Activism or Bureaucracy: What Are We Teaching Students Through Local Climate Action Projects?

Helen L Fitzmaurice, University of California Berkeley, hfitzmaurice@berkeley.edu
Michelle H Wilkerson, University of California Berkeley, mwilkers@berkeley.edu

Abstract: Advancing student empowerment through climate action projects in K-12 classrooms is an often-cited goal in the climate change education community, specifically to ameliorate the mental health challenges experienced by K-12 students in association with climate change. Less discussed, however, are the *orientations-of-action (1)* that manifest in classroom activity in the context of such projects: the extent to which classroom activity is oriented more towards critically questioning and reimagining systems (activism) or more towards working within the context of existing systems (bureaucracy). Here, we discuss *orientations-of-action* within classroom projects in the context of a professional development program around justice-centered climate change pedagogy in an urban school setting. In the context of teacher accounts of classroom activity, we define an orientations-of-action rubric and observe a progression towards bureaucratic orientations-of-action through different elements of classroom projects. Through two focal projects we explore this progression, as well as teacher intentionality with respect to orientations-of-action.

Introduction:

Climate change has significant impacts on K-12 students' physical well-being and mental health (Dooley et al, 2021). Schools' general functioning are also affected by the crisis, as in California where districts now routinely build "smoke day" cancellations into their calendar year in response to poor air quality caused by wildfires. In response, state standards (e.g., NATIONAL RESEARCH COUNCIL, 2013) and curriculum projects (e.g. Ten Strands, 2022) are increasingly addressing climate change in K-12 curriculum and content designs. Amidst this work, recent research and curricular development has focused on justice-centered approaches to addressing the climate crisis in formal classroom contexts (e.g., Damico et al., 2020, Segura et al., 2021, Reigh et. al, 2022, Bradford et. al, 2023). But the magnitude of the problems that arise from climate change, and particularly its disproportionate impacts on frontline and Indigenous communities and communities of color, can be discouraging for students: a survey of more than 1000 youth across the U.S. found that ~75% of Generation Z report that climate change has a negative impact on their mental health (Dooley et. al, 2021).

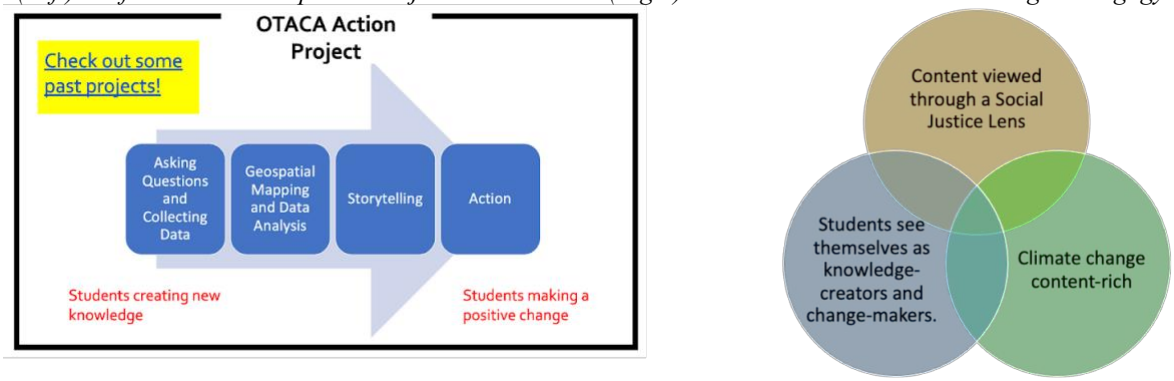
Scholars, curriculum developers, and teachers working to bring climate change teaching into classrooms are concerned about the impact climate change and environmental justice has on student mental health. For example, Bradford et al. (2023) reported teacher concern about the emotions introduced when students impacted by environmental racism are asked to think about and discuss the racialized causes and impacts of environmental injustice. Many scholars and practitioners (e.g. Rousell & Cutter-Mackenzie Knowles, 2020) point to student action as a way to support students experiencing climate change related trauma. But what forms that action can take, teachers' motives or reasons for choosing a form of action, and most importantly the impacts that different forms of student action have on students' theories of change, self-perception as changemakers, and mental health, remain unexplored.

