Linking Climate Learning to Climate Outcomes through Curriculum Redesign and Evaluation:

A Case Study of New York Sun Works

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UNBOUNDED ALLIANCE

NYSUNWORKS HYDROPONIC CLASSROOMS

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This policy brief draws on ongoing work led by Unbounded Alliance in partnership with New York Sun Works on measuring the Carbon Emissions Reduction Potential of climate change education. Members of the Unbounded Alliance team include Juan Camilo Suárez, Dr. Christina Kwauk, Natalia Villalpando Páez, Dr. Alvin Vista, and Francisco Zavala. The team would also like to acknowledge the foundational work of former team members Meryem Demirkaya and Anna Pettee.

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EXECUTIVE SUMMARY

As states move to mandate climate change education, the central challenge is no longer whether climate content is included in classrooms, but whether instruction is designed to produce meaningful climate outcomes. Three critical gaps continue to limit the effectiveness of climate change education efforts:

- A design gap, in which curricula are not intentionally structured to translate learning into climate-relevant behaviors;
- A data and measurement gap, which makes it difficult to track outcomes beyond knowledge gains; and,
- A financing gap, as funders and policymakers lack clear evidence linking education investments to climate results.

This policy brief examines New York's climate education mandate as a pivotal opportunity to realize the promise of high-quality climate change education. It argues that curricula and evaluation systems must be intentionally designed to link learning outcomes to behavioral pathways and, ultimately, to measurable contributions to climate mitigation, adaptation, and resilience.

Designing climate change education to achieve learning-to-behavior-to-climate outcomes—and measuring this impact chain—is critical for accountability and systems change, enabling society to understand what works while giving leaders and funders the evidence needed to scale effective climate solutions.

Using New York Sun Works (NY Sun Works), an environmental education organization, as a case study, the brief illustrates how education organizations can operationalize this learning–behavior–climate impact chain in both curriculum design and program evaluation. Through a systematic curriculum audit, targeted redesign, and the development of an innovative monitoring and evaluation framework, NY Sun Works aligned its instructional content, pedagogical approaches, and assessment tools with a clear theory of impact for climate action. Early pilot results suggest that it is possible to measure not only climate learning, but also behavioral decision-making and the potential carbon emissions reduction associated with those choices.

The brief concludes with recommendations for state and district leaders, education organizations, and funders to move beyond compliance-focused implementation and to instead invest in curriculum design, data systems, and partnerships that advance the "why" of climate change education: empowering learners to translate knowledge into collective action with real climate impact.

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Quality Climate Change Education Matters Now More Than Ever

New York has adopted one of the most ambitious statewide mandates for climate change education in the country, creating both urgency and opportunity for districts and education organizations seeking to design instructional programs that truly matter for climate outcomes.

In the fall of 2025, as part of the NY Inspires: A Plan to Transform Education in New York State, the New York State Education Department (NYSED) proposed an amendment to the Commissioner's regulations requiring climate change education in all K-12 schools.[1] Under the amendment, climate change instruction would be phased in by grade band: by the end of grade 4 in elementary school, grade 8 in middle school, and grade 12 in high school. After moving through public comment, the amendment was approved by the Board of Regents in March 2026, with implementation beginning in the 2027-28 school year for middle and high schools and the 2028-29 school year for elementary schools.

With this decision, New York has joined a growing group of states[2] that are strengthening their approach to climate change education, raising the stakes for designing programs and support that are not only aligned with new mandates but also effective at advancing real outcomes. As more states move in this direction, climate change education advocates and leaders are wisely expanding their attention from policy advocacy to providing evidence-based, practice-driven implementation guidance and support.

But to realize the promise of New York's new mandate also requires decision makers, education leaders, and advocates to confront three closely related gaps: a design gap, a data and measurement gap, and a financing gap. Left unaddressed, these gaps can impede the potential of this momentous opportunity to scale climate change education across the state's K-12 system.

1 NYSED, 2025.

2 Other notable champions are California, Colorado, Connecticut, Illinois, Maine, Maryland, New Jersey, Oregon, and Washington (see NAAEE's State Climate Education Policies in the U.S.).

The Challenges Ahead

Critically, NYSED and climate change education stakeholders in New York are already collaborating on the development of comprehensive guidance that will clarify priority topics and learning outcomes as well as developmentally appropriate learning progressions for instruction—guidance that may also benefit from efforts happening globally.[3]

But in addition to helping districts prioritize content and pedagogy (the what and the how of climate change education), there is also an urgent need for general guidance around curriculum and program design. Such support will help to ensure climate change education is designed to build climate literacy[4] that supports behavioral pathways that contribute to measurable impact on climate change mitigation, adaptation, and resilience outcomes. Attending to this design gap is attending to the why behind 'why climate change education matters': empowering students to move from climate change knowledge to climate action, by themselves and with others—something which, collectively across school districts, could lead to carbon emissions reductions at measurable societal scales.[5] This design gap is something education stakeholders should not lose sight of as the education system in New York moves into implementation mode.

