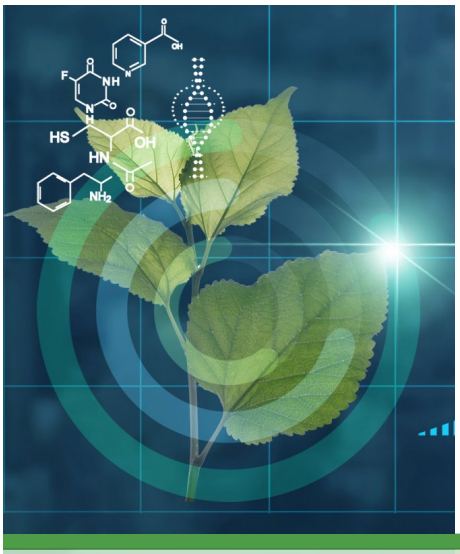
Report on K-12 Climate Change Education Needs in New Jersey

PREPARED BY:
Dr. Lauren Madden

February 2022



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Vision

Ensure that all teachers, students and educational leaders in New Jersey understand climate change and are empowered develop solutions to climate-related problems.

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Letter from the Executive Directors of the New Jersey School Boards Association and Sustainable Jersey

Dear Member of the New Jersey Education Community,

In June 2020, New Jersey became the first state in the U.S. to incorporate K-12 climate change education across content areas when the State Board of Education adopted the 2020 New Jersey Student Learning Standards.

Much credit for this ground-breaking action must go to New Jersey's First Lady, Tammy Murphy, who was a driving force behind the climate change education standards. In the year prior to the adoption of the standards, the First Lady met with more than 130 educators from across the state who were reviewing and revising the existing student learning standards, a process that occurs every five years. In the past few years she has also visited schools throughout the state that have already implemented strong climate change education and sustainability initiatives.

However Mrs. Murphy was joined in the process by a broad range of education stakeholders in the state. In reviewing and revising the standards, the New Jersey Department of Education also received input from teachers, administrators, and representatives from non-profit organizations and agencies, higher education, rural, urban and suburban districts, and public, nonpublic and charter schools. Feedback from the public gathered through regional testimony sessions, and written comments received by the NJDOE were also considered in the process of revising the standards.

In response to the standards change, the New Jersey School Boards Association and Sustainable Jersey convened the Climate Change Education Thought Leader Committee to determine an appropriate plan for implementing these standards statewide.

The committee, co-chaired by Randall Solomon, executive director of Sustainable Jersey, and John Henry, STEAM and sustainable schools senior manager at the New Jersey School Boards Association, included local school board members, representatives from the state and federal government, the state's major education groups, non-profit environmental advocacy groups, higher education, and the private sector.

The committee met for several months, working to identify needs related to climate change education. The group has developed 34 recommendations, focusing on the areas of professional learning, curricular resources, community-based climate change education and what boards of education can do to support this process.

We believe the information contained in this report will prove valuable to our members and to the greater education community as New Jersey moves forward with the implementation of these standards.

New Jersey has long been a leader in public education, and continues in this tradition with the incorporation of climate change education in instruction for K-12 students. In doing so, the state's students will be better prepared to contend with the global warming crisis and prosper in the green economy of the future.

Dr. Lawrence S. Feinsod, Executive Director, New Jersey School Boards Association

Randall Solomon, Executive Director, Sustainable Jersey

Goals

1. Ensure that all New Jersey public school teachers are prepared to fully integrate climate change education across grade levels and content areas within five years of adoption of the 2020 New Jersey Student Learning Standards.
2. Educate all members of school communities, including families, students, teachers, school staff, administrators, school board members and community partners on scientifically accurate information regarding climate change to ensure that schools are designed to foster a sustainable future and economic prosperity.
3. Encourage community-focused collaboration among stakeholders including board members, students, families and teachers, facilities professionals and administrators to ensure that schools develop a comprehensive approach to climate change education.
4. Use an equity-focused approach to ensure that the neediest schools and districts receive the necessary financial and logistical support for climate change education implementation. Further, the disproportionate effects of climate change seen by communities of color, immigrant communities and low-income communities must be highlighted.
5. Center climate change education and experiences on what is happening locally. Place-based approaches to education that emphasize the New Jersey-specific effects of climate change, and the local actions that impact global trends are more likely to make a lasting impact with students and motivate communities to commit to solution-building.
6. Provide multiple entry points to allow for school- and teacher-autonomy in deciding how to integrate climate change content within each unique learning context.