In this paper, we embark on the *first part* of such an exploration, in the context of a teacher professional development program designed to support teachers to engage students in projects culminating in local climate action. We do this by addressing the first of the questions posed above: What forms can local climate action projects take? More specifically, we ask what it looks like for classroom project activities to assume an activist- or bureaucratic- orientation. We begin by clarifying what we mean by activist- and bureaucratic- *orientations-of-action* in the context of climate action projects through the development of a rubric across three stages of a classroom action project (See Table 1). We then use teacher accounts of classroom activity to take a birds' eye view of manifestations of *orientations-of-action* across a number of classroom projects. Through this birds' eye view, we observe a progression towards bureaucracy within many of the projects, which we illustrate through the narration of two focal projects. We also gain some insights into teachers' intentionality and confidence around creating learning activities oriented in one direction or another. In our discussion, we conclude by hypothesizing the ways we might use the rubric we have developed here to (1) support teachers in clarifying their intentions, plans, and in-the-moment teaching with respect to orientations-of-action in the context of climate and (2) investigate the ways that activist- and bureaucratic- orientations of action mediate student experience.

Context

We explore the phenomenon of student-action project typology, which we call orientations-of-action, in the context of a professional development program (Barton & Fitzmaurice, 2022) aimed at supporting teachers in implementing an action-oriented, justice-centered climate change curriculum in an urban school district. The Oakland Teachers Advancing Climate Action (OTACA) program, founded by teachers who share an interest and common experiences in activism, aims to support teachers in implementing student-led climate change action projects through the professional development project framework (Figure 1, left). Participation in OTACA is open to teachers of all grade levels and subjects K-12. In the 2023-2023 school year, 40% of participants taught elementary, 14% taught middle, and 46% high school. Although high school teacher participation was majority science teacher, the cohort also included several English teachers, an art teacher, a physical education teacher, and a social studies teacher. Teachers committing to the program for the year develop and implement a student action project in their classroom, and receive support through workshops crafted around the project framework, professional learning committees, and one-on-one check-ins. In addition to the project framework, teachers are asked to build projects around the idea of justice-centered climate change pedagogy (JCCCP) (Figure 1, right), which we describe in more detail in our theoretical framework.

Figure 1:
(Left) Professional Development Project Framework. (Right) Justice-Centered Climate Change Pedagogy*



* *Image taken from professional development workshop slides.*

One of the authors of this paper (Fitzmaurice) has been engaged since 2020 in facilitating OTACA and since 2016 in organizing with a subset of the teachers who founded the program. She meets weekly with the teachers on the planning committee, write grants to support the continuation of the program, engage in one-on-one to brainstorm with participating teachers and connect them with resources, and play a key role in organizing and facilitating program workshops. The work analyzed in this paper refers to projects implemented by participating teachers in the 2022-2023 school year.

Theoretical framework

In our introduction, we motivated the need to clarify and critically examine the orientations-of-action that students engage within the context of climate action projects. There are many dimensions we could choose to examine with respect to climate action project typologies (e.g., mitigation v. adaptation v. healing, scale of change). However, we choose to examine orientations-of-action along a spectrum of activist to bureaucratic, because the power structures associated with systems of oppression (e.g. racism, colonialism, capitalism, genocide) are both implicated in and lead to inequities in harm associated with climate change (e.g., Tessum, 2021; UN, 2019). Below we explain what we mean by activist- and bureaucratic- orientations. We then elaborate on how we think about the importance of examining this dimension specifically, in the context of the professional development described above and in the context of critical pedagogies which have motivated the framing of that professional development ,and discuss why such a framing is especially important in the context of climate change.

Although scholars in the learning sciences (e.g. Pham and Philip, 2021), science education (e.g., Morales-Doyle & Frausto, 2021) and in education policy (e.g., Ferman, 2020; Renée, 2011) have enumerated types of activist activity with great nuance, for the purposes of this paper, we start with relatively broad characterizations of activist and bureaucratic orientations. We do this to facilitate a birds-eye-view approach in this study, to gain a view of the broad forms these orientations take through classroom activity. Our understandings of activist and bureaucratic orientations stem from their facing towards existing power structures. By power structures, we mean

both large scale systems of oppression (e.g. racism, colonialism, capitalism, genocide), but also local holders of power (e.g. a school district's facilities department, PTAs) influenced by the larger-scale systems of oppression (e.g., racially disparate funding in public schools), and epistemic systems that have been traditionally wielded by systems of oppression (e.g. STEM analysis positioned as *devoid of* social context). Then, in the context the teacher accounts of classroom activity analyzed by this study, by activist-oriented activity we mean activity that supports students in reimagining existing power structures (e.g. Girroux & McClaren, 1988) and by bureaucratic-oriented activity, we mean activity that engages students in leveraging existing power structures.