Relatedly, the data and measurement gap and the financing gap intersect with and amplify this implementation challenge. Most climate change education efforts still emphasize tracking knowledge gains and changes in attitudes, rather than assessing whether learning leads to measurable changes in emissions, adaptation practices, or community resilience indicators. Developing methods for tracking the latter—whether climate learning leads to measurable changes in climate outcomes—would be a challenging methodological task.[6] However, not attempting to do so weakens the case for investing in climate change education, fueling a financing gap in which schools and education NGOs struggle to secure adequate, sustained resources to deliver

3 See for example, UNESCO, 2024.

4 Climate literacy is not only the knowledge of Earth's climate system and how humans influence climate, but also the skills and behaviors needed to translate scientific understanding about climate change and local and Indigenous knowledge into informed decisions related to climate change and into effective and transformative collective action (Bodor, Bristow, Cawood, et al., 2025; USGCRP, 2024).

5 Bhowmik, et al., 2020; Kwauk, 2020.

6 Notably, other researchers like Cordero, et al. (2020) and Misra & Verma (2015) have also attempted to navigate this methodological challenge through the use of innovative modeling.

and scale ambitious climate change education programs.[7] Until education programs and education systems can show, with credible data, the climate impact of strengthening climate literacy, action competence, and pro-environmental behaviors, funders and decision makers will remain cautious and sometimes skeptical—especially in contrast to climate solutions in other sectors like transportation whose impact may be more immediately and more easily measured but not necessarily as transformative as climate change education.

The opportunity for innovation, therefore, is not simply to bring more climate change content into K-12 classrooms across the state of New York. It is to do so while designing instructional programs and support that build climate-relevant outcomes. And, crucially, to design monitoring and evaluation systems that clarify whether climate change education is influencing behavior and climate outcomes.

Insights From the Field

This brief responds to this opportunity for innovation by highlighting a concrete case study of how efforts to scale climate change education might go beyond the whats and the hows to the broader issues of design that are rooted in the why. That is, to enable positive outcomes for climate mitigation, adaptation, and resilience.

Specifically, this brief presents insights from NY Sun Works, an environmental education organization that has undertaken a systematic curriculum and program audit to strengthen its focus on climate change and to align its learning outcomes, activities, and monitoring and evaluation with climate-relevant behaviors and impacts. Published in the month following the Board of Regents's vote, the brief aims to help state leaders, district administrators, and education NGOs identify practical approaches to implementing the climate change education requirement in ways that generate meaningful and measurable climate impact.

The insights illuminated here are the product of an ongoing partnership between Unbounded Alliance (UA) and NY Sun Works to advance an innovative methodology to measure and calculate the climate impact of education.

7 Kwauk, 2025; Sabarwal, et al., 2024, listen also to the International Education Funders Group's podcast mini-series on how education funders are attempting to fill this financing gap (IEFG, 2025).

NY Sun Works: A Case Study of Designing for—and Measuring—The 'Why'

NY Sun Works is a 501(c)(3) non-profit organization that builds Hydroponic Classrooms and provides sustainability science and climate change education programming to PreK-12 urban schools. Working primarily in New York City but also in schools in New York State, New Jersey, and Birmingham, Alabama, NY Sun Works provides partner schools with a comprehensive PreK-12 curriculum (Discovering Sustainability Science) and long-term teacher training and professional development. Its educational programming allows students to grow food from seed-to-harvest while learning a comprehensive range of mandated science content with a specific focus on climate and sustainability.

NY Sun Works was founded on the idea that climate and sustainability education can be incorporated into the classroom through engaging hands-on science learning. As such, climate change education was always at the heart of its curricula, even if not explicitly named—sometimes climate content and connections were folded into other content or included under the larger umbrella of sustainability. But with New Yorkers seeing the immediate local effects of the climate crisis (e.g., heavy rainfall resulting in the flooding of the city's subway system), coupled with shifts in the political climate and increasing public demand for climate change education, NY Sun Works' leadership decided that climate change needed to be explicitly named across their work. The organization added the goal of becoming a leader in climate change education to its strategic plan and began a curriculum redesign.

