's comments reflect her critical attunement to the implications of her racialized identity, given that global majority communities and other marginalized peoples are most directly and severely impacted by environmental and climate issues and are often at the forefront of resistance, restoration, and justice movements. Although she and Stacy played a crucial role as "facilitators and conveners" in the CJL, they

were not and should not be positioned as experts.

In our process interview, Stacy clarified her perspective on this design approach that prioritizes relationship-building and partnering with experts:

> One of the things that I think is really unique about this effort is it was really, really, really collaborative from the start. And I think some of that's just the way that I prefer to work, like I want to bring in people who are more knowledgeable about a topic than I am. I can't be the person teaching about all of these things. I just am not, that's not my role, but what I can do is find people who know more about a topic and bring them together and help be… kind of like the glue between these ideas.

Stacy emphasized the importance of collaborating with individuals who are personally engaged in different forms of social, environmental, and climate justice work and hold greater wealths of knowledge and experience related to the topics. In a separate conversation, Stacy shared that educators appreciate hearing from community experts and that these knowledge-shares often give rise to powerful shifts in teachers' thinking and practice. She described how this strategy of "building people in" led to richer, more generative possibilities for conversation and shared intellectual work in the professional learning community. Stacy elaborated on her role as the "glue":

> The one thing I can do is see how they all fit together and then try to build that in. [...] It's a weird strength, but I've recognized that that's something that I've really enjoyed about this work is that I get to play that role a lot, and I love it because I love learning more about what other people are doing and how it connects to this. And I think it makes those learning experiences feel more coherent for teachers. You need someone to be the glue, you need someone from the teacher perspective, helping them make sense of how it all connects.

Although Stacy does not see herself as a content expert, she highlighted her own responsibility of being the connective force between multiple partners' contributions. As an educational leader, she is highly knowledgeable about the opportunities, constraints, and other contextual realities of the educational

system and can support teachers in their meaning-making around the insights shared by experts.

In this reflection, Stacy also mentioned her love of continuous learning and seeking out more perspectives, a characteristic that Meredith also noted in herself during our phenomenological interviews. This desire to expand their own and educators' thinking through collaborative partnering, as well as the awareness of their racial positionality and the need to decenter themselves, both contributed to a humble approach to facilitating professional development. Stacy and Meredith described their experience as engaging in shared learning alongside participating teachers and collaborators: "We are in this to learn together." Stacy shared that this humble, collaborative stance enabled her to dive into climate justice education work despite not feeling like an expert on the complex topics:

> We didn't have a full coherent plan about where it was going to go and what it was going to look like, but we were like, "We have to do it. We have to try. We have to get started, even if we're all still learning about this together." And I think that that's not a comfortable stance for everybody to engage in learning if you don't feel like you're an expert. I think there's a lot of times, and I see this in teachers I work with too, where people are nervous about doing learning if they don't feel like they can answer every question that comes up. Sometimes, that fear means that people don't want to engage in something that they are not fully confident about doing. And there's no way I was fully confident about doing this, but one of the things that I did was I gathered a bunch of really amazing people together in the room, so if hard questions came up, there was a whole bunch of people there to help answer and talk about it. And so for me, that is what helps me engage in work that I'm uncomfortable with or don't feel like an expert in. And I think it's also, for me, authentic to just reflect that we're all doing this together, we're all learning together, none of us are experts, but let's think about what we can learn and what we can try.

Stacy discussed how collaboration with more knowledgeable others was a source of courage in facilitating justice-centered professional development because they were able to draw upon multiple perspectives from community leaders to support the shared learning. This humility from educational

leaders also models to teachers a practice of decentering their expertise and their desire to be perceived as experts in their own learning spaces with students.

In the CJL, this decentering of facilitator expertise created necessary space for people of the global majority to share their insights and lived experiences as scholars, educators, and community organizers and advocates. Many of the partners were Black, Latinx, and Asian folks who are deeply engaged in various forms of activism at the intersections of social, environmental, and climate justice — and were able to share ideas with teachers based on their many years of experience in liberatory movement spaces. For example, Tiffany Mendoza was, at the time, the Director of Strategic Initiatives at Front and Centered, a coalition of environmental and climate justice organizations across Washington State led by communities of color. She shared with teachers in the 2019-20 cohort about their policy and advocacy work rooted in listening parties and other strategies for understanding the issues that different communities are navigating. In the second year of the project, Dr. Isabel Carrera Zamanillo provided an introductory framing of key concepts within environmental and climate justice, including risk, exposure, vulnerability, and disproportionate impact. At the time, Dr. Zamanillo was a Diversity, Equity, and Inclusion Specialist in the University of Washington College of the Environment, though her strategic approaches were informed by her background in community organizing and research, particularly around food justice. Also in 2020-21, Dr. Megan Ybarra, a professor of Geography at University of Washington, shared about her engagement in abolitionist organizing against the Northwest Detention Center in Tacoma, Washington. Dr. Ybarra's stories wove together threads of racial and immigration justice (the threat of incarceration and deportation for undocumented immigrants and their families), environmental justice (the detention center is located on the Tacoma Tideflats, a Superfund site and liquefaction zone), climate justice (an active battle against the Tacoma Liquified Natural Gas refining facility and other expansions of fossil fuel infrastructure), and tribal sovereignty (these interconnected harms are located on the ancestral territory of the Puyallup Tribe, who are leading the resistance against the LNG facility) in a concrete, localized example of resistance and social transformation movements. This storytelling invited

teachers to consider how they can structure classroom activities around locally relevant case studies, including exploring intersecting injustices as well as learning about and participating in activism efforts.

In addition, collaborative facilitation in the 2020-21 cohort of CJL also included partnerships with young global majority individuals who are deeply engaged in activism and education efforts related to environmental and climate justice. Terrell Engmann (a Ph.D student in Biomolecular Sciences) and Jordan Jackson (at the time, a senior at UW studying Microbiology) are co-founders of an organization called Basilica Bio that works toward environmental justice and health equity through community action projects and designing educational materials focused on the social determinants of health. During the third session of CJL, Terrell and Jordan shared their anchoring phenomenon and guided teachers through several of the learning activities they had created, such as community asset mapping and discussing amenities and disamenities in different neighborhoods. Also in the third session, Sanjana Bajaj (a high school student) presented about her work with the Tomorrow Project, designing multimedia educational resources to mentor younger students to become informed environmental advocates. All three of these youth partners shared their expertise — speaking as young people who are invested in environmental and climate justice — to inspire teachers to support youth action, student voice, and civic engagement through classroom science learning experiences. At the same time, centering youth leaders as experts in a professional learning space modeled how educators can honor and learn from the brilliance and changemaking power of young people.

These collaborative partnerships with people of the global majority strengthened the CJL as a space of critical professional development in several ways. By sharing their understandings gained from on-the-ground engagement, each of these partners expanded educators' critical, multidimensional analyses of environmental and climate injustices and intersecting systems of oppression. As educators and learners, they also offered specific pedagogical strategies, resources, and frameworks to support teachers in implementing these crucial ideas in their own classrooms. These learning experiences can contribute to educators' political clarity and ability to facilitate justice-centered learning that cultivates youth agency

and sociopolitical consciousness, as described in chapter 3. Importantly, many of the collaborators grounded their storytelling in their own racialized and other social identities, personal and family histories, and community affiliations. Within professional learning communities, centering the expertise of global majority leaders who are enacting liberatory praxis is an important way to disrupt settled expectations and dismantle the Euro-Western supremacy that shapes school-based science learning, as discussed in previous chapters. As shared in chapter 4, exposure to worldviews and lived experiences that differ from one's own can also be a powerful catalyst for educators' development of political clarity. Given that all three CJL cohorts consisted of predominantly white teachers, listening to stories from global majority experts was an opportunity to encounter a multitude of perspectives that may have been unfamiliar. In these ways, Stacy and Meredith's collaborative stance in the design and facilitation of the Climate Justice League opened up possibilities for teachers to learn from and with experts who are practicing different forms of transformative action.

Designing for Relationality and Role Remediation in Justice-Focused Professional Learning

In the previous sections of this chapter, I described the key activities that each cohort of the CJL engaged in, which were designed to support teachers' development of critical awareness about intersecting injustices, justice movements, and local examples impacting their communities, and to strengthen their understanding of how to facilitate justice-centered learning in their classrooms. I then discussed how the collaborative stance adopted by facilitators enabled the participation of multiple global majority experts who shared rich insights rooted in their personal, professional, and community experiences. These aspects of critical professional development opened up possibilities for teachers' sociopolitical learning and shifts in practice.

In this next section, I focus on how Stacy, Meredith, and their partners prioritized relationality and role remediation in their shared learning with teachers in the CJL. I interweave examples and stories from both the 2019-20 and the 2020-21 cohorts to clarify multiple dimensions of their relational approach. Specifically, I highlight how the iterative design of the professional learning community

emerged from Stacy's long-term trusting relationships with educators in southwest Washington and was continually shaped in response to their needs and interests. I then describe how the educational leaders respected and positioned teachers as expert collaborators and co-learners in a shared leadership model that disrupted the entrenched power dynamics of antidialogical professional development. Finally, I share how the CJL became a space for support, community, cross-pollination, and solidarity for teachers as they deepened their commitments to justice work within and beyond their classrooms. These dimensions of relational change-making indicate how a dedication to sustained relationship-building with and among teachers can contribute to their political clarity, their individual and collective agency, and their participation in social transformation.