The program we describe in the context section, operates from the assumption that climate change and environmental education must be justice-centered and works to support teachers in bringing such pedagogy into their classrooms through student research and action projects through JCCCP. JCCCP (Fitzmaurice & Barton, *accepted*), following Morales-Doyle's (2017) Justice-Centered Science Pedagogy, is defined by three elements: 1. Climate change phenomena are viewed through a social justice lens, 2. Instruction is intellectually rigorous, directly engaging students' lived experiences and supporting their learning of climate change content, and 3. Students grow in their self-perception as knowledge-creators and change-makers.

Furthermore, JCCCP necessitates critically interrogating environmental racism in social and structural context by both teachers and students. This stance is rooted in a long tradition of critical education and not novel to JCCCP. For example, Giroux &McLaren (1988) call for educators "*assume the role of transformative intellectuals treat students as critical agents, question how knowledge is produced and distributed, utilize dialogue, and make knowledge meaningful, critical, and ultimately emancipatory"* and Youth Participatory Action Research (Cammarota & Fine, 2008) and Youth Participatory Science (Morales-Doyle & Frausto, 2021) both position youth as knowledge-creators and change-makers.

Even without considering the catastrophic circumstances of climate change, both JCCCP and the tradition of critical education JCCCP follows, call for pedagogy that is activist-oriented in contrast to more bureaucratic and normative forms of education. For example, Cheuk & Morales-Doyle (2022) call out the role that traditional science education plays in filling the capitalist and the United States' military industrial complex workforce. But the need for a pedagogy that supports students in reimagining and understanding that they can make an impact on the existing power structures in which they exist is especially compelling in the context of climate change. To avert climate disaster and heal ourselves, each other, and our planet, we will all need to collectively rethink the power structures responsible for climate injustice and ecological crisis.

Methodology and data

The data for this paper came from teacher participants in the 2022-2023 school year who implemented some type of project in their classrooms. 35 teachers participated in OTACA that year, nine of whom participated in semi-structured interviews. Of the teachers interviewed, five were high school science teachers, two were middle school teachers, and two were elementary school teachers. Although all but one of the teachers interviewed were from the same school district, the racial demographics and socio-economic status of students at those schools varied greatly. For example, one middle school teacher taught at a school where only 13.8% of students were African American or Latinx and only 9% were eligible for free or reduced-price lunch, while one of the high school teachers taught at an Alternative Education High School where 91% of students were eligible for free or reduced price lunch and 96% were Black or Latinx. During these interviews, teachers were asked to reflect on the projects they implemented in their classrooms, as well as their own experiences in "taking action" related to either climate change or other social justice issues. We used these interviews, as well as teachers' end of year presentations to code student action project elements (project framing, analysis, action skills employed) as either activist, bureaucratic, or containing both activist and bureaucratic elements, using the rubric shown in Tbl 1.

The project elements in this rubric are based on the project framework (Figure 1) as posed to teachers, but we collapse the "storytelling" and "taking action" elements into one category, because for many student action projects, *public storytelling* (whether students were approaching customers at a local supermarket about the refrigerants being used or showing a documentary they made to their parents at a public showing) was the culminating action of the project. For each project described either in an interview or via teachers' final projects, we coded project elements as being of activist-orientation, bureaucratic-orientation, or being simultaneously activist- and bureaucratically- oriented. Sometimes, project elements did not seem to fit into any of the defined categories. For example, one elementary teacher working with 5th graders framed the project as a "gift" they could give their school, from which they would not benefit, since they would be leaving for another school as 6th graders. We did not code these elements.

In addition to coding project elements, we also coded the following related to teachers' comments related to activist- or bureaucratic-orientations of action: actions teachers took outside of teaching, confidence in their ability to enact or teach actions of activist- or bureaucratic- orientations, and the importance of teaching such

orientations to students. Finally, in discussing teacher interviews, we retain the gender signifier used by the teacher (Mx., Ms., Mr.) and assign them a randomly generated letter for their last name.