Climate Change Education Thought Leader Committee Membership

Co-Chairs:

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John Henry, New Jersey School Boards Association (NJSBA)
STEAM and Sustainable Schools Senior Manager

NJSBA Staff

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Al Miller
Vice President, Howell Township Board of Education

Cheryl Pitts
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Regina Robinson
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Cathy Lindenbaum
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Introduction

In June 2020, New Jersey became the first state in the U.S. to incorporate K-12 climate change education across content areas when the State Board of Education adopted the 2020 New Jersey Student Learning Standards.

New Jersey First Lady Tammy Murphy was a strong supporter of this initiative, and praised the State Board for its action. "The adoption of these standards is much more than an added educational requirement; it is a symbol of a partnership between generations," said Murphy in a statement. "Decades of short-sighted decision-making has fueled this crisis and now we must do all we can to help our children solve it. This generation of students will feel the effects of climate change more than any other, and it is critical that every student is provided an opportunity to study and understand the climate crisis through a comprehensive, interdisciplinary lens."

Former U.S. Vice President Al Gore, a dedicated environmental activist, also applauded the new state standards in a statement. "I am incredibly proud that New Jersey is the first state in the nation to fully integrate climate education in their K-12 curricula," said Gore. "This initiative is vitally important to our students as they are the leaders of tomorrow, and we will depend on their leadership and knowledge to combat this crisis. We will need leaders who are not only well educated about the effects of climate change, but leaders who can craft the solutions for climate change and implement those solutions."

With the June 2020 adoption, climate change education was incorporated across seven content areas –Career Readiness, Life Literacies and Key Skills, Comprehensive Health and Physical Education, Computer Science and Design Thinking, Science, Social Studies, Visual and Performing Arts, and World Languages.

In response to the state's ambitious and forward-thinking action to address climate change through teaching and learning, the Climate Change Education Thought Leader Committee was convened to determine an appropriate plan for implementing these standards statewide.

The committee, co-chaired by Randall Solomon, executive director of Sustainable Jersey, and John Henry, STEAM and sustainable schools senior manager at the New Jersey School Boards Association, included local school board members, representatives from the New Jersey

Department of Education, the federal government, the state's major education groups, non-profit environmental advocacy groups, higher education, and the private sector.

Through an iterative process, the committee identified needs and recommendations related to climate change education and solicited additional input from other experts from a variety of arenas at several points.

Climate change education needs were identified through several rounds of survey data collection and discussion at Thought Leader Committee meetings in Spring 2021. Surveys were distributed to the committee, and members were encouraged to share the survey with knowledgeable colleagues. Several expert teachers currently implementing climate change education across content areas also were asked to contribute. All responses were kept anonymous. Wherever possible, recommendations in this report are supported by national reports and scholarly work by leading educational researchers.

In this report, the committee identified goals for climate change education. These goals are followed by time-sensitive recommendations for actions needed prior to June 2022 to allow for an effective implementation of these standards in the 2022-2023 academic year.

An examination of key needs resulted in further recommendations for the comprehensive implementation of these standards. These needs, which fall into the broad categories of professional learning; curricular resources; community-based climate change education; and board of education and school administration support, are analyzed and serve as subsections of the report. Suggested benchmarks, which can serve as a timeline for achieving various objectives, are also included.

New Jersey's public education system is perennially ranked as one of the best—if not the best—in the nation.

With the implementation of these standards, New Jersey will better equip its students to combat the climate crisis, thrive in the green economy of the future and become the leaders who will accelerate the state's progress toward a cleaner, more sustainable future.

Primer on Climate Change Education

Climate change is one of the planet's most pressing concerns and its effects are more intense in New Jersey more than in many other places throughout the world.

The New Jersey Department of Environmental Protection's report, "2020 New Jersey Scientific Report on Climate Change," details specific effects of climate change on New Jersey, including the rise in sea level, increased severe weather events and increases in annual temperatures resulting in changes in a variety of plant and animal species.

To truly understand the magnitude of climate change and the scope of its effects, one must also consider the systemic factors that have led to these changes. Overuse of resources, unsustainable practices and policies, and behaviors have resulted in many changes to Earth's systems, and the most noticeable among these is climate change.