With a reach of over 1,700 teachers and 140,000 students, NY Sun Works operates at a "sweet spot" for scale, capturing a cohort size that, if successfully mobilized, has the potential to optimize individual agency and collective impact on climate outcomes.[8] In thinking about how to improve the curriculum to explicitly include climate change education and to include learning activities and instructional practices aligned with climate change education research, the question arose as to how the organization would know if it were making a difference—a difference not only on learning outcomes but also on the behaviors that could,

8 Bhowmik, et al., 2020.

at scale, help to reduce emissions, help students and their communities adapt to the impacts of climate change, and strengthen community climate resilience.

While the efficacy of the curriculum could be evaluated internally by the NY Sun Works education team and feedback collected from partner teachers, if the organization was going to truly demonstrate impact on climate and sustainability outcomes, it would need to understand the learning and behavioral outcomes of students in NY Sun Works classrooms. Critically, this means not only measuring learning outcomes but also measuring the links between what students are learning, how this learning is shifting behaviors, and what the potential is for these behaviors to impact climate mitigation, adaptation, and resilience outcomes.

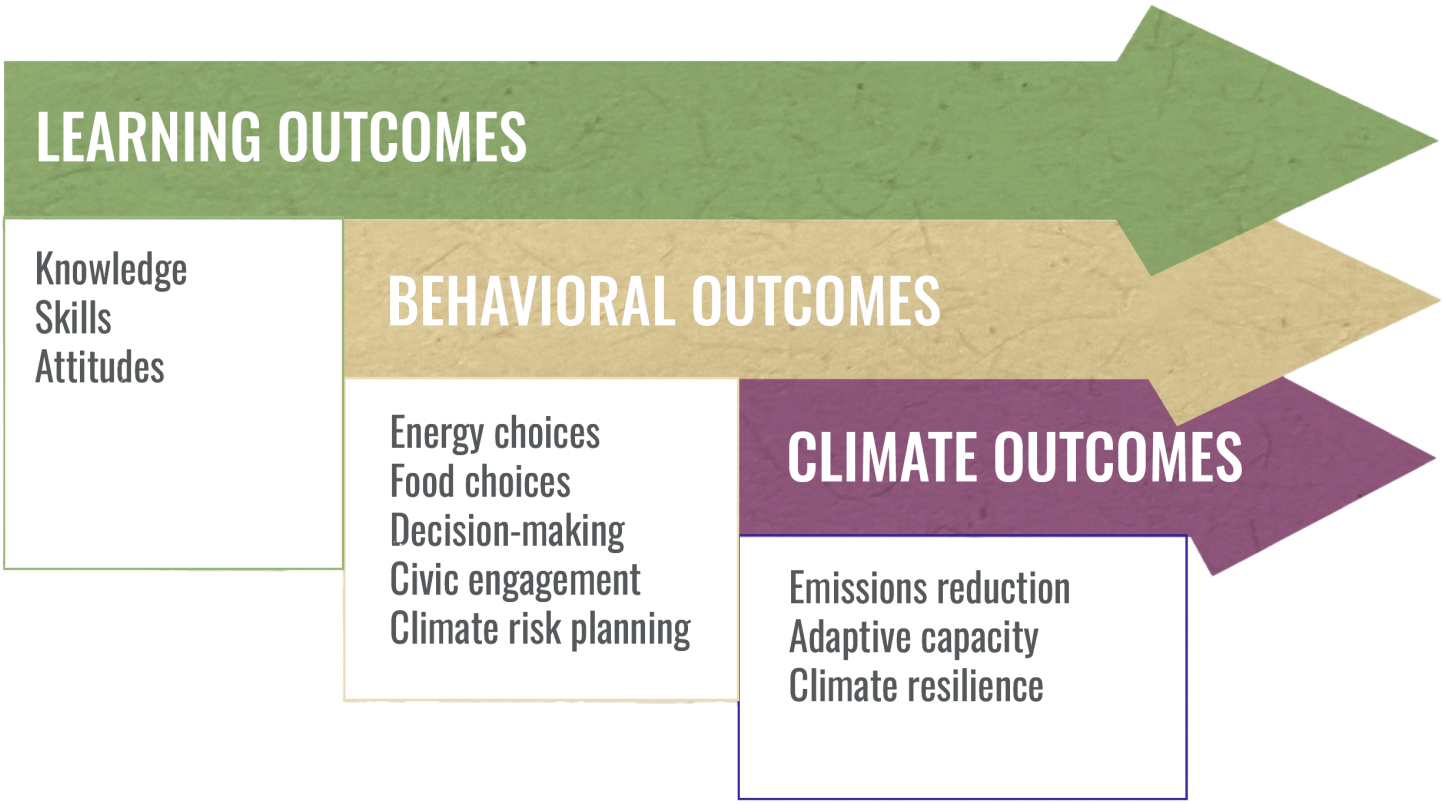
To achieve this impact, the curriculum redesign would not only need to be oriented to designing and delivering high quality climate change education, but education that can impact climate change. The challenge would be to design for such outcomes, and also to measure these outcomes. This led to the partnership with Unbounded Alliance (UA) to explore how a data-driven approach to measuring and evaluating the impact of NY Sun Works' climate change education programming could help to inform its approach to curricular redesign.