Table 1:
Rubric of Activist and Bureaucratic Orientations*

	Activist	**Both Activist and Bureaucratic Orientation**	**Bureaucratic**
Project Framing *(Asking Questions and Collecting Data)*	**Students are encouraged to reimagine a system to change current circumstances.** *An art teacher introduces students to the history of a local activist group that fights against the transport of coal through their city along with the history of art's use in protest.*	**Students are encouraged to reimagine a system but are also reminded of ways in which they can access levers of power within existing systems.** *Projects are framed around the needs of community members, termed "clients". All classroom activity is led by students.*	**Students are encouraged to reimagine a circumstance but are asked to work within the current system to impact that circumstance.** *5th grade teacher explains that she will submit a site plan to the grounds and maintenance department in order to add trees and that students' job is to help devise that plan.*
Student Analysis	**Students are encouraged to <u>critically</u> explore the historical and current systems that lead to a situation.** *Middle school students interview school district officials about district waste practices. When district officials decline to tell students how much the district is being fined for improper waste sorting, students highlight this lack of transparency in a documentary that they make and showcase to their parents.*	**Students are encouraged to <u>both</u> critically explore a system and to learn about the hierarchy they will need to navigate to make change through the intended channels within existing systems.** *HS Physics students use historical redlining maps and current maps of gentrification index to discuss relationships between historical racism, current displacement, and green housing elements, using an ArcGIS tool. During this process, the teacher continuously reminds students that ArcGIS and map analysis are both skills they can put on their resumes and use to get internships and to stand out when they apply to college.*	**Students engage in logistical analysis of current circumstances and learn about the hierarchy they will need to navigate to make change through the intended channels within existing systems.** *Students map their school's campus to explore tree / shade opportunities that they will recommend to the district facilities and maintenance department.*
Action Skills Used or Developed	**Students gain practice in skills that may lead to reimagining or altering existing systems.**	**Students gain practice both in skills that may lead to reimagining or altering existing systems *and* gain practice in asking permission to make**	**Students gain practice in asking permission to make change through the proper or systemic channels.**

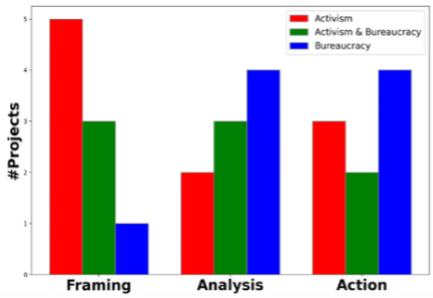
Students petition and meet with school board members, give public comments, and attend school board meetings to urge the school district to adopt a "Climate Literacy" resolution.	**change through the proper channels.** *Students engage in power mapping strategies and organize turnout at a community meeting around local air quality issues, but all planning and student action is determined by student "project managers."*	*Students fill out the proper paperwork to propose tree planting sites on their school's campus and submit their proposals to the district's maintenance office.*

***Characterization criteria is in bold**. *Examples are italicized.*

Findings

In all, we characterized the typology of projects occurring in nine classrooms, implemented by participating teachers through the 2023-2024 school year (*Figure 2, left)*. Through each project element (and in most cases within individual projects), we observed a wide range in orientations of action. From this small sample size, we see that the majority of teachers interviewed (5/9) started by framing projects to students in an activism-oriented manner. Notably, although only one of nine projects was framed using *only* a bureaucratic orientation, meaning that all but one projects asked students to imagine changes to current systems, four of nine projects engaged students in only bureaucratically-oriented analysis or action, meaning that students engaged in these projects gained practical action skill *only* in making changes as allowed by the rules and structures of current systems. Within individual projects, we observed a shift in activist-oriented framings to bureaucratic-oriented action, but not vice versa. No projects framed using a bureaucratic-orientation or both a bureaucratic- and activist-orientation resulted in exclusively activist-oriented action. Teacher interviews also revealed teachers' intentionality and motivations around orientations-of-action in their projects.