Responsiveness and Long-Term Relationship-Building with Educators

In research check-ins with Stacy and Pranjali, they often emphasized the importance of their relationships with teachers in the region for guiding their creation of supportive structures for justice-centered learning. During one conversation, Stacy reflected:

> The other thing I think you and I both do is we listen. Before doing a thing, we try to gather information about what are the needs, what do teachers need right now, how do I hear all of that and think about how to put my efforts into something that's going to make a difference [for a] broad number of teachers, based on what I'm hearing.

Stacy described how her design of professional learning resources and spaces is always responsive to the needs and current realities that teachers in southwest Washington are experiencing, rather than a top-down determination of what she believes that educators should learn or do. As Stacy highlighted, strong connections with teachers are essential for this approach and they "can't do anything without our relationships and partners[hips] with teachers." She continued:

> There's a lot of folks that don't even build those relationships with teachers, they don't know the teachers personally, and I think that you and I both take the approach of like… If you're going to rattle off any school, we could tell you "Oh well, this individual, and I worked with this

> person…" That's the way you and I think about our work is all about the individuals and their context and their students, and so we take all of that information in and then think about, "Okay, I've got all these people that I work with, what are some things I can do that are going to make a difference?"

Stacy emphasized how her personal relationships with teachers across the region and her understanding of the systems they navigate are the starting point for her work. As Stacy shared, this relationship-building and attunement to teachers' needs underlies all of her and Pranjali's efforts as educational leaders.

This commitment to trusting relationality, a listening stance, and responsiveness is informed by Stacy and Pranjali's humility and continued sense of identity as teachers. Pranjali highlighted how Stacy's approach is guided by a "deep respect for the profession and for teachers," in contrast with the "mindset of superiority" and "down-talking" tendencies that educational leaders sometimes adopt as they "get arrogant about this perceived power that we have." Stacy agreed, responding:

> I think that that is one of the things about actually both of us is I think you and I both still see ourselves as teachers. And that is always first and foremost how I think of myself and my role, even though I'm no longer in the classroom.

In other conversations, Stacy re-affirmed this sentiment and elaborated that this self-perception as an educator is a crucial influence on her professional endeavors. Pranjali reflected on why this felt affiliation with the profession of teaching is necessary:

> I just feel like in our roles we can either become further and further removed from the classroom and our work becomes really irrelevant really quickly, or we have the opposite, where we continue to stay anchored in that, and our work stays impactful and relevant.

Rather than holding attitudes of superiority that can lead to the deprofessionalization and demoralization of teachers, Stacy and Pranjali carry their identities as educators as a touchstone in their roles as educational leaders.

Both Stacy and Pranjali reflected that sustained relationship-building with and responsiveness to

teachers have greatly strengthened their project work, including the development of new ideas and the continual refinement of existing efforts. For example, Stacy's awareness of teachers' needs led to the creation of the STEM Seminar model, another project with EarthGen that is funded by ClimeTime. STEM Seminars are professional development workshops that build educators' understandings of climate change through collaborations with science researchers and engagement in data analysis and modeling practices focused on a regional climate impact, such as increased wildfires, ocean acidification, and changes in water availability. The workshops also include discussion of social and cultural implications of the phenomenon and community-led responses, often in partnership with local experts. Stacy initially conceptualized the structure of STEM Seminars based on conversations with teachers who felt that their own limited understanding of climate science and climate change impacts was a barrier to incorporating these topics into their classroom. Scaffolded encounters with authentic scientific findings, knowledgeable professionals, and stories about communities' lived experiences all support educators' confidence in facilitating climate learning with their students — as does intentionally structured time for teachers to develop plans for implementation in their contexts. Through Stacy's partnership with EarthGen, this professional learning model has been brought to life, iteratively refined, and utilized with teachers across Washington State.

The Climate Justice League professional learning community was also inspired and shaped by input from teachers in southwest Washington. Some educators regularly participated in STEM Seminar offerings and were seeking additional support for in-depth learning, collaboration, classroom implementation, and critical reflection. Given the standalone design of STEM Seminars, Stacy wanted to provide an option for sustained engagement for teachers who were activated and eager for more intensive work. Along with the sociopolitical, personal, and professional contexts shared in chapter 4, these desires from teachers led to the emergence of the CJL as a community of inquiry and practice focused on the intersections of science learning and social justice. In both the STEM Seminars and the Climate Justice League, the design of new professional learning opportunities was closely informed by educators'

expressed needs and interests rather than educational leaders' assumptions — a responsiveness enabled by long-term working relationships with teachers.

Within the Climate Justice League project, Stacy's long-standing relationality with teachers was also a powerful asset in the collaborative design and facilitation of the learning experiences themselves. Stacy reflected on this contribution to her partnership with Meredith:

> I think we've done a good job of understanding what our strengths are and what we each bring to the collaboration and then set[ting] up the learning so that we're building on those strengths. And I think one of my strengths is I know my teachers, I know my communities that I'm working with, I know the resources they have to teach, I know what some of the constraints are that they're working with, and so that's always in my mind when I'm then in the role of trying to think about "Okay, so how can we take this learning and help it come into the classroom for you?"

The different strengths that Stacy and Meredith bring to their work are a result of their unique institutional positions — whereas Meredith leads a nonprofit organization that works with educators and districts across the state, Stacy's responsibilities as an educational leader are to provide more localized and ongoing support to teachers in southwest Washington. Stacy's description indicates that the statewide nature of EarthGen's work is complemented by her deep knowledge of individuals and communities in her region, resulting in a highly responsive and supportive experience for teachers in the southwest CJL cohort.

After the first year of the project, many of the teachers from the 2019-20 cohort wanted to stay engaged with their colleagues and continue their collaborative learning. In 2020-21, a few of the educators decided to join the professional learning community again and participate in the second iteration of learning experiences to further strengthen their understanding of justice-centered teaching. Stacy also offered CJL teachers an opportunity to be involved in curriculum design work, building out selected justice-focused lessons they had enacted the previous year into Storylines that could be shared as open educational resources. Given the growing interest in climate change education nationwide — for

example, in 2020 New Jersey added climate change to its educational standards across all discipline areas and grade bands — freely available lessons and other curricular materials were a useful contribution to broader dialogue about what climate justice learning can look like in science classrooms. Stacy identified the need for concrete examples of on-the-ground practice through conversations with educators, educational leaders, and ClimeTime leaders. This idea was also inspired in part by the impact of the STEM Storylines Pranjali writes, which have traveled widely and supported justice-centered teaching within southwest Washington, across Washington State, and even in other states and countries.

Six of the educators from the 2019-20 cohort decided to take on this endeavor, working in pairs to create three Storylines focused on an introduction to environmental justice movements and histories, water scarcity and water justice, and health inequities and epidemiology. The group and Stacy met in February 2021 to hold preliminary discussions about the scope and strategies of their work, which were responsive to teachers' capacity given the difficulties and exhaustion of teaching during the pandemic. Then, they convened via Zoom on a biweekly basis from March through June to develop short arcs of student learning structured around driving questions. Much of the time was dedicated to collaborative work in design teams, but each session also held space for full group check-ins and idea-sharing. Stacy invited Pranjali to join and support teachers' efforts based on her background and expertise in crafting curriculum resources in the STEM Storylines project. At the first meeting in March, Pranjali presented an overview of project-based learning principles and her own design process. In subsequent meetings, she provided feedback and encouragement as teachers moved through their Storyline-writing experience. The flexible approach and guidance from Pranjali enabled educators in the group to engage in the intellectually challenging work of curriculum design.

The emergence of the Storyline design group indicated how teachers in the first cohort of the CJL were invested in continuing their shared learning and relationship-building, and how Stacy responded to this interest by creating opportunities for extended engagement after the initial professional learning series. These activities demonstrate Stacy's commitment to long-term, multifaceted support of teachers'

justice-related learning journeys beyond the duration of professional development offerings. These forms of responsive relationality enable educators to form strong connections with each other that are pivotal to their ability to take justice-centered action in their classrooms, schools, and communities. These design dimensions resonate with research indicating that high-quality professional learning opportunities should be sustained over time, enabling the accumulation of collective sense-making experiences (Borko et al., 2010). In the following sections, I look more closely at how the CJL served as a context for self-determined learning by positioning teachers as experts and changemakers in their professional practice. I also share how educators in multiple CJL cohorts, especially the Storyline design group, formed a web of emotional affirmation and mutual solidarity that was crucial in maintaining their energy and well-being as they navigated a complex sociopolitical climate. These dimensions of relationality are essential for cultivating teachers' individual and collective transformative agency as educators and community members working toward systemic shifts and more just futures.