A Theory of Impact for Climate Change Education

For climate change education to demonstrate meaningful scalable impact on climate mitigation and other desired outcomes, it must operate through a clear causal pathway: learning must equip and motivate action, which in turn must lead to measurable improvements in emissions reduction, adaptive capacity, and climate resilience (see Figure 1). Too often, climate change education programs are designed and evaluated in isolation of this logic, focusing primarily on whether students have gained environmental awareness or can articulate climate concepts, without examining whether those learning outcomes translate into behavioral change or contribute to positive climate outcomes. A robust theory of impact for climate change education should connect all three essential links in the causal chain.

Critical for the first link in this chain is curriculum design: curriculum designed to equip learners with the motivation, skills, and agency, i.e. the internal

Figure 1. A theory of impact for measuring the climate impact of education



capacities required to act.[9] This extends the focus of learning outcomes beyond just knowledge about climate change to environmental responsibility, a sense of ownership over climate challenges, action competence, and collective agency. These learning outcomes position students not as passive recipients of information but as empowered actors capable of recognizing opportunities for change and willing to work with others to pursue them.

The second link requires that education programs intentionally create or strengthen behavioral pathways for students to exercise that agency in ways that matter for climate outcomes—both as individuals and as members of collectives. This could be opportunities for responsible environmental behavior such as shifts towards plant-based diets, reductions in energy usage and plastic waste, or through collective actions made possible through increased civic engagement in climate policy and advocacy. These behaviors, in turn, are the mechanisms through which climate change education influences tangible climate results—measurable contributions to climate mitigation, adaptation, and resilience.

Importantly, behavioral pathways can be facilitated by both real opportunities for action that may require additional resources and support to make possible, as well as through imagined opportunities facilitated by curriculum design: engaging instruction, problem-based inquiry, role-playing, scenario-based reflection, etc. Which behaviors should be targeted (and measured) is dependent on and should be responsive to context (i.e., the focus of the curriculum, the local relevance of the behaviors, the availability and/or accessibility of opportunities to act, etc.).

The third and often-overlooked link is the design of monitoring and evaluation systems that can credibly trace the full logic from curriculum inputs through learning and behavior to positive climate outcomes. In contexts like New York City, these impacts might be measured in terms of calculating the emissions reduced from individual transportation choices to modeling the adaptive capacity of communities to flooding from increased climate-risk planning. Without monitoring and evaluation (M&E) that captures each stage of the pathway, climate change education programs cannot demonstrate their impact on climate outcomes, nor can they identify where interventions are succeeding or not working as intended.

A comprehensive evaluation framework must therefore measure not only learning outcomes (e.g., environmental awareness, action competence, etc.) but also behavioral outcomes (e.g., responsible environmental behavior, changes in consumption, participation in civic activities) and, wherever feasible, climate actions with measurable impact on positive climate outcomes (estimated emissions reduced from food choices, transportation choices, etc.). By making this causal chain explicit, climate change education programs can better speak to the why behind why climate change education matters: to empower students to make a real impact on climate change. And by making this causal chain measurable, either through direct measurements or by proxy, climate change education programs can build better evidence needed to secure sustained investment, refine implementation strategies, and ensure that the expansion of climate change education truly advances progress on climate goals.

The Curriculum Audit

With a theory of impact that puts measurable positive climate impact among the targets to achieve, NY Sun Works took an impact-driven approach to their curriculum redesign, beginning with a curriculum audit to better understand potential entry points for curricular integration and redesign.

Both UA and the Education Team at NY Sun Works conducted asynchronous audits of NY Sun Works curriculum. UA's audit focused on identifying potential learning and behavioral outcomes relevant to climate actions with known emissions calculations that could be reasonably included in an evaluation framework. After reviewing lesson plan objectives, lesson plan activities, and extension lessons for its Farming Foundations curriculum, UA found that there were indeed learning outcomes that could be reasonably linked to pro-environmental behavioral intent and possibly also to behavioral change, and thereby assessment tools could possibly be developed to measure this change. But making a link between these behaviors and climate outcomes would require strengthening the climate connections (and intentions) in the curriculum.