Yet, in order to develop solutions to the problems that arise as a result of climate change, we must prepare a climate-literate populace with comprehensive and accurate knowledge of the topic. This requires major shifts in the structure and content of K-12 public school teaching and learning, and adequate funding to ensure that all teachers are prepared to make these changes, and all school districts are prepared to support them.

There have been international calls for comprehensive climate education. In a joint statement following the G-7 Summit on June 13, 2021, the world leaders at the conference noted:

> "The unprecedented and interdependent crises of climate change and biodiversity loss pose an existential threat to people, prosperity, security, and nature. Through global action and concerted leadership, 2021 should be a turning point for our planet as we commit to a green transition that cuts emissions, increases adaptation action worldwide, halts and reverses biodiversity loss, and, through policy and technological transformation, creates new high-quality jobs and increases prosperity and well-being." (G7, 2021)

In October 2021, G-20 education ministers held their meeting with the theme of *People, Planet, and Prosperity* just ahead of the United Nations' climate conference in November (Rogers and Winthrop, 2021). Many stakeholder groups have urged the G-20 leaders to make compulsory climate education a key priority, "as fundamental as reading and writing," as documented in the *Joint Civil Society Statement on Climate Education Ambition*, compiled by EarthDay.org (2021).

In a recent Brookings Institute Report, Kwauk and Winthrop (2021) echo these sentiments by emphasizing the dire need for climate change education.

With its adoption on June 3, 2020, of Climate Change Education Learning Standards, New Jersey stands at the forefront of climate change education.

This report summarizes the most pressing needs with regard to climate change education in New Jersey as we prepare for widespread implementation of climate change education standards, in line with recommendations by EarthDay.org and others.

Kwauk and Wintrop (2021) highlight studies that suggest if just 16% of high school students in middle- and high-income countries were educated about climate change, there would be a tremendous reduction of carbon emissions (nearly 20 gigatons) by 2050. Through education, not simply about climate change itself, but the "green skills" and habits of mind needed to address the effects of climate change, more sustainable future becomes possible.

In Fall 2020, climate change education will be integrated across content areas and grade levels. The standards set the tone for the reasoning and the scope of learning related to climate change.

For example, the science standards state, "The addition of academic standards that focus on climate change is important so that all students will have a basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally, and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems." (N.J. Department of Education, 2020)

These standards will be enacted beginning in September 2022, creating a need for a comprehensive plan for implementation across all schools in New Jersey.

Time-Sensitive Recommendations: To Enact Before June 2022

1. All K-12 public school educators, school staff and school board members must be introduced to the climate change standards at the various grade levels and content areas.
2. All K-12 public school teachers should be provided with the developmentally appropriate and content-specific explanations of climate change and its effects.
3. All K-12 public school teachers should have access to high-quality curricular materials beginning in September 2022.

It is our recommendation that school leaders support teachers in using a series of planning periods (grade level or content area team planning sessions) during the 2021-2022 academic year to begin the process of implementing K-12 climate change education. This time should include a minimum of four meetings and should allow teachers to:

(a) Use text, video, or web-based resources to build their own content background related to climate change.

(b) Determine logical places within their curriculum to integrate and/or enhance existing climate change instruction.

(c) Create a professional development plan by identifying grade-level or content-specific questions, needs and next steps.

We strongly suggest that New Jersey public school districts employ teacher leaders and district-level curriculum supervisors to support team planning throughout this process.

We further recommend that a micro-credentialing and/or badging system be developed to ensure that teachers receive acknowledgement for the completion of the grade level or content area-based professional learning opportunities along with the school/district based professional development.

Following this initial series of climate change education planning sessions, further attention must be paid to developing a more comprehensive approach to climate change education. At a minimum, this should include school- and districtwide plans to coherently implement climate change education across grade levels and content areas. The following report offers suggestions and recommendations for a five-year climate change education agenda for our New Jersey's K-12 public education system and beyond.

Climate Change Education Resources Available from the NJDOE

The New Jersey Department of Education has developed a comprehensive website to assist school districts in planning for the implementation of climate change education.

The NJDOE's Climate Change Education website provides:

- Instructional resources, such as webinars, instructional strategies, literature and standards-based lessons — by grade level and by subject.
- Links, videos, highlights and news stories to innovative lessons on climate change occurring in New Jersey schools.
- Activities and projects for students in and out of the classroom.
- Opportunities for students to take part in community engagement.
- A portal for educators and other stakeholders to share their stories, feedback and resources.