Positioning Educators as Expert Collaborators within a Shared Leadership Model

Within the design of the Climate Justice League professional learning community, Stacy and Meredith also adopted a humble and responsive approach as facilitators that is grounded in their view of teachers as the experts of their own practice. In a writing meeting in spring 2021, Meredith highlighted how she and Stacy both take "the stance that teachers know best." Stacy similarly shared during a research check-in, "We always come from it from a place of 'Well, you know best. You're the teacher, you know your students, you know your community, you know what's going to work.' It's our job to support that." This perspective underlies Stacy's commitment to listening to the needs and interests of teachers in her region when developing professional support structures, as described in the previous section. At the same time, the belief that teachers know best shaped how Stacy and Meredith recognized and positioned educators as expert collaborators and agents of change in the Climate Justice League.

In conversations about other initiatives in southwest Washington, Stacy emphasized the need to create space for teachers to be authentic partners in any equity and justice work in educational systems.

She described how she often witnessed educational leaders and school and district administrators making decisions on behalf of educators without their own involvement. Despite positive intentions of transforming inequitable systems, this top-down model fails to address the realities teachers are navigating in local community contexts or recognize the vital knowledge they hold from their professional experiences. Stacy expressed that "teachers need an active role, they're not the audience or the participants." She continued, advocating for the necessity of collaborative engagement that disrupts uneven power dynamics to cultivate sustainable change: "Teachers need to have an equal voice and role in this work, because it's acknowledging their role and their expertise in the work that they're doing on the ground." In the same research check-in conversation, Pranjali noted how educational leaders frequently perpetuate narratives that teachers are the problem or are deficient in various ways.

In contrast, Stacy and Meredith's work with educators in the Climate Justice League operates with an asset-based framing within a shared leadership model. This approach aligns with research regarding democratized power dynamics and decentralized governance structures that support distributed leadership and teacher leadership within particular schools (e.g., Alma Harris, 2005; Muijs & Harris, 2003; Wilson, 2016) — although the CJL professional learning cohorts connect educators across regions. In the CJL context, shared leadership entailed honoring teachers' desire to enact justice-centered practices, leveraging their expertise in collective learning, and providing meaningful forms of support and shifting oppressive structures in educational systems in order to make teachers' liberatory work more possible. In this section, I highlight how these forms of role remediation — explicitly confronting the deprofessionalization and disempowerment of educators and engaging with them as partners and agents of change — were a crucial dimension of Stacy and Meredith's relational changemaking approach in the CJL project.

The opening activity of the CJL experience with the 2020-21 cohort clearly reflected this positioning of educators as experts of their own teaching practice and their contexts. To introduce themselves to their peers and begin building relationships within the professional learning space, teachers

were asked to generate multimedia representations of their schools and communities in a shared slide deck. They utilized text, images, maps, quantitative data, and other types of information to convey their responses to the following prompts: "What is important for us to know about your school / community? What issues are important or central to your community? How does justice / injustice show up in your community?" During the first synchronous session, educators presented their stories to their colleagues as a way to initiate conversations about what climate justice education might look like in their particular contexts.

Rooting collective learning in teachers' initial reflections about their schools and communities was an intentional design choice to encourage educators to focus their subsequent participation around the specific circumstances of their personal and professional lives. Stacy explained that educators' experience of "bringing this learning, these conversations to students in their classrooms is, on the ground, just going to be experienced really differently." As facilitators, Stacy and Meredith recognized that justice-centered environmental and climate learning would take different forms based on where teachers live and work, shaped by factors like racial and cultural demographics, political ideologies, histories, geographies and ecological challenges, and many other aspects of specific communities. Stacy shared that the activity was similar to other professional development approaches that engage teachers in critical reflection about their positionalities and identities, but broadened to the level of institutional, community, and other local place-based considerations. Stacy elaborated on the purpose of the storytelling activity:

> What are the cultural identities and lenses that exist in their school community, and how does that help teachers think about what case study it might be that they bring in for their students to explore that's relevant to their community, what conversations might come up in their classroom…

The CJL facilitators developed this activity in response to stories shared by teachers in the 2019-20 cohort about confronting resistance and backlash from community members as they worked to implement justice-focused learning in their classrooms. The storytelling experience offered educators an opportunity

to frame their inquiry and reflections around these considerations from the outset. This strategy resonates with research emphasizing that knowledge is *situative*, or shaped by the environments teachers are situated within, and that professional learning should therefore be rooted in teachers' own contexts of practice (Borko, 2004; Borko et al., 2010; Putnam & Borko, 2000).

Centering teachers' firsthand expertise about their contexts was a design focus throughout the year-long professional learning community. Although facilitators demonstrated approaches to environmental and climate justice learning, such as structuring learning around locally relevant case studies and justice-related phenomena, they positioned educators to decide how these ideas and practices related to their own work. Meredith explained:

> It's not about a one-size-fits-all curriculum, it's about supporting teachers to generate their own resources that fit with the needs of their students. I feel like that idea of teacher as expert, or bringing in their own experience, bringing in their own stories and expertise, extended to "Show us what you tried! So you picked something to try, and you did it, and tell us how it went, and we're going to learn from you." So, it wasn't like "Okay, and now here's the answer, now that we've heard all your stories, we're going to give you the canned curriculum." It was "We're going to support you to develop something."

Stacy and Meredith described this model of professional development as "teacher-centered learning" that recognizes educators' agency and invites them to actively create their own learning experiences. In the same conversation, Stacy shared:

> Like you were saying, it's really self-determined in some ways, like it's really up to the learner to assess their own connection to the content, their own ways of interpreting and applying the content, and then to come back and reflect on it. It's really about the teacher identifying their own needs, what they want to take from the learning that they're going to apply. And I think we've done that very intentionally with this work. It's been very structured to offer lots of ideas and examples with no expectation that anyone did any particular thing with it, it was really up to the

learner to figure out what pieces made sense for them in their context.

As Meredith and Stacy noted, teachers were not asked to enact a predetermined set of activities with their students. Instead, the CJL supported educators by showcasing a variety of possibilities for justice-focused teaching and holding space for them to make sense of which aspects of the collective learning resonated with their community contexts and how to incorporate them into their practice. This approach reflected a design priority of nurturing active teacher inquiry shaped by their own interests (Borko et al., 2010). This open-ended style of facilitation disrupts the inequitable power dynamics and deficit views of teachers that underlie antidialogical professional development. In doing so, it also parallels the authentic, student-centered, self-determined, and community-connected forms of learning described in chapter 3 — thus prompting teachers to consider their own role as facilitators of emancipatory learning with students in their classrooms.

After teachers in each cohort developed and implemented a justice-centered learning experience with their students, they were invited to share about their practice at the final session of the CJL. In 2019-20, this took place in person at the third meeting and included an overview of the student learning activities, how they were informed by the CJL, and examples of student work. In 2020-21, teachers each created a slide about their Story of Climate Justice Learning, responding using text and images to the following prompts: "What did you try? What did you learn? How will you continue this work?" Educators from both the southwest and northwest cohorts came together in a Zoom gathering and presented in breakout groups with several of their peers. Meredith described how the share-out strengthened a sense of community and mutual support:

> I remember the last meeting of the first year, in person of course, sitting in a circle [...] and having the teachers take turns going around the circle and sharing what they had tried in their completely different settings, different aged students, different applications of what they had learned, but just holding the space for one another and really, it felt [like a] very respectful community-oriented experience.

This sharing activity provided teachers an opportunity to reflect on their design process, synthesize their personal learning across the professional development series, and determine next steps to further extend their learning. At the same time, this closing session served as a bookend by returning to educators' schools and communities and focusing on how they applied their justice-related insights to their home contexts. Finally, the share-out was a powerful culmination of the peer-to-peer learning that was threaded throughout the CJL. As teachers in each cohort built trusting working relationships over time, they engaged in collective sense-making and cross-pollination by sharing their experiences and learning from each other. This dimension of the CJL resonates with research indicating the need for opportunities for teachers to develop trust to support collaborative engagement within professional learning communities (Hallam et al., 2015). These strategies also echo research findings regarding the importance of reciprocal expertise-building within *discourse communities* to navigate challenges and support critical shifts in teaching practices (Borko et al., 2010; Putnam & Borko, 2000). In these ways, the CJL centered on shared learning based on teachers' assets and perspectives, as opposed to top-down delivery of professional development by educational leaders.

Stacy and Meredith uplifted teacher expertise in other ways in the Climate Justice League project as well. For example, the Storyline design work with a subset of the 2019-20 cohort was a strategy for amplifying the knowledge of teachers and sharing their efforts as inspiration for other educators. During the Storyline-writing meetings, Stacy provided only light facilitation and instead held space for teachers to learn from and with each other through sharing their iterative design processes and offering constructive feedback:

> When these teachers start talking about what they're doing in their classroom and some of the work that they're doing with students, it gets me really excited that there's just so much more potential to collaborate on a bunch of other ideas. And the other thing about these teachers is they all want to share ideas across and among. So, we have them working in pairs on Storylines, but I think that the plan is that there's always a space for us to come back and share and iterate together.