9 Bodor, et al. 2025.

Figure 2. NY Sun Works Climate and Sustainability Education Framework

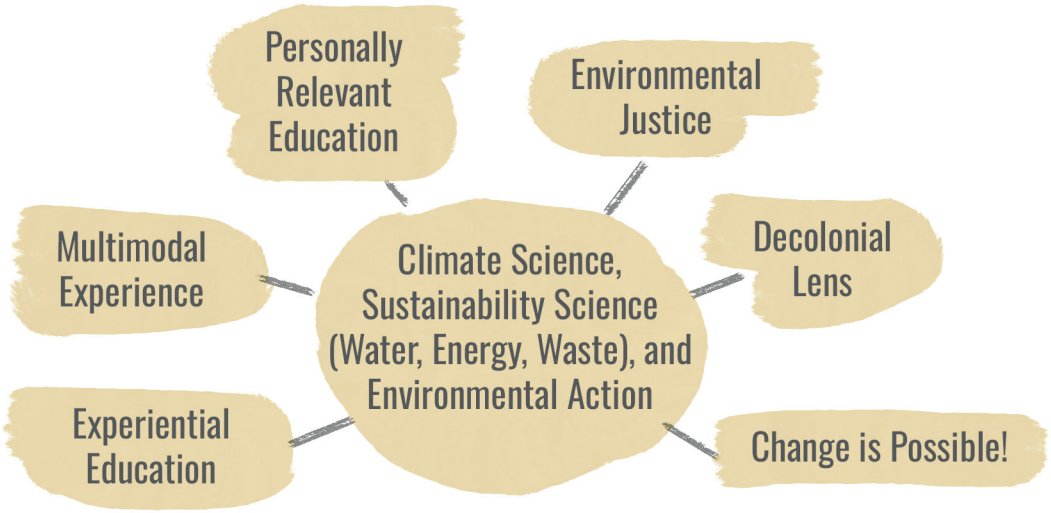


Table 1. Underlying Criteria for NY Sun Works Climate and Sustainability Education Framework

DIMENSION	CRITERIA
Experiential Education	The lesson provides engaging opportunities for students to experience the information being learned.
Multimodal Experience	The lesson provides opportunities for students to engage with content through sensory experiences, including visual, auditory, and/or tactile modalities.
Personally Relevant	The lesson supports students in relating content to their own lives and local environments, including drawing local connections when examples are not context-specific.
Environmental Justice	The lesson identifies inequities related to the topic and examines their impacts on disproportionately affected communities.
Decolonial Lens	The lesson introduces diverse ways of knowing, challenging colonial and settler-colonial assumptions about human-nature relationships, and presents the natural world as imbued with meaning beyond resource use.
Change is Possible!	The lesson promotes agency and hope by introducing pathways for change and engaging students in developing solutions to the issue.

NY Sun Works responded by conducting a climate-focused gap analysis of its entire curriculum (including accompanying presentations, student-facing materials, and extension activities) with the goal of identifying where in the curriculum it could modify, add, and/or deepen connections to climate change and related topics, including environmental justice. NY Sun Works also developed a Climate and Sustainability Education Framework by which to evaluate the curriculum and to guide the curriculum redesign. The Framework draws from research on transformative approaches to climate change education and input from UA. It includes six lenses through which curriculum should be developed as well as five content areas through which climate change education could be delivered through NY Sun Works' programming (see Figure 2).

After reviewing more than 300 lessons from its different K-12 programs, the Education Team at NY Sun Works found that 84% of its curricular suite could undergo light or modest changes to content and pedagogical activities to align with the criteria set by the Climate and Sustainability Education Framework (see Table 1), while 16% of its content would require major rewriting.

The Curriculum Redesign

Following the curriculum audit, NY Sun Works began a large-scale revision of its curriculum. The initial redesign focused on its Farming Foundations curriculum, NY Sun Works' foundational seed-to-harvest unit that is used across all grade bands. Internal data shows that this 15-lesson introductory unit is used more than any other in the NY Sun Works curriculum, therefore having the most potential reach and climate impact. Grade-level specialists revised each lesson to better meet the new requirements. Table 2 provides a snapshot of a lesson on carbon offsetting before and after the curriculum redesign.