Figure 2:
(Left) Summary of All Projects. (Right) Focal Projects



	Activist-Oriented	Activist-Oriented and Bureaucracy-Oriented	Bureaucracy-Oriented
Framing	🎓		🌳
Analysis	🎓	🌳	
Action			🎓 🌳

** (Left) Portion of each project element described in teacher interviews and presentations characterized as having activist, bureaucratic, or both activist and bureaucratic qualities. (Right) Typologies of project elements of the two focal projects. The graduation cap represents Ms. L's class project in her senior capstone class. The tree represents Ms. C's class project.*

In the subsections below, we illustrate both a progression towards bureaucracy and teacher intentionality through the discussion of two focal projects (Figure 2, right). Through project A, implemented by Ms. L in her senior capstone class, we illustrate an example of a shift from activist to bureaucratic framing over the course of a project, and highlight the barriers she cites to following through with her activist-oriented intentions. Through project B, centered around adding trees to the play area of an elementary school, was implemented by Ms. C, an elementary school technology teacher with her 5th grade students, we highlight a substantially different path and intention: a teacher who is intentionally engaging students in bureaucracy, because it is the best way she knows to affect change at her school site.

Project A: Activist framing → bureaucratic action

This shift, from activist framing to bureaucratic action was illustrated in the context of project A in Ms. L's senior capstone class. In this project, students were tasked with undertaking a project that would investigate and

implement change around an environmental justice issue impacting their school community. Ms. L explicitly taught her students to use critical lenses around structural racism to analyze the topics that they researched, through model lessons around power dynamics and intersectionality. In the end, all groups of students took concrete actions around the topics of their research, but most of the projects engaged students in bureaucratic actions (e.g., learning to write professional emails, asking permission from the principal to place plants or food carts in a particular place around campus and amending plans when permission was not granted). Ms. L reflected that she wished she was able to engage students in using more critical (activist-oriented) lenses in their projects due to the constraints of the school year and her own self-perception as a change agents, saying that she wanted "there to be a colonialism, a capitalism aspect that just feels so hard to fit into a year when, when it already feels like such a packed project."

Outside of the student projects she implemented, Ms. L brought her students to several climate marches and environmental justice protests throughout the year. Despite her aspirations towards engaging students in what we define as activism-oriented action, and her engagement of students in activism-oriented action outside of their project, Ms. L expressed low confidence in her own efficacy and experience as a change-maker, saying "I think that is something I feel a little bit like an imposter, teaching something like this." Although Ms. L goes on to list various ways in which she has engaged in activism for social change via protest, union organizing, and holding restorative justice circles, she feels inadequate, because she has not "been on the frontlines of organizing, I think. … I haven't spearheaded a lot of like … movement- based things." Ms L. clarifies further: "like, coalition building is real. And I believe … I do believe that climate change is not an inherently unsolvable problem. And I think that is the driving force behind a lot of the curriculum that I tried to build around climate change. So I think like, theoretically, belief-wise, I do believe in the things I am teaching [...] but in practice, I've never … I didn't like work for, like Sunrise movement before coming here." Here we hear Ms. L saying that although believes it *important* to engage her students in applying critical lenses and activist-oriented action skills, she feels uncomfortable doing so, in part because she has never been a *leader* in activist-oriented activities, especially activities related to climate justice.

Project B: Tree planting as an intentional exercise in bureaucracy

In contrast with Project A, which was framed with an activist-orientation, Project B was framed to students in a bureaucratic manner from the start: students were asked to reimagine a *situation*, but within the parameters dictated by the system that had created the situation. The situation students were asked to reimagine involved something tangible and related to student experience: trees and shade. Like most elementary schools in the district where we work, the play area of Ms. C's elementary school is completely devoid of shade, leading to uncomfortable (and dangerous) recess conditions on hot days. Furthermore, an empty lot next to the school that had been covered by mature trees, (that the class later discovered was owned by the school district) was clear cut at the beginning of the school year and many of Ms. C's students commented on how the clear-cutting made it "look hotter" near their school. Ms. C chose a tree-planting project in response to these issues, but explained to students at the start of the project that they, as a class, were going to go through the school district's process to get more trees planted within the play area of their school, telling us that she "showed [the 5th graders] the application process for … we're getting something done at the school. So I actually showed them the application to the school district, to the garden Council. And you guys, I'm going to have to apply for trees. And you're going to do an exercise where you write something up about where you recommend these trees to be and justify it [to send to the district]."

As part of this project, students analyzed the situation in a number of ways, both bureaucratic and activist in orientations. For example, students started to engage with the questions around shade and heat through activist-oriented means: exploring neighborhood social media posts (from Nextdoor and Facebook) curated by Ms. L about the lot next to the school that had been clear cut, investigating which entity owned the lot, discussing emotional perceptions around heat and how different groups of people are disproportionately impacted by the heat. Students then went on to explore and analyze the phenomena through more conventional scientific means (e.g. using IR surface thermometers to map out the hottest spots on their campus). After their analysis, students were tasked with the action skill of creating maps with tree planting proposals and writing justifications of their proposals to the district's garden council, gaining practice in the bureaucratically-oriented action skill of *applying for permission from a power structure*. After months of waiting for approval, students engaged in planting the few trees that had been permitted in large barrels (because concrete removal had been deemed too costly).