Co-designing Storylines with their colleagues was an opportunity for teachers to contribute to broader conversations about justice-centered environmental and climate learning, as well as to expand their own ideas and practice through collaboration with knowledgeable peers. By honoring educators as leaders and creative professionals, this process was a powerful counter-narrative to the entrenched power dynamics that tend to position teachers as passive implementers of curricular resources.

Another clear example of uplifting educator expertise was inviting Gretchen Kraig-Turner, a high school biology and biotechnology teacher, to present about her engagement in justice-centered science teaching at one of the 2020-21 CJL check-ins. Gretchen described several lessons she had developed to connect science topics and social justice issues through transdisciplinary learning, including medical apartheid and the Tuskegee Syphilis Study, the story of Henrietta Lacks as context for learning about cells, and DNA electrophoresis as a tool for exonerating wrongly convicted individuals. Members of both the 2019-20 and 2020-21 southwest CJL cohorts were able to join and gain inspiration from Gretchen's presentation of concrete examples of student learning activities.

In these ways, Stacy and Meredith positioned educators to learn directly from each other through collaborative engagements, reciprocal knowledge-sharing, and spreading their justice-centered work to broader audiences. Their ability to leverage teacher expertise to support peer-to-peer capacity-building was enabled by their commitment to sustained relationality with educators, as described in the previous section. These approaches to professional learning stand in contrast with common practices of antidialogical professional development, which presume teachers are deficient and in need of rote technical training led by external experts and aimed at compliance and social control (Kohli et al., 2015). The CJL served as a space for role remediation by disrupting the oppressive power dynamics that often persist between teachers, school and district administrators, and educational leaders. These strategies and commitments resonate with frameworks of *practitioner inquiry*, in which educators are powerful holders and generators of grounded professional knowledge and active participants within teacher-research communities that support their intellectual endeavors (Cochran-Smith & Lytle, 2015; Lytle & Cochran-

Smith, 1992). By emphasizing teacher-centered learning and what Freire described as "dialogic action," the facilitators practiced critical professional development that "frames teachers as politically-aware individuals who have a stake in teaching and transforming society" (Kohli et al., 2015, p. 9). Centering educators as equal partners in the co-construction of shared inquiry and emancipatory praxis contributed to teachers' shifting professional identities as they came to recognize their agency, expertise, critical consciousness, and leadership capacity.

Building Solidarity in Navigating Complexities of Transformative Changemaking

As outlined in the previous section, teachers in the CJL strengthened each other's practice through collaborative meaning-making and expertise-sharing activities. Mutual assistance also extended beyond these forms of intellectual and professional relationality and into powerful moments of emotional sustenance and solidarity. In this section, I describe how educators in justice-focused professional learning spaces cared for each other's psychological well-being as they navigated community pushback, unsupportive administrators, and other barriers to their transformative changemaking efforts. In addition to learning from their colleagues' expertise, teachers acted as co-conspirators through peer-to-peer support and strategizing in response to emerging challenges. In these ways, the CJL and related professional development projects cultivated affinity group-like communities that were a source of holistic nurturance for educators who are committed to justice-centered teaching and liberatory action.

In recent years, educators in southwest Washington have been experiencing backlash for incorporating equity and justice into their work with students. This politically charged context, in part a response to broader social justice movements, involved parents and community members attacking individual teachers, giving public commentary at school board meetings, and holding protests on school campuses. Their concerns included any discussion of race, racism, or racial justice, which right-wing rhetoric has labeled as the teaching of "critical race theory" and targeted as an example of racist indoctrination and shaming of white students (Adam Harris, 2021; Kreiss et al., 2021). Their critiques included other forms of classroom-level equity work as well, such as conversations about gender identity

and pronoun use. Parents and other stakeholders also pushed back on districts' COVID-19 policies, especially the mandatory masking requirements in schools. At one school board gathering, a parent threatened to release teachers' names on social media, presumably to invite online harassment. This atmosphere of suspicion and politicization within the public education system impacted teachers in the CJL throughout the 2020-21 academic year. One member of the 2019-20 CJL cohort had several students removed from her class after she discussed the Green New Deal, a case study of solar energy, and disparities in access to renewable resources in a climate science elective course. Another teacher encountered a parent interrupting a virtual class to yell at her and call her a communist for facilitating a lesson about scientific misinformation in the context of COVID-19 media coverage. As indicated by these examples, patterns of intense backlash that have emerged across the state and the U.S. have also arisen in southwest Washington. These local instantiations have been driven in part by the strong far-right presence in the region, led by extremist organizations like Patriot Prayer and the Proud Boys.

Given this sociopolitical context in which discussing seemingly innocuous topics can trigger significant repercussions, justice-centered teaching is a fraught endeavor that can pose risks to teachers' professional positions and personal safety. Support structures across multiple levels of the educational system are crucial for enabling educators to navigate these complexities and continue engaging in transformative action in their communities. This includes state-level policies and resolutions, resources for district and school leaders, and direct support for educators in responding within their specific local contexts. The Climate Justice League and other justice-focused professional development spaces like the 2021 climate change and COVID-19 workshop served as an infrastructure of reciprocal sharing and strategizing for teachers. Stacy described how educators actively sought out these opportunities:

> One of the things that I sense from the teachers who are involved is that they're people who care very deeply about issues of justice and want to feel supported engaging in that work in the classroom but don't always feel supported, whether that's from their colleagues, from their district — that that's not an assumption that of course you would have these kinds of conversations in the

> classroom, in the science classroom. And so, I often sense teachers are relieved and grateful to have a community to collaborate and share and talk about what that kind of learning looks like.

From her conversations with teachers, Stacy recognized that professional learning communities can provide collaboration and solidarity that they don't experience in their own school contexts. The explicit emphasis on justice is also uncommon in other professional development offerings, as Stacy reflected after the climate change and COVID-19 session:

> So many of the teachers said, "Can we continue to work together? Can we continue to do more of this with you?" Because they're not finding that in their professional learning networks anywhere else. So, there is something that's so critical about the teachers networking with one another, hearing about the kinds of work that they're engaged with, learning from one another.

For teachers in the CJL and other justice-centered learning spaces, these gatherings introduced them to like-minded colleagues who are similarly committed to liberatory changemaking. They were eager to build community and share ideas with their peers across the region and the state.

These forms of solidarity were especially evident among the teachers who participated in the 2019-20 CJL cohort and continued their engagement in 2020-21. The educators established strong working relationships during their shared learning activities in 2019-20. From the beginning of the project, the clear focus on critical consciousness and transformative action invited teachers into connecting with each other and with facilitators as co-conspirators. During the very first session in fall 2019, Olivia, one of the participating teachers, reflected that she frequently had these conversations with her friends over a glass of wine, but never in a professional setting. Opportunities to engage in open, honest dialogue about systemic injustices enabled teachers to build a community of support and cross-pollination. During our process interview, Stacy reflected on the effects of this intentional effort to cultivate a safe space to discuss difficult topics:

> I think that that created a pretty close-knit group of educators. It just, it felt powerful. I remember at the third session, where people were sharing, that people talked about things that they would

> not talk about in any other kind of professional development setting. They talked about struggles and issues they've been having in their own districts or buildings around trying to confront [...] institutionalized racism in their school and in their system, like recognizing that having a system that tracks students for AP classes from the beginning, they start at middle school, was not actually serving their students well, especially and specifically not their students of color. And so, we had teachers who would talk about, "These are things that I confront every day in the system where I work," and talk about that in a place where they felt they could voice these frustrations and get ideas about ways that they could challenge those assumptions, those protocols, those things that had been embedded in their system. I think that's because we spent time together in a room grappling with hard issues.

Stacy described how educators in the 2019-20 cohort used the CJL community as a space to receive and offer emotional affirmation, to deepen their sociopolitical analyses of their work contexts, and to co-generate strategies for confronting the inequities they witnessed. As demonstrated by the story that Stacy shared, these critical discussions moved beyond issues of climate justice into a larger constellation of interconnected concerns, including educational marginalization of global majority students.

In the following year, the teachers in the 2019-20 cohort were excited to continue connecting with each other, exchanging ideas and resources, and developing their personal and professional relationships. Several of the educators attended the optional Zoom check-in session in December 2020 and participated in the conversation with Gretchen Kraig-Turner. After the presentation, these teachers convened in a breakout room. They talked about their experiences facilitating lessons on controversial topics, how their positionalities influence their justice-centered efforts, and the need to disrupt dominant Euro-Western conceptions of science and decolonize science education. The educators discussed the backlash they received from families and communities and recounted strategies they used to navigate these responses. They also shared updates about how they were extending their CJL learning and other ways that they were taking transformative action in their schools and districts. At the end of the conversation, teachers

expressed their desire to stay in touch and said that reconvening with each other felt reinvigorating and grounding for their liberatory work. Olivia reflected that seeing her colleagues reaffirmed that "what we did last year was just the beginning" and "the wheels are back on the pavement."