The Education Team also saw the need for more lessons to reinforce student learning and further support teachers, leading to the development of Farming Foundations 2: Climate and Sustainability Science. Designed to follow Farming Foundations 1, this new unit follows the same seed-to-harvest process but lessons are explicitly centered on issues of climate and sustainability. For example, while learning about the plant life cycle and observing germination in Farming Foundations 1, students learn that temperature can affect germination rates

Table 2. Curriculum Redesign Example: Carbon Offsetting Lesson

BEFORE	AFTER
Students explore the concept of carbon offsets by reviewing the carbon cycle and analyzing the ways in which carbon is both beneficial and harmful to the environment and how humans are increasing the amount of carbon in the environment. Students are introduced to carbon offsets as a potential solution to incentivize large companies to positively impact the environment and "offset" the carbon they are emitting. Finally students use a carbon footprint calculator to estimate their own carbon footprints and reflect on the actions individuals and corporations can and should take in order to reduce carbon emissions and have a more environmentally-friendly impact on the world.	While the lesson contains similar content (carbon cycle, impact of humans and carbon on the environment, carbon offsets), students now work in groups to play a "Choose Your Own Adventure" game (see Figure 3). They are given roles as executives in an automotive company and have to make a series of decisions with the goal of getting their company's carbon emissions from 5.6 tons per year to as close as they can to 0 tons per year. This activity allows students to make concrete decisions and see a direct quantifiable result of their decisions in terms of carbon emissions.

Figure 3. Image From NY Sun Works' Choose Your Own (Carbon Offsetting) Adventure Game

Table 3. Examples of Designing for Climate Action Across Interconnected Systems

IMAGINED BEHAVIORAL PATHWAYS	REAL BEHAVIORAL PATHWAYS
The Journey of Produce: Students play a board game where they gain points for purchasing produce that is in season and locally grown, while tracking the carbon emissions of "food miles."	Seed Bank: After learning about the impact of climate change and extreme weather on seeds, students create a seed bank with plants from the Hydroponic Classroom and the community to ensure they will always have the seeds they want and need. They make connections to global work on seed banks and vaults.
The Honorable Harvest: Students practice reducing food waste by learning the indigenous principles of the honorable harvest, guiding the way humans interact with the natural world by emphasizing respect, reciprocity, and sustainability.[10]	Waste Audit: Students conduct a waste audit of their classroom and create signage for sorting bins and reducing waste for their classrooms and larger school community.
Urban Heat Island Solutions: Students analyze heat and tree map data from their neighborhood and other locations throughout New York City, then work on redesigning their community's green space, housing, and roads to reduce the heat island effect.	School Composting: Students compost food scraps in their classroom worm bins and are given resources for composting at home.

10 Kimmerer, 2013.

and consider how this may be impacted by climate change. In Farming Foundations 2, they revisit this topic by digging deep into data on climate change and rising soil temperatures, design an experiment to mimic the effects of increased soil temperature on the germination rates of various types of plants, and discuss possible solutions for preserving plant species that are threatened by the impact of climate change on germination.

Importantly, the curriculum redesign did not stop at filling the whats (climate content) and the hows (pedagogical approaches), but also the climate change education design gap around the why: empowering students to translate knowledge into meaningful action. Inspired by Bioecological Systems Theory that explores how individuals develop through interactions across nested systems of influence, NY Sun Works' curriculum redesign integrated real and imagined opportunities for action. This created opportunities for students to become active agents of change within their classrooms, home, school, local community and broader society (see Table 3 for examples).[11]

Designing and Testing a Monitoring and Evaluation Framework

While NY Sun Works redesigned its curriculum, UA began developing a monitoring and evaluation (M&E) framework for measuring the full logic from NY Sun Works' curricular inputs to its potential positive climate impact. However, linking the measurement of NY Sun Works' impact on students' learning outcomes to students' behavioral outcomes and the potential positive climate impact of these behaviors would require diligently navigating a host of methodological challenges. Top among these are the administrative and logistical challenges of collecting student-level data in public schools and issues of data quality that emerge from self-reported survey data on behavioral change and/or willingness to act more pro-environmentally. To design an impact-oriented M&E framework would thus require developing metrics and innovative data collection tools for proxying behavioral change relative to climate actions as well as developing a creative modeling methodology for estimating the potential impact of these actions on climate outcomes of relevance.

In this case, UA focused on developing a task-based, gamified data collection tool to observe what high school students (the population of participants most likely to have some degree of agency over their day-to-day choices) would choose to do if faced with several fictitious but realistic scenarios. Each task or scenario comes with a hypothetical trade-off where students must consider the environmental cost and the personal benefit of their options in a short amount of time. Figure 4 and Figure 5 indicate the multiple learning and behavioral outcomes being measured by the tool, allowing for a more holistic picture of a complex mechanism of programmatic impact.