Ms. C explained that the assignment was motivated by how much bureaucracy she had encountered throughout the years. "Between the [environmental organization] for 10 years, and … you know, I'm doing the garden council work and the garden group at […], it's a lot of bureaucracy. I mean, you know about that. So I kind of got them to do a simple exercise. And I have that, that activity. And then I chose … when I applied to the

garden Council, I chose one of the kids' [proposals]." Ms. C intentionally engaged her 5th grade students in bureaucratic activity, because it matched her experience in what was needed to accomplish meaningful material change at her school site.

Discussion

In this paper, we define orientations-of-action with respect to activism (reimagining systems of power) to bureaucracy (working to leverage existing power systems) in student action projects and give examples of each through different project elements. We find a widespread in where different projects land on the spectrum we define, as well as a lack of coherence throughout individual projects, but more often than not, we find that projects framed with an activist orientation migrate towards a bureaucratic orientation when it comes to the action skills in which students engage. This is notable given the activist roots of this program and attention to action typology within the professional development provided. It is also notable, given the program's location in an urban, coastal city, where climate change and notions of climate justice are generally accepted as important, if not well understood. Based on these findings, we consider implications for the teacher professional development program described in the context section, as well as implications for future research.

Implications for professional development

First, we hypothesize that our rubric (Table 1), supplemented with critical questions, may be a useful reflection or planning tool for teachers (and ourselves) to clarify, critically reflect on intentions, and troubleshoot barriers with respect to activist- and bureaucratic- orientations-of-action in the context of classroom climate action projects. First, as a reflection tool, the rubric will help teachers to track projects they have implemented in the context of activist or bureaucratic orientation and reflect on the ways in which the orientations manifest in student activity did or did not match their intent or values (in absence of intent during planning). For example, we speculate that Ms. L, in articulating the trajectory that her classroom project took, might identify places where classroom activities deviated from her values. She might, by herself, or with other teachers identify barriers (for example time within the year) and work-arounds to these barriers.

As a reflection or planning tool, we might also ask teachers engaging students in bureaucratic action to clarify the power structures they are having their students leverage. For example, in the context of project B, Ms. C engaged her students in bureaucracy in a purposeful manner. Even though this activity is not aligned to classroom activity supported by our theoretical framework, we assume two practical and positive reasons she did this, namely that she wanted her students to go through a process which would lead to success, and that she wanted to achieve material change for the broader student community at her school. Asked to name the power structures she engages her students with, she might name the school district's garden council and asked to name a large-scale system of oppression impacting that local structure, she might articulate that our school district has limited funds for tree maintenance because racially disparate funding of schools and disinvestment in schools as a public good resulting from a recent push towards charters or in a longer context of property tax codes in our state that have shielded the wealthy from contributing to public education since the late 1970s. We might then ask her to consider, even in a small way, to help her students understand the broader context and systems of oppression related to the bureaucratic action they take.

Finally, by asking teachers to reflect on and articulate their intentions with respect to our rubric, especially in the context of student epistemologies and theories of change, we hope that they will introduce more nuance into our understandings of orientation of action, specifically in the context of classroom climate action projects.

Implications for future research

In our introduction, we articulate student experience as our motivation for investigating the phenomena of orientations-of-action. However, we have focused in this paper on *teacher* experience and *teacher* accounts of classroom activity, largely because the zoomed-out view we see by looking across several projects allowed us to clarify the directionality of these orientations for ourselves. We must next zoom in. We hope that through careful observation of individual classroom projects and by speaking directly with students, that they will help us to understand the impact that activist- and bureaucratic- orientations have on their mental health, epistemologies, theories of change, and sense of self as knowledge creators and change-makers.

Endnotes

(1) We differentiate "orientation" from "intention," because we conceptualize activism and bureaucracy as *directions towards which* an activity may be oriented. By orientation-of-action, we mean that a classroom

activity faces in the direction of either activism or bureaucracy, regardless of the direction the teacher and students intend to face. We do not suppose a match between teacher or student intentionality with respect to these orientations and how these orientations manifest in classroom activity. In a new place, absent familiar landmarks, we often walk in a *direction* we do not intend, because we are *disoriented*. For many of the teachers we work with, classroom action projects are a new place.