Once the Storyline design group began meeting regularly, the six teachers in the group consistently engaged in the curriculum-writing sessions despite being overworked and juggling many responsibilities. Stacy reflected on educators' dedication to and appreciation of the group as a space that felt supportive:

> They have leadership roles in lots of different aspects of their professional world. These are the teachers that lead the Green Team and also lead the LGBTQ+ support group for students after school, and also… I know that many of these teachers are already taking on multiple roles in other forms. They're overworked, they're stressed, and they will show up to this group and say, "This is the only thing that I could imagine doing that's work-related right now that actually gives me a feeling of hope and relief and comfort." They show up also to be like, "Well, I can hang out and talk with you guys, this is a safe place, this is a place where I get rejuvenated."

At multiple points throughout spring 2021, members of the group mentioned that the time together was enjoyable, meaningful, and filled their cups. During the final session in June, Jessie shared that working and being with the group felt easy. Similarly, Leah said that she felt anxious attending most meetings but that the experience of collaborating with CJL colleagues was wonderful. These reflections indicate that teachers in the Storyline design group not only felt committed to the collective work but also found emotional sustenance in their relationships with peers.

Although Stacy, Meredith, and their collaborators did not specifically plan for the CJL and Storyline design team to become affinity group-like spaces, their design priorities enabled these forms of trust and solidarity to develop. Responsiveness to educators' needs over time provided opportunities for sustained relationship-building. Positioning teachers as experts within a shared leadership model scaffolded their deep respect for each other as knowledgeable peers and colleagues. Holding space for

educators to be vulnerable and talk about difficult topics like intersecting injustices built a foundation of love and support. These ways of partnering with teachers in shared professional learning align with the idea of role remediation by intentionally disrupting power dynamics between teachers and educational leaders, cultivating more expansive and sustaining forms of relationality, and becoming accountable to the emergent needs within the community rather than external obligations (Bang & Vossoughi, 2016).

Designing for relationality and role remediation in justice-focused professional learning in the CJL project also contributed to the strength of the experience as an example of critical professional development. Stacy and Meredith incorporated all four dimensions of critical professional development in the justice-focused professional learning community: cooperation through open and responsive dialogue; unity and solidarity in moving toward a shared purpose; organization of power-sharing structures that honor teacher agency and expertise; and "cultural synthesis" in which educators themselves identify, analyze, and take action to address issues occurring in their contexts (Kohli et al., 2015). By facilitating critical discourse and caring solidarity, the CJL positioned teachers as "agents of change, offering them the space and structure to develop as liberatory actors" (Kohli et al., 2015, p. 22). These forms of dialogical professional support — which center justice in both content and approach — stand in direct contrast with common models of professional training that deprofessionalize educators and fail to recognize their brilliance and power. Examining the underlying assumptions and radically transforming the design of professional learning experiences is necessary to sustain teachers in their efforts to work toward intersectional justice in their classrooms, schools, and communities.

Liberatory Action and Changemaking Within and Beyond the Classroom

In the previous sections of this chapter, I described how facilitators created the Climate Justice League to center the iterative design of critical learning experiences, prioritization of collaboration with community experts and leaders, and a relational stance toward partnering with teachers. These dimensions of the professional learning community supported educators in strengthening their political clarity and transformative agency through justice-focused learning, scaffolded praxis, and solidarity-building with

co-conspirators. Many of the teachers had already begun developing their critical consciousness and commitments to justice prior to the CJL and carried their personal and professional experiences into the shared sense-making. The CJL, as a space of role remediation and critical professional development, enabled educators to build upon, deepen, and broaden their existing knowledges and justice-centered practices. In this final section of the chapter, I share stories of how teachers who participated in the Climate Justice League engaged in expansive forms of liberatory work. These examples of changemaking included shifts in teachers' curricular content and pedagogical methods, but also extended beyond their classrooms into their schools, districts, and local communities.

Teachers in each cohort of the CJL designed and implemented science learning activities that addressed different aspects of environmental, climate, and social justice. Leah, an Indigenous educator, worked to incorporate traditional ecological knowledge and topics like first foods and growing patterns, fishing rights, and collective Indigenous-led resource management into her science classes. During the breakout room conversation in December 2020 with colleagues from her CJL cohort, Leah shared about the importance of decolonizing the institutions of science and science education by disrupting the normativity of dominant Euro-Western perspectives and making space for multiple knowledge systems. Leah was also considering pursuing a doctorate in a program focused specifically on weaving social, environmental, and climate justice connections into science education — an effort to continue her learning and grow her power as an agent of change. Other teachers in the 2019-20 cohort facilitated student investigations about the impacts of climate change on agriculture, water rights and access to clean water, media literacy and scientific misinformation, and energy justice and equity considerations in the transition to green energies. Given the current social controversies and right-wing backlash, discussing these justice-related issues in science classrooms was a salient expression of teachers' political clarity and a powerful form of political action.

In addition, teachers in the Climate Justice League practiced transformative agency through different ways of catalyzing systemic change in their local contexts. Their justice work demonstrated their

critical awareness of the interconnections between multiple structures of oppression that impact their students and their dedication to taking action not only as educators but as community organizers and leaders. In reflecting with Meredith about teachers' expansive engagement, Stacy shared:

> We saw a lot of teacher action that was not necessarily directly connected to the classroom. And that, I don't think, was something that we planned for, it was something that came about as a result of working with teachers and engaging in this kind of work, that's how I think about it. [...] Teachers are starting to take this learning and apply it in multiple contexts, not just in the classroom but also in other areas of their life, their professional life and otherwise.

In a separate conversation, Stacy described how "engaging teachers in this kind of learning is spurring teachers to take action." This reflects both dimensions of political clarity: understanding of how sociopolitical dynamics and intersectional injustices operate in their communities *and* a felt sense of responsibility to enact liberatory praxis within their various spheres of influence.

Educators' actions spanned different levels of the educational system and related social structures. Several teachers in the 2019-20 cohort cultivated supportive and sustaining spaces for youth in their schools, including a Green Team and an LGBTQ+ affinity group. Some spoke out in local and state-level public fora to advocate for justice and thriving in their communities, including giving public comment at school board meetings; communicating with news media about the far-right attacks against teachers and school districts; petitioning the county health commission to recognize racism as a public health issue; and testifying at legislative committees about their climate justice teaching experiences and the importance of justice-centered education and professional learning opportunities. The educators also participated in various forms of collective action and community activism. For example, several teachers served as representatives and held leadership positions in their unions, working on justice-centered efforts such as crafting anti-racism statements. Some created and facilitated equity committees to push for transformation within their schools and districts. Some also supported local organizing efforts by parents and community members to coordinate political initiatives and counter the right-wing influence over

educational discourse. By practicing these kinds of leadership, teachers sought to dismantle oppressive structures and address the complex interconnections between racial, educational, environmental and climate, and other forms of justice. These grassroots actions indicated educators' broad conceptualizations of their sociopolitical agency and responsibility in moving toward systemic change in their schools and communities. The range of activities demonstrated how teachers exercised their political clarity in creative ways based on their identities, experiences, strengths, and the contexts they live and work within.

These educators' justice-related pathways certainly began before they joined the CJL community. Many teachers were already actively practicing some of these forms of leadership prior to their involvement in the professional learning experience. However, the design and facilitation of the CJL provided space for teachers to extend their critical, intersectional analyses and their participation in community-engaged action. Stacy reflected on how the group's open-ended dialogue and far-reaching discussions of interrelated justice considerations may have contributed to teachers' political clarity:

> It's sort of like the work that we're doing, talking about justice issues and what that looks like in your classroom, and the focus on thinking not just about the content that you're teaching but also *how* you're teaching, makes it really easy for teachers then to connect to "Well, how else am I moving through this big educational system in which I work, what are other things that need to be dismantled in my building, in my school district, that are creating barriers for students, or for teachers…"

The multidimensional and multi-sectoral approach to justice work in the CJL supported teachers' expansive engagement as agents of change. The framing of multiple entry points into justice-centered teaching — through shared learning activities, collaborations with community experts, and scaffolded reflection on different aspects of their professional practice — encouraged educators to recognize and address the overlapping injustices that are built into educational and other social systems. In addition, the role remediation that emerged through Stacy, Meredith, and their collaborators' facilitation of the CJL positioned teachers as powerful intellectual, professional, and political leaders within the professional

learning community and beyond. These experiences may have contributed to educators' sense of individual and collective agency to shape educational systems, community discourse, policy, and other societal structures. In these ways, teachers in the CJL developed deep commitments to emancipatory changemaking in the spaces that they live and work within. These processes align with theories of transformative learning that focus on changes in self-understanding within social contexts through experiences of critical reflection, dialogue, emotional and spiritual growth, and sociopolitical agency (Blalock & Akehi, 2018; Merriam & Bierema, 2013; E. W. Taylor, 2008).