UA also developed a methodology for quantifying the program's Carbon Emissions Reduction Potential (CERP), or the amount of carbon dioxide equivalent (CO_2e) potentially averted as a result of students' choice behaviors on a predefined set of climate actions with known CO_2e calculations (see Figure 6). But for the CERP measure to be a meaningful outcome measure of the impact chain—and thus to be able to attribute impact to NY Sun Works' climate change education program—UA and NY Sun Works would have to administer the data collection tool and model the CERP not only with students in NY Sun Works' classrooms but also with a comparison group of students who have never participated in NY Sun Works programs in the past. So, beyond the design of the M&E framework, tool, and modeling methodology, NY Sun Work's M&E system would need to be redesigned as a "lab in the field"—a model adapted from experimental and behavioral economics and increasingly used in environmental psychology.[12]

To test this approach, UA and NY Sun Works conducted a small pilot study in four public high schools in New York City during the 2024-2025 academic year (see Box 1). Results from this pilot indicate promising early results: First, pilot data shows that the assessment tools developed are reliable, valid, and fit-for-purpose. They measure what they are designed to measure and they are correlated with each other, providing a way to triangulate data. Second, there is a meaningful relationship between students' self-reported pro-environmental mindsets, attitudes, and behaviors and their actual performance on the task-based assessment that estimates their carbon footprint. These associations remain robust even after

11 Bronfenbrenner & Morris, 2007.

12 See for example, Berger & Wyss, 2021.

controlling for potentially confounding variables. Third, students in NY Sun Works' program tend to score higher than the comparison group and their results are directionally-positive (although not statistically significant), suggesting NY Sun Works is having meaningful practical impacts on target outcomes.

With more testing to come, including refining the assessment tools and CERP model, these efforts suggest that it is possible to fill the data and measurement gap when it comes to generating evidence of the climate impact of quality climate change education. Although the jury is still out on whether this will translate to closing the climate change education financing gap, these efforts will only be strengthened as more education systems and education NGOs join in.

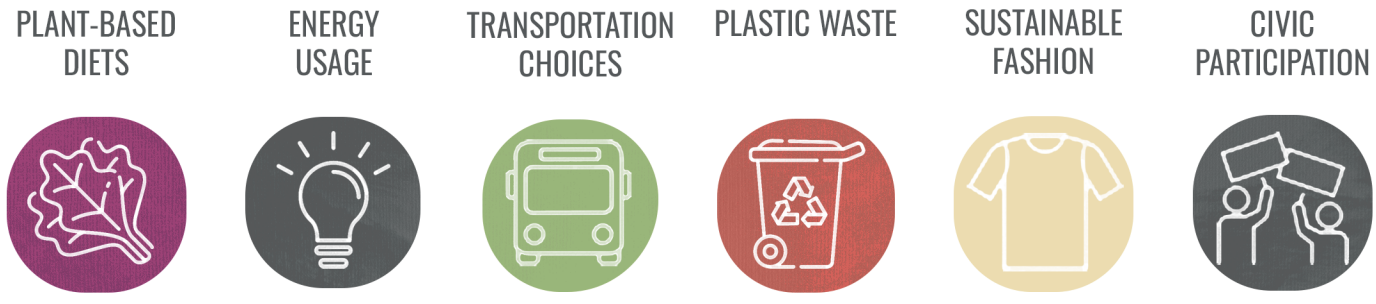
A Call to Action for The Field

Effective climate change education is action-oriented, impact-driven, and behavior change-dependent. Success depends not only on what students learn but what they (feel they can) do individually and—perhaps more importantly—collectively. Addressing the design and data and

Figure 4. Learning Outcomes Relevant to Climate Action Selected for NY Sun Works' M&E Framework:

Figure 5. Behavioral Outcomes Relevant to Climate Action Selected for NY Sun Works' M&E Framework:

Figure 6. Climate Actions with Measurable Impact on Climate Outcomes Selected for NY Sun Works' M&E Framework:



Box 1: Testing a novel approach to measuring the climate impact of education

During the 2024-2025 academic year, UA and NY Sun Works conducted a small pilot study to test the reliability and validity of the data collection tools and the approach to modeling CERP.

The pilot was conducted with 275 students in grades 10-12 at four public high schools in New York City. Each school serves a student body that is majority students of color (Asian, Black, Hispanic, and/or Native American) and is located in communities that have been identified by NYSED as high on the Economic Need Index. At the time of the study, all four high schools were actively participating in NY Sun Works programming. Two hundred students recruited from NY Sun Works classrooms in these schools were assigned to the treatment group and another 75 students who had not ever participated in NY Sun Works programming were assigned to the control group. Baseline and endline measures were taken in the fall/winter and at the end of the school year, respectively.

