

Education and Climate Change: Synthesizing the Evidence to Guide Future Research

Matthew A. Kraft, Sohil Malik, and Grace T. Falken

Climate change is disrupting our schools. Can they also lead the response?

As climate-related disasters close schools, damage infrastructure, and disrupt learning, it's clear that education systems are on the front lines of a warming planet. But schools aren't just victims. As the nation's second-largest public infrastructure system and a central part of students' lives, they are uniquely positioned to lead climate solutions by investing in more resilient facilities, reducing their environmental footprint, and preparing the next generation to meet the challenge head-on.

Yet despite this potential, **U.S. PreK–12 education policy and practice have not kept pace with the urgency of climate change.** Fragmented federal support, decentralized school governance, and a long history of incremental reform have left us with a patchwork of programs rather than a coordinated strategy. Meanwhile, researchers across a range of disciplines have begun to examine the many ways climate and schooling intersect, but their efforts often remain siloed and disconnected from policy conversations.

Drawing on interdisciplinary research and original data analysis, the authors identify five key dimensions where education and climate change intersect, from decarbonizing school operations to preparing students for careers that support sustainable practices.

To ensure students have access to safe and productive learning environments and are prepared with the knowledge and skills required for an uncertain future, we need to see climate change as a core education policy issue.

KEY FINDINGS AND POLICY IMPLICATIONS

1 The Environmental Impacts of the U.S. PreK-12 Education System

Schools are a major part of the nation’s public infrastructure and contribute significantly to carbon emissions through energy use, transportation, and food systems.

- The U.S. PreK–12 public education system emits 41 to 72 million metric tons of carbon annually, roughly equal to the output of 18 coal plants or 15 million cars.
- School buildings are the third-highest energy consumers among commercial buildings in the U.S. They use enough energy to power 16.3 million homes annually.
- Fewer than 10% of K–12 schools use on-site solar energy, and fewer than 3% of school buses are electric.
- School meal programs produce considerable food waste that results in 2.1 million metric tons of CO₂ equivalent emissions, but only 6 states had composting policies as of 2020.

Policy Implications:

- Develop district-wide sustainability plans with dedicated central-office staff to coordinate and advance these efforts
- Prioritize electrification, high-efficiency HVAC systems, energy-efficient lighting, and LEED-certified building materials and practices during school renovations or rebuilds to reduce emissions and operating costs.
- Offer incentives to transition school bus fleets to electric vehicles.
- Encourage local sourcing, composting, and reusable serving materials in school meal programs.
- Use free online benchmark tools such as EnergyStar to monitor school energy efficiency to inform policy and assess progress.

2 Climate Change Impacts on School Infrastructure, Budgets, and Operations

Climate-related disasters are increasing in frequency and intensity, putting physical strain on school facilities and finances.

- Climate change is damaging school infrastructure. Around 25% of U.S. public schools are located in areas classified by the Federal Emergency Management Agency as “very high risk” for environmental hazards such as flooding, wildfires, heat waves, and hurricanes.
- Most school facilities are outdated and underprepared. Half of U.S. school districts reported needing major HVAC, plumbing, or structural upgrades in 2019.
- Climate-driven extreme weather is causing property insurance costs to rise sharply in some markets (e.g., 47% premium hike post-Hurricane Ida in New Orleans).
- Climate change disrupts school operations. The 2024–25 school year alone saw over 9 million students affected by closures or activity cancellations due to extreme weather events based on data collected by UndauntedK12.
- Following climate disasters, some communities are seeing declines in student enrollment and lower local tax revenues, which erode district budgets.

Policy Implications:

- Expand access to capital funding, particularly in low-income areas, through state and federal investment or programs such as credit enhancement, thereby lowering the cost of borrowing.
- Track climate-related school disruptions, building conditions, and insurance costs to inform preparedness and policy responses.

Incentivize climate-resilient school design to withstand future extreme weather conditions and reduce long-term costs.

3 The Effect of Environmental Pressures on Students and Teachers

Environmental pressures negatively impact students' cognitive development, health, attendance, and achievement, and also strain teachers' well-being and ability to support learning.