The journeys of teachers within CJL also parallel the spread of justice as a central force across different areas of Stacy's personal and professional life, as described in chapter 4. As liberatory praxis becomes a priority in one realm of activity, such as the incorporation of justice-centered phenomena in curriculum design, it naturally ripples out and touches other interrelated realms such as student-centered pedagogical approaches, amplification of marginalized knowledge systems, and community leadership and activism. More broadly, teachers' collective learning in the CJL resonates with the stories of educational leaders' justice-related learning pathways that were shared in the previous chapter. The Climate Justice League offered opportunities for educators to be exposed to new insights, localize justice considerations within their own communities, and deepen their felt relationalities and responsibilities. They developed more complex and intersectional understandings of systemic oppression and more just possibilities.

In the current sociopolitical context, these expansive forms of justice-centered practice and community action also made CJL teachers more vulnerable to right-wing aggression. In May 2021, several of the educators in the Storyline design group encountered an escalation in bigotry, discrimination, and personal attacks in their schools and districts. Olivia, who identifies as gay, had multiple students pulled out of her class by parents who did not want their children to be "exposed" to her. The administration at Olivia's school failed to address this and other examples of derogatory and dehumanizing behavior by students and parents. During the Storyline design meeting, Olivia shared that

teachers of color in her district had been quitting their positions due to the hostile working environment and lack of support from administrators. In addition to this targeting of educators with marginalized identities, there was an increase in right-wing activity at local schools in spring 2021. Patriot Prayer and other far-right activists attended several school board meetings and gave public commentary against "critical race theory" and COVID-19 policies. They held rallies and protests, sometimes on school grounds. They ran for school board positions despite their lack of experience with the educational system. They submitted public records requests against teachers and searched for evidence of "anti-White" content. In these ways, a few loud voices dominated public education discourse in southwest Washington throughout the spring.

During both of the Storyline design group gatherings in May, the meeting time was dedicated to addressing these emergent issues. Teachers reported developments from their local contexts, held space for each other's exhaustion and frustration, and offered emotional support and solidarity. Meredith reflected that "they're showing up at these meetings for that support explicitly, and even if they thought they were going to be doing something else, they really just need to talk about what's happening and hear from one another." In response to the sociopolitical climate impacting their personal and professional lives, the group shifted their focus for the time together from curriculum development to collective strategizing.

This use of the Storyline design sessions demonstrated how the flexible facilitation of the professional learning community created necessary space for the practice of solidarity, as described in the previous section. Olivia expressed gratitude to Stacy for the "time dedicated to having each other's back and hearing words of affirmation," and for "making this time and space in a scary world where the work we're doing in this group makes us all vulnerable." Others echoed this appreciation: Jessie shared that "it has been a rough year and month and we've got another month to go. Spending some time not shoving things under the rug is better for everyone's mental health." Isabella similarly said that "it's such a weight, and getting that off our chest and having support is great." The group became an ecosystem of support in

which educators could provide and receive care and love that sustained them through the difficulties of engaging in justice-centered work. Being present for each other was equally as important as their collaborative design work, if not more so. These community spaces are vital for strengthening teachers' individual and collective empowerment and transformative agency.

As these events unfolded, the educators and facilitators also worked as a group of trusted co-conspirators to organize efforts to resist far-right rhetoric and interlocking systems of oppression in their communities. Teachers shared useful knowledge and strategies drawn from their political-professional roles and responsibilities, including insights about union representation, legal and policy protections, public records requests, and public communication and media relations. For example, they mentioned highlighting how their justice-centered teaching is aligned with broadly accepted science education standards as a way to protect their classroom practices. Teachers discussed how foregrounding student voices at school board meetings can sway public opinion, and how intentional communication tools could be developed to facilitate more generative dialogue with families and communities. They offered insights into the public records request process and how specific stipulations within the policy could be used to protect educators who are doing justice-focused work. They described ways to connect with their local union representatives, leverage their existing union involvement, coordinate collective action across regional and state levels, and seek support from other institutions like the Office of Superintendent of Public Instruction. As these examples demonstrate, teachers' multiple engagements as liberatory changemakers enabled them to further expand their power when they convened. They cross-pollinated strategies and shared the expertise they developed through their activism in order to confront the challenges presented by opposing forces. In these ways, individual and collective empowerment emerged synergistically within the CJL as a space of learning, praxis, and solidarity.

Educators in the CJL received intellectual affirmation and emotional solidarity from their colleagues that supported their translation of critical consciousness into transformative action within their classrooms and beyond. They participated in sustained idea-sharing, relationship-building, and

collaboration within a trusting community of practice that strengthened their power as agents of change. This professional learning community was enabled by the structural and financial support of ClimeTime as a statewide initiative centering climate education and NGSS implementation. The powerful ways in which the CJL has emerged serve as an exemplar of how liberatory transformation of educational, social, and ecological systems can occur through intentional *infrastructuring* of professional supports (P. Bell, 2019). As we navigate sociopolitical upheaval, environmental precarity, and the climate crisis, developing and sustaining similar endeavors is necessary to scaffold educators' involvement in the urgent work of social changemaking. Educators are uniquely positioned not only to teach *about* intersecting justice concerns and thus activate and support young people, but also to participate directly *within* broader social movements. At the same time, teachers are also heavily impacted by the current realities of political extremism and right-wing backlash against equity and justice efforts in public education. Cultivating learning spaces for educators that are explicitly dedicated to critical professional development, political clarity, relationality and emotional sustenance, and collective empowerment is crucial for supporting teachers' engagement in joyful and emancipatory struggle toward more just and thriving futures.

CHAPTER 6: CONCLUDING THOUGHTS AND INVITATIONS

In this concluding section, I offer a synthesis of some salient themes that emerged across the previous four chapters and present design principles that may be of use in other educational contexts. The preceding chapters each focused primarily on one case study — the STEM Storylines in chapters 2 and 3, and the Climate Justice League in chapters 4 and 5. In this synthesis, I weave together threads across the two project spaces and highlight resonances in Stacy, Pranjali, and their collaborators' approaches to supporting intersectionally just and justice-centered teaching and learning. I then share design considerations for the creation of systemic infrastructure and cultivation of professional communities of practice like ClimeTime to support transformative sociopolitical and socio-ecological changemaking. I hope that these concluding thoughts, and the text more generally, can serve as an invitation into critical analyses and liberatory praxis in other settings.

Although I described their efforts separately in order to construct a clearer narrative about the two projects, Stacy and Pranjali conceptualize their work as collectively building *a holistic ecosystem of support for emancipatory forms of environmental and climate learning*. They do so through action at multiple levels, including the design of curricular and pedagogical supports and the facilitation of justice-focused professional learning spaces. Through Stacy and Pranjali's ongoing dialogue, strategizing, and collaboration, the two projects iteratively inform and strengthen each other. Their efforts are united by a common vision of moving toward intersectional social, environmental, and climate justice through science learning experiences for all learners that center *critical engagement with justice concerns and community-connected action*. The projects also both aim at a shared purpose of *honoring the lifeways, lived experiences, expertise, leadership, and thriving of global majority communities*. In these ways, although the implementation contexts differ, the case study projects are synergistically connected in contributing to systemic transformation.

The STEM Storylines and the Climate Justice League projects demonstrate possibilities for *recognizing and building upon the power, agency, and leadership of youth and educators*. For both

students and teachers, this involves disrupting inequitable power dynamics in our educational systems, challenging the deficit logic that shapes classroom learning, and dismantling interconnected systems of oppression that constrain their engagement in liberatory learning experiences. In the previous chapters, I focused on how the STEM Storylines support students' sociopolitical consciousness and transformative agency and how the Climate Justice League contributes to teachers' political clarity and expansive forms of community action. However, both projects move toward strengthening these dimensions as interconnected processes. For example, the open-ended and expansive design, content, pedagogies, and support structures of the STEM Storylines are an emancipatory counter-story not only against the forces restricting young people's learning but also against the tendency of educator deprofessionalization embodied in highly scripted, superficial, and "teacher-proof" curriculum materials. Although the Climate Justice League most directly engaged with teachers, the professional learning supported educators to explore multiple dimensions of intersectionally just and justice-centered pedagogical practices within and beyond their classrooms. These included critical shifts that resonate with those scaffolded in the STEM Storylines, including centering learning around justice-related phenomena, attending to student experiences and rethinking instructional practices, positioning learners as capable intellectuals and agents of change, facilitating community-connected learning and action, and representing global majority communities in just and dignified ways. Across both projects, Stacy, Pranjali, and their collaborators' approaches desettle expectations in science learning and create possibilities for re-positioning, role remediation, and reimagined praxis. Their efforts affirm the necessity of asset-focused teaching and learning practices that honor the brilliance and changemaking power of students, educators, and all other participants in communities of learning.