Preliminary results from phase one of the pilot study suggest that the learning and behavioral gains students made from NY Sun Works programming are positively associated with reduced carbon emissions. We estimate that the CERP of NY Sun Works' program is on average 920.3 grams of CO_2e per student (roughly the equivalent of each student not driving a car for 2.3 miles). However, challenges with sample size and attrition reduced the pilot study's statistical power and ability to detect significant program effects, methodological challenges which phase two of the pilot study seeks to address with a more robust approach to sampling and a larger study sample.

More details about the pilot and follow-up studies are forthcoming.

measurement gaps are thus critical for state-, district-, and NGO-led efforts to generate the evidence of impact needed to signal to decision makers, funders, and the public why climate change education matters now more than ever among a host of competing climate financing priorities.

Although a case study of one, the approach developed by UA and NY Sun Works to model this impact, the CERP, could be used by education programs and education systems around the state—and beyond—to show how climate change education can make a difference on district- and city-level emissions targets. As more states move to advance climate change education, the call to action for the field is to expand advocacy and technical support from defining the what and the how to also designing curriculum and evaluation strategies that are rooted in advancing the why. This will require leaders, practitioners, and researchers to embrace the messiness of breaking new methodological ground[13] and to work collectively to operationalize approaches to designing for and measuring this learning-behavior-climate impact chain.

This brief provides one example of what this operationalization might look like—and what it might require—in practice. To do so at scale across the state of New York and beyond will require another level of coordination, collaboration, partnership, and resources. The following recommendations sketch out how different stakeholder groups might focus their efforts in the short- and long-term.

For state and district leaders:

- Support teachers with curriculum resources and professional development so they can deliver

13 In the spirit of Berger & Wyss (2021), Cordero, Centeno, & Todd (2020), and Misra & Verma (2015).

the what and the how. Without this support, it will be challenging to design for and to deliver the why: turning climate change learning into measurable positive climate impact. Build on replicable models and work with what teachers are already doing; don't reinvent the wheel. Tap into climate change education organizations like NY Sun Works and networks like the Climate and Resilience Education Task Force.

- Develop implementation guidance not only on priority topics, learning outcomes, and learning progressions for instruction, but also on aligning M&E systems to measure outcomes beyond learning gains and to connect these to locally relevant climate outcomes. Importantly, build in time and resources for data collection to monitor and track this chain of impact.
- Enable evidence-driven climate change education by fostering a data-ready environment. Help make learning and climate outcome data accessible and actionable to accelerate the R&D and investment needed to accelerate effective climate change education.

For education organizations:

- Build explicit behavioral pathways when designing or revising curriculum; pair these with explicit measurement frameworks to track, model, or proxy the impact of learning on real-world climate outcomes.
- Foster a collaborative climate change education ecosystem by sharing anonymized data, embracing transparency, and learning collectively. Measuring the climate impact of education requires diverse approaches, collective experimentation, shared innovation, and iterative course corrections to generate evidence on how climate change education drives real-world impact.
- Support teachers with professional development on how to incorporate climate change education into what they are already teaching. Climate change education cannot be one more thing teachers must do but aligned with the state standards they are required to teach and the existing courses they are already teaching.
- Take advantage of built-in opportunities for partnership and collaboration with teachers. For example, the NYC DOE Office of Sustainability Climate Action Days are a set of four days throughout the school year where schools are encouraged to engage in climate action and sustainability. Support teachers by providing professional development and relevant curriculum materials that they can use to make climate connections.

For philanthropy/funders:

- Invest in both program innovation and innovations in measurement. This is critical for a field where the methodologies and capacity for building evidence of climate are still emerging.
- Invest in coalitions and collaborative networks that share resources, data, and lessons learned to enable collective progress in designing for and measuring the why behind climate change education. Help to catalyze collaboration across organizations, districts, and researchers to pool resources, data, and insights across the climate change education ecosystem.
- Provide multi-phase support that balances short-term pilots and long-term research to track and model how climate change education influences behavior and climate outcomes, building an evidence base that accumulates over time and informs ongoing improvements.
- Fund capacity building for measurement and evaluation. Even the best programs fail to capture impact without skilled teams and robust systems. Investing in training and building organizational capacity in impact measurement and evaluation, including data infrastructure and methodological development, can enable education programs to rigorously track behavioral change and real-world climate outcomes.

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