- Prenatal and early childhood exposure to pollution, extreme heat, and natural disasters harms children's cognitive, behavioral, and emotional development.
- Exposure to high heat and air pollution lowers test scores, increases absences, and reduces academic success.
- Rising heat and air pollution negatively affect students' physical and mental health, increasing the risk of respiratory illness and even long-term neurological damage.
- Climate disasters place increased strain on teachers' lives and work with their students, leading to potential emotional fatigue and burnout.

Policy Implications:

- Review local environmental risks and make locally-tailored investments in school resilience such as HVAC upgrades, fire-resistant roofing, flood-resilient landscaping, and heat-mitigating infrastructure (e.g., shaded outdoor areas).
- Provide support services to students dealing with climate anxiety and trauma from natural disasters.
- Develop emergency response protocols and remote learning systems to reduce instructional time loss due to heat waves, wildfires, and extreme weather events.

4 Teaching and Learning about Climate Change

Many U.S. students graduate with limited knowledge about climate science or careers that advance sustainable practices.

- Climate education in U.S. schools is inconsistent and often inadequate. As of 2020, 20 states did not include standards about human-caused climate change in a required class. According to a national survey in 2014-15, a third of surveyed middle school science teachers gave equal time to climate "doubt," despite scientific consensus.
- Integrating traditional ecological knowledge into science instruction can offer insights about sustaining ecologically balanced relationships with nature.
- More than half of surveyed K-12 teachers in 2016 received no formal instruction on climate change during their preparation programs.

- In 2019, nearly half of U.S. teens reported learning little or nothing about climate change causes or solutions in school. On the 2015 PISA international assessment, U.S. students score well below their peers in environmental science knowledge, even when overall science scores are similar.
- There is strong public support, but uneven implementation, for climate education. 76% of U.S. adults support teaching about global warming in schools, though support varies by state.

Policy Implications:

- Strengthen state standards and assessments for climate education. Ensure all students receive accurate, developmentally appropriate instruction on climate science, causes, and consequences across subjects and grade levels.
- Explore opportunities to integrate outdoor and nature-based education to provide hands-on learning about the natural world.
- Provide pre-service training for educators on how to teach about climate change across subject areas and support for in-service teachers to integrate these issues into existing lesson plans.
- Strengthen CTE programs that prepare students for careers that advance sustainable practices.

5 Schools' Broader Influences on Students, Families, and Communities

Schools have influence beyond the classroom: they shape students' and families' climate beliefs and behaviors, serve as trusted community hubs, and have the potential to drive broader environmental awareness and resilience.

- Higher educational attainment is linked to greater concern about climate change and stronger support for climate policies. Environmental education increases not just knowledge, but also students' pro-environmental attitudes and behaviors.
- Environmental learning often results in intergenerational spillover: students share knowledge with parents and shift family beliefs.
- Schools serve as polling places, emergency shelters, recreation centers, and social service hubs, making them well-positioned to anchor local sustainability efforts.

Policy Implications:

- Make investments in clean energy and sustainable infrastructure visible to families and the public, and pair them with interactive and educational installations.

Recognize schools as essential infrastructure in municipal climate adaptation strategies and ensure they are integrated into emergency response and sustainability plans.

THE CRITICAL ROLE OF RESEARCH

- Researchers can help identify and scale cost-effective climate-related education policies and programs by generating evidence on what works, why, and for whom.

- Research should focus on interventions that produce co-benefits, such as reducing emissions, lowering operating costs, improving learning environments, and promoting equal educational opportunity.
- Research on climate education should be informed by teachers' experiences inside the classroom and prioritize approaches that are feasible within existing demands on teachers' time and adaptable to the local context.
- Major data gaps currently limit progress. Key areas needing better data include:
 - School infrastructure conditions and climate vulnerability
 - School and district carbon emissions
 - Climate-related costs to school budgets
 - Diffusion and effectiveness of climate education
 - Student knowledge and attitudes about climate
 - Schools' community-facing roles and impacts
- Interdisciplinary collaboration is essential, especially between education researchers and experts in environmental science, public health, and engineering.
- Education research and policy organizations can catalyze this work by building scholarly communities and fostering cross-sector partnerships.
- Urgency is high: the need for evidence-based solutions grows as climate change intensifies. The authors close with a call to action—"Let's get to work."

FULL WORKING PAPER

This report is based on the EdWorkingPaper "*Education and Climate Change: Synthesizing the Evidence to Guide Future Research*," published in July 2025. The full research paper can be found here: <https://edworkingpapers.com/ai25-1238>

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