Stacy and Pranjali's shared vision also includes their understanding that *youth and educators enter learning encounters already holding these forms of expertise and power*. Rather than seeing their role as bestowing knowledge and agency, they work to leverage and amplify the existing capabilities of students and teachers through collective learning and shared leadership models. Through the STEM

Storylines and Climate Justice League, they support educators to facilitate collaborative meaning-making experiences that draw upon young people's socio-ecological knowledges and practices rooted in home, family, and community contexts. Emancipatory learning experiences deepen students' already-existing agency and ingenuity through meaningful opportunities to broaden their critical awareness, learn from community leaders and experts, and practice engaging as informed political actors. These principles are similarly evident in Stacy and Pranjali's relational approaches as educational leaders, especially their commitments to a humble, listening stance within sustained partnerships with teachers in the region. In chapter 5, I described in depth how the intentional design of the Climate Justice League emerged from and continuously evolved in response to educators' expressed needs, interests, challenges, and opportunities. Within the professional learning community itself, teachers were invited to share insights from their own practice and learn from their peers' experiences to strengthen their justice-centered pedagogies. Close relationships with teacher-leaders also shape the creation of STEM Storylines through co-design and iterative feedback processes. These collaborations enable Pranjali to refine the structure and content of Storylines over time in order to offer more usable and relevant resources capable of supporting sustainable change and liberatory practices. Across both projects, these strategies acknowledge that educators are experts of their professional contexts and must be engaged as authentic partners in transforming educational systems. Rather than top-down forms of leadership, Stacy and Pranjali enact relational changemaking and grounded solidarity with teachers.

These resonances across projects demonstrate how educational leaders can work across scales and levels of the educational system to nourish critical consciousness and justice-centered learning that moves toward intersectional justice. Radical shifts in educational and socio-ecological processes are possible through centering emancipatory changemaking as a focus of teaching and learning and working from a stance of just relationality with learners, educators, and communities. These case studies are an invitation to other educators and educational leaders to imagine and implement the profound, fundamental changes necessary to dismantle oppressive structures and build more caring and thriving futures.

For both educators and educational leaders, *learning spaces explicitly dedicated to sociopolitical learning and the development of political clarity are crucial* for transforming personal and professional practices. Across these chapters, I offered insights regarding educational leaders' processes of deepening their critical analyses and praxis through catalytic relationships, encounters, and experiences. These stories of their learning pathways can inform how we design and facilitate justice-focused learning communities. For example, the narratives shared in chapter 4 highlight the importance of intentional exposure to multiple perspectives and life experiences, opportunities to situate systemic injustices in localized and personally salient contexts, and engagement with the existing forms of relational responsibility that each of us carry. The experiences of educators in the Climate Justice League, described in chapter 5, indicate the power of holding space for challenging conversations that directly address justice concerns. Their active participation in the professional learning community also emphasizes the central role of cultivating collective relationality that is grounded in mutual trust, support, and emotional sustenance. These qualities can be leveraged in the creation or refinement of learning spaces that aim to nurture political clarity and community action.

The activities of the ClimeTime network more broadly also suggest design principles for similar efforts of *systems-level change and infrastructure-building*. As discussed in chapter 4, the clear focus on equity and justice in the framing of the network allowed for intentional justice-related conversations and shared learning over the years of the proviso. These stated commitments and associated learning opportunities supported the emergence of creative justice-focused projects and the expansion of these projects across the state. In addition, deliberately prioritizing relationship-building, collaboration, and cross-pollination among partners working across different institutional contexts contributed to the development and spread of justice-centered innovations. These sharing practices also created openings for engagement with problems and opportunities of practice relevant to participants' ongoing work — for example, the critical dialogue about developmental appropriateness described in chapter 2. The rich, multidimensional stories of educational leaders in the network, as shared in chapter 4, also indicate the

potential of lifting up individuals' personal experiences and expertise through storytelling and other protocols to support collective justice-related sense-making. Building communities of practice like ClimeTime, in which educational leaders can broaden and deepen their political clarity and build connective tissue with co-conspirators, is critically important for moving toward intersectionally just and justice-centered learning at a systems level. These interwoven narratives from the ClimeTime network reveal how the creation and strengthening of emancipatory educational innovations are possible within broad-scale implementation initiatives and emphasize the need for sustained policy, funding, and other infrastructural supports to cultivate these catalytic spaces. I hope these stories can offer insights to leaders and decision-makers in other regions who are nurturing similar ecosystems of environmental and climate learning — and that their efforts can reciprocally inform continued work in Washington State.

In offering these high-level implications and principles, I invite all who are invested in educational, sociopolitical, environmental, and climate justice to consider what expansive and liberatory praxis can mean in your own worlds. The design of learning spaces and processes will of course be attuned to local opportunities, concerns, priorities, and possibilities, and cannot be neatly transplanted across contexts. However, I hope that you are able to find resonances and critical inspiration that can serve as seeds for your own lifelong engagement in systemic transformation toward just and thriving socio-ecological futures.

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Appendix A

Protocol for First Phenomenological Interview: Reflecting on the Past
(italics indicate additional optional probe)

The first interview will focus on your pathway into climate education; your evolving definitions of social, educational, and environmental and climate justice; and your experiences with relationship-building and shared learning related to climate education. In preparation for this first conversation, please select and bring **an artifact that connects with an important learning moment for you with regard to justice-centered climate education**. Artifacts could include presentation slides, photographs, video clips, physical objects, journal reflections, etc. The artifact could come from your ClimeTime project(s), or from other environmental and climate activities that you are involved with. Please choose an artifact and learning moment from the last 2-3 years, if possible.

Personal understandings re: social justice and educational justice

1. How would you currently describe or define social justice?
2. Have your definitions of social justice evolved over the last several years? How so?
3. What experiences have shaped your evolving understandings of social justice?
4. Do you see ideas of social justice connecting with your work as an educator? How so?
    a. *How would you describe or define educational justice?*
    b. *What does it mean to engage in justice-centered teaching and learning?*
    c. *Can you think of an example of a time that you experienced or were a part of a justice-centered learning experience?*
    d. *How have the experiences of students and families come into your thinking about justice-centered learning?*

Personal understandings re: environmental and climate justice

5. How would you currently describe or define environmental and climate justice?
6. How did you begin to integrate issues of the environment and climate with issues of justice?
    a. *How have the experiences of those most impacted by climate change informed your framing or your practices related to climate justice?*
7. Do you see ideas of environmental and climate justice connecting with your work as an educator? How so?
    a. *Do you believe that justice is an integral value for climate education? Why/why not?*
    b. *What does it mean to engage in justice-centered climate teaching and learning?*
    c. *Can you think of an example of a time that you experienced or were a part of a justice-centered climate learning experience?*
    d. *Can you share an example of how you are currently enacting these understandings of environmental and climate justice in your ClimeTime project(s)?*

Recent learning processes outside of ClimeTime

8. Have your personal definitions of environmental and climate justice evolved over the last several years? How so?
9. Before you became a part of the ClimeTime network, which individuals, communities, and/or organizations most informed your thinking about environmental and climate justice?

10. Before you became a part of the ClimeTime network, what were some of the important experiences that shaped your thinking about environmental and climate justice?

Recent learning processes within ClimeTime

11. Since you started participating in the ClimeTime network, which individuals, communities, and/or organizations have most informed your thinking about environmental and climate justice? These could be folks you know through ClimeTime or from other spaces.
    a. *Who do you look to to build and inform your thinking and practice around how to teach about climate change?*
    b. *Who do you look to to learn about justice related practices?*
    c. *Can you share a specific example of how you are personally learning from/with other members of the ClimeTime network with regard to environmental and climate justice?*
12. Since you started participating in the ClimeTime network, what were some of the important experiences that have shaped your evolving understandings of environmental and/or climate justice? These could be experiences within ClimeTime or in other spaces.
    a. *What tools and resources have helped move your practice?*
    b. *In thinking about learning activities within ClimeTime, which ones have made a difference in shifting your practices? How?*
    c. *Describe in more detail a recent shared learning experience that transformed your understanding of justice-centered climate education. Who was in the room? How was the learning facilitated?*
13. I invited you to bring an artifact that connects with an important learning moment for you with regard to justice and climate. Were you able to bring something? If not, can you think of anything you'd be willing to share now?
    a. Can you describe this artifact? What does this artifact show? What is the learning moment that this artifact comes from?
    b. Why did you choose this artifact? Why is it important for you?
    c. How would you describe your big takeaways from this learning moment? How did this learning moment change your thinking about climate learning and/or justice?
14. *Given what you have shared about your recent learning with regard to environmental and climate justice, how are these learnings reflected in the project work you are involved with in your organization?*
    a. *How do you approach your work as an educator differently based on your evolving understandings of environmental and climate justice? Can you share some specific examples?*
15. *How have your organization's practices and processes shifted in recent years based on learning from/with members of the ClimeTime network with regard to climate justice?*
    a. *Can you share a specific example?*

Wrapping up

16. Is there anything else you would like to share with me?
17. Is there anything you'd like to ask me?

Appendix B

Protocol for Second Phenomenological Interview: Describing the Present
(italics indicate additional optional probe)

The second interview will focus on the current climate education related work that you do. In preparation for this conversation, please select and bring **an artifact that represents your current educational practices and project work** (e.g., documentation of a design process, meeting notes, brainstorming document, curricular or instructional resource, slides from a recent PD, etc.). In particular, if you have an artifact that relates to **your or your organization's current thinking about equity and justice**, please bring that. The artifact should come from your work on ClimeTime project(s), if possible.