References

Barton, J.C., Fitzmaurice, H.L. (2022, April). *Supporting Urban Public School Teachers in Creating and Implementing Place-based, Justice-centered Climate Change Curriculum.* [Paper and Roundtalbe Presentation], American Education Research Association (AERA), San Diego.

Bradford, A., Gerard, L., Tate, E., Li, R., & Linn, M. (2023). Incorporating investigations of environmental racism into middle school science. *Science Education*, 1–27.

Cheuk, T., & Morales-Doyle, D. (2022). Talking through the "messy middle" of partnerships in science education. *Science Education*, 106(5).

Damico, J. S., Baildon, M., & Panos, A. (2020). Climate justice literacy: Stories-we-live-by, ecolinguistics, and classroom practice. *Journal of Adolescent & Adult Literacy*, *63*(6), 683-691.

Dooley, L., Sheats, J., Hamilton, O., Chapman, D., & Karlin, B. (2021). Climate change and youth mental health: Psychological impacts, resilience resources, and future directions. *Los Angeles, CA: See Change Institute*.

Ferman, B. (2020). Preserving education as a public good: Lessons from the grassroots. *Urban Affairs Review*, *56*(3), 921-929.

Fitzmaurice, H.L., Barton, J.C., (in press). Creating a Family of Educators Committed to Justice-Centered Climate Change Pedagogy. *Connected Science Learning*

Giroux, H. A. (1988). *Teachers as intellectuals: Toward a critical pedagogy of learning*. Greenwood Publishing Group.

Giroux, H., & McLaren, P. (1986). Teacher education and the politics of engagement: The case for democratic schooling. *Harvard educational review*, *56*(3), 213-239.

Morales-Doyle, D. (2017). Justice-centered science pedagogy: A catalyst for academic achievement and social transformation. *Science Education*, *101*(6), 1034-1060.

Morales-Doyle, D., & Frausto, A. (2021). Youth participatory science: A grassroots science curriculum framework. *Educational Action Research*, *29*(1), 60-78.

National Research Council. (2013). Next generation science standards: For states, by states.

Pham, J. H., & Philip, T. M. (2021). Shifting education reform towards anti-racist and intersectional visions of justice: A study of pedagogies of organizing by a teacher of Color. *Journal of the Learning Sciences*, *30*(1), 27-51.

Reigh, E., Escudé, M., Bakal, M., Rivero, E., Wei, X., Roberto, C., & Wilkerson, M. H. (2022). Mapping Racespace: Data Stories as a Tool for Environmental and Spatial Justice. *Occasional Paper Series*, *2022(48*).

Renée, M., and S. McAlister. (2011). *The Strengths and Challenges of Community Organizing as an Education Reform Strategy: What the Research Says.* Community Organizing as an Education Reform Strategy Series. Prepared by the Annenberg Institute for School Reform at Brown University. Quincy, MA: Nellie Mae Education Foundation.

Rousell, D., & Cutter-Mackenzie-Knowles, A. (2020). A systematic review of climate change education: Giving children and young people a 'voice'and a 'hand'in redressing climate change. *Children's Geographies*, *18*(2), 191-208.

Segura, D., Morales-Doyle, D., Nelson, S., Levingston, A., & Canales, K. (2021). Sustaining Community-School Relationships Around Shared Visions of Climate Justice and Science Teaching. *Connected Science Learning*, *3*(5), 12318702.

Ten Strands (2022). *Climate Change and Environmental Justice Program*. https://tenstrands.org/work/climate-change-and-environmental-justice-program/

Tessum, C. W., Paolella, D. A., Chambliss, S. E., Apte, J. S., Hill, J. D., & Marshall, J. D. (2021). PM2. 5 polluters disproportionately and systemically affect people of color in the United States. *Science advances*, *7*(18), eabf4491.

United Nations, Human Rights Council. 41st Session. U.N. Doc A/HRC/41/39 (July 17, 2019) Climate Change and Poverty: Report of the Special Rapporteur on extreme poverty and human rights. https://digitallibrary.un.org/record/3810720/files/A_HRC_41_39-EN.pdf?ln=en on April 10, 2024.