Justice-centered practices in your current work

1. In your current climate education related work, how are you *personally* trying to address justice and equity?
    a. *Has this shifted since we last spoke?*
    b. *Please describe how your involvement with a current project centers social, educational, and/or environmental and climate justice.*
    c. *What challenges or needs have you identified that are shaping your justice-related climate work?*
    d. *What are your personal practices and/or processes to make sure that you are centering justice and equity within your climate education work? How do you hold yourself accountable?*
2. What are some of the tools and resources that you find particularly helpful for centering justice in your current climate education work and supporting climate justice learning?
3. Are you encountering any tensions or challenges in your current efforts to address justice and equity in climate education work? If so, what? How have you tried to address these challenges?
4. How does your *organization* currently work to center justice and equity in climate education related efforts? Is this similar or different to how you personally work to address justice and equity?
    a. *What practices and forms of accountability does your organization use to ensure that efforts are aligned with justice and equity commitments?*
5. Is your organization encountering any tensions or challenges in current efforts to address justice and equity in climate education work? If so, what? How have you tried to address these challenges?
6. Do you see any opportunities for justice-related work in your own or your organization's current climate education efforts that aren't yet being enacted? If so, what? Why do you think these opportunities aren't being fulfilled?
7. Beyond your own work, in what ways do you currently see ideas and practices related to justice integrated into climate education?
    a. *What are some examples of this within the ClimeTime network that come to mind?*
    b. *What are some examples you are aware of in the field more broadly?*
    c. *Are there specific examples of justice-centered climate learning for young learners that you can think of?*

8. I invited you to bring an artifact that connects with your current educational practices and project work, especially related to justice and equity. Were you able to prepare something? If not, is there an artifact that comes to mind that you'd be willing to talk about?
    a. Can you describe this artifact? What is the context of the project that this artifact comes from?
    b. What does this artifact show? How is this artifact related to your current educational practices and project work and/or your thinking about justice and equity?
    c. Why did you choose this artifact? Why is it important for you?
    d. Is there anything else you want to share about this artifact that might not be immediately visible?
    e. Is there anything you would want to change about this artifact and/or the project it is connected with? If so, what?

Collaborative learning and design processes in your current work

9. Are your experiences of relationship-building and shared learning within the ClimeTime network influencing a current climate education project you are involved with? How so? This could be a project within ClimeTime or a separate project.
    a. *Please share an example of how these experiences shape your day-to-day activities as an educator within this project.*
10. Given your experience in building relationships with learning partners (e.g., educators, families, community members and experts, professional scientists, etc.), have you made changes to your approaches to designing learning experiences and educational systems?
    a. *Please share an example of how these experiences shape your day-to-day activities as an educator.*
    b. *Have you encountered any challenges in your efforts to build relationships with learning partners? If so, what? How have you tried to address these challenges?*
    c. *Do you work to engage the voices of those most impacted by climate change in your planning and programming? If so, how?*
    d. *Do you engage with local communities in your current ClimeTime work? If so, how? How do you ensure that the project work meets their needs and interests?*
11. Are you working to build a community of learners in your region or sphere of influence through your ClimeTime work? If so, how are you approaching this?
    a. *Do you take steps to promote shared learning through your ClimeTime projects? If so, how?*
    b. *Have you encountered any challenges in building a community of learners? If so, what? How have you tried to address these challenges?*

Climate learning for early childhood and elementary years in your current work

12. In your current work, are you supporting climate learning for early learners and elementary students? If so, how are you approaching climate learning for early learners and elementary students? What is your rationale for these approaches?
    a. *How does/can climate science learning align with early childhood learning and development?*
    b. *What do you think is appropriate and/or important to share with young learners about*

climate science?

   c. *How can we ensure that youth have positive experiences with climate science learning, as opposed to feeling scared and overwhelmed? How can we help families understand the importance of this framing?*

13. What methods of engagement allow young learners to express and build their ideas?
    a. *How can we invite young children into climate science learning in ways that are relevant to their lives?*
    b. *How can we sustain and support that engagement as learners progress through PK-5?*
    c. *What approaches don't work so well with young learners?*
14. Are you evaluating the learning and engagement of young learners within your climate education project(s)? If so, how?
    a. *What methods or processes are you using to ensure that climate science learning within your ClimeTime project is developmentally appropriate for young learners?*
15. Do you engage with early childhood and elementary educators within your climate education project(s)? If so, how do you think about these relationships?

Wrapping up

16. Is there anything else you'd like to share with me?
17. Is there anything you'd like to ask me?

Appendix C

Protocol for Third Phenomenological Interview: Dreaming the Future
(italics indicate additional optional probe)

The third interview will focus on your visions for justice-centered climate learning, including your own personal and professional aspirations as well as your hopes for your organization and the field more broadly. In preparation for this conversation, please select and bring **an artifact that brings you hope and inspiration for the future of climate learning or represents something you would like to see in the future of climate learning**. The artifact could be related to your ClimeTime project(s) or from other environmental and climate activities that you are involved with.

Supporting justice-centered environmental and climate learning

1. When you imagine a young learner who has engaged in sustained justice-centered climate learning, what characteristics do you imagine?
    a. *Are there any particular students you can think of who've engaged in ClimeTime projects who have started to develop these characteristics? Can you tell me about them?*
    b. *What teaching and learning practices need to continue or be introduced to make this possible?*
    c. *Are there unique challenges for engaging with young learners around climate topics? What is needed to address these challenges?*
    d. *Are there unique opportunities for engaging with young learners around climate topics? How can we leverage these opportunities? What are some ways we can support PK-5 students' engagement with climate science topics?*
2. From your understanding, to what extent do youth have access to meaningful outdoor learning experiences (in your region, Washington State, or beyond)?
    a. *What supports enable youth to access meaningful outdoor learning opportunities?*
    b. *What barriers are preventing youth from having meaningful outdoor learning experiences as an essential part of their PK-12 learning?*
    c. *What do educators, administrators, and policymakers need to do to build equitable access to meaningful outdoor learning experiences?*
3. How can we continue supporting justice-centered environmental and climate learning on a systemic level (in your region, Washington State, or beyond)?
    a. *How does/can justice-centered environmental and climate learning fit within the formal school system?*
    b. *How might this work take place beyond the formal school system?*
    c. *What processes and structures at different levels of the educational system are needed to support justice-centered environmental and climate learning?*
4. When you think about the future of climate learning (in your region, Washington State, or beyond), what concerns do you have? Why?
5. When you think about the future of climate learning, what do you feel excited about? Why?
6. I invited you to bring an artifact that brings you hope and inspiration for the future of climate learning or represents something you would like to see in the future of climate learning. Were you able to prepare something? If not, is there an artifact that comes to mind that you'd be willing to talk about?

   a. *Can you describe this artifact? What does this artifact show?*
   b. *Why did you choose this artifact? Why is it important for you? How is this artifact related to your hopes and visions for justice-centered climate learning?*
   c. *Is there anything else you want to share about this artifact that might not be immediately visible?*

Relationship-building and shared learning

7. Given your experiences of relationship-building and shared learning within the ClimeTime network, what are some of the important characteristics of a professional community of practice for climate education?
   a. *If you were to design a professional network to support climate learning, what structures, processes, and practices would you prioritize?*
   b. *What has been the most valuable aspect for you of being involved with the ClimeTime network?*
   c. *What have you found challenging or concerning about being involved with the ClimeTime network? How could a professional community of practice address these challenges and concerns?*
8. In your experience in building co-design relationships, what challenges have you faced? How have you worked to address these challenges? Given these experiences, what suggestions would you give to future projects that center collaborative work?
9. Who do you think should be at the table in discussions about how youth can engage in justice-centered environmental and climate learning?
   a. *Who should be involved in asking questions and setting priorities?*
   b. *How can climate justice work emerge authentically from the communities involved?*
   c. *Whose visions and perspectives do you think are missing from your ClimeTime work? What is needed to invite these voices?*

Learning edges and hopes for the future

10. When you consider your own work regarding justice-centered climate learning, what do you see as some of your learning edges?
    a. *What would you like to learn more about? How do you hope to build on your current understandings? How do you hope to strengthen your practices?*
11. How do you imagine your roles within environmental and climate education shifting in the next five years? Ten years?
12. When you consider your *organization's* work regarding justice-centered climate learning, what do you see as some possible learning edges?
    a. *How would you want to strengthen your organization's justice-related practices?*
13. What do you think is the role of an educational organization like yours in advancing environmental and climate justice? How would you describe the current role your organization plays? What role(s) do you hope it will play in the future?
    a. *How do you imagine that environmental and climate education can interact with social, environmental, and climate justice movements?*
    b. *How do the experiences of students, families, and local communities impacted by climate change shape your vision for justice-centered climate learning?*

c. *How can your organization support and engage with learners, families, educators, and educational leaders in these learning processes?*

Wrapping up

14. Is there anything else you'd like to share with me?
15. Is there anything you'd like to ask me?