Comprehensive Recommendations

The report details specific recommendations for the key needs, which are identified beginning on page 15. Those recommendations include:

Key Need: Professional Learning

1. Funding should be made available for the creation and implementation of comprehensive professional learning opportunities for a minimum of five years.
2. Climate change professional learning efforts must be funded in such a way that schools with more need receive the necessary money and assistance. These efforts should be inclusive of all learners, including those who need additional support and modifications.
3. Access to funding for this work should not be contingent on a competitive application process and all schools should have the support needed to integrate climate change education in grades K-12.
4. Schools and districts should have flexibility in how they proceed with regard to professional learning. Web-based programs, e-courses, on-site in-person workshops, peer-to-peer learning, college courses, and partnerships with nonprofits can allow schools autonomy in selecting the best fit for their own professional learning needs.
5. Professional learning initiatives must be created using research-based frameworks.
6. Climate change professional learning must include adult-level content knowledge, experiential active learning and opportunities for reflection.
7. Professional learning efforts must include opportunities for collaboration and mentorship.
8. Professional learning efforts should model effective classroom practices and clarify the disproportionate effects of climate change on vulnerable communities.
9. Teachers should have input into which modality (in-person, remote, or hybrid) is used for professional learning efforts within schools and districts.

Key Need: Curricular Resources

10. The New Jersey Department of Education and/or leading nongovernmental organizations should provide a wide range of resources to ensure that the needs of teachers and schools are met, and develop a compendium of climate change education resources.
11. Funding should be made available for curricular materials for educators in K-12 public schools and districts. Experiential learning in ecological systems and built environments should be prioritized.
12. Districts should align course offerings both across grade levels and content areas to ensure students develop a comprehensive understanding of climate change, its effects and mitigation strategies. Districts should offer experiential coursework related to green collar professions and climate change careers.
13. Curricular resources should be selected using research-based frameworks.
14. Multiple entry points must be available to teachers when selecting climate change curricula. Teachers should have opportunities to refine and modify curricular selections over time.
15. Curricular resources should be easily searchable, retrievable, and developed by educational professionals.
16. Nontraditional curricular resources should be valued alongside standard lessons and units.
17. Resources should include a variety of structures from scripted to open-ended. Curricular resources should include opportunities for differentiation and inclusion.
18. Curricular resources should include relevant and fact-based information regarding the disproportionate effects of climate change on vulnerable communities and emerging career paths for students to pursue.

Key Need: Community-Based Climate Change Education

19. Climate education initiatives should connect global issues with those in local communities.
20. Place-based approaches with local and regional examples should be prioritized in all curricular and professional learning efforts.

21. School districts should have flexibility concerning how they choose to implement climate change education initiatives with regard to professional learning and curriculum. For example, some districts might opt to inventory and revise existing opportunities with minor tweaks in current curriculum, while others might adopt new districtwide courses and training. This autonomy and adaptability will allow all schools to forge a path that is suitable for their own well-defined needs.

22. Explicit attention should be paid to foundational experiences in preschool learning environments and offerings in higher education to ensure that extends beyond the K-12 arena.

23. Project-based and solution-focused explorations should be centered on local and state-specific climate change issues and their effects on ecological systems.

24. Career and technical education schools should implement new programs that reflect emerging "green collar careers" in electric and hybrid vehicles, agriculture and food security, green buildings, renewable energies, sustainable design and architecture, and health and wellness. Programs should reflect actions related to working in ecological services and protecting communities from the effects of climate change such as living shorelines, habitat migration, changing plant species, etc.

Key Need: Support from Boards of Education

25. School boards should evaluate their current policies, strategic plans and board goals and update them to ensure they are aligned with New Jersey Student Learning Standards related to climate change education and other statewide initiatives throughout the district so it becomes part of the district's culture. The United Nations' Sustainable Development goals and national initiatives that support the New Jersey specific policies also should be addressed.

26. School boards should include climate change professional learning and curriculum in strategic planning efforts.

27. School board members would benefit from engaging in professional learning on climate change education prior to making decisions and recommendations regarding school-based climate change education plans. This should include decisions and recommendations that are related to the school buildings and grounds, fiscal responsibility, evaluation and hiring of staff that supports

policies related to climate change education. School board members also play an important role in the process by effectively engaging and educating the community on the topic.

28. Boards of education should support professional learning opportunities for staff members, and ensure there is sufficient professional development time allotted to undertake this effort.
29. Boards of education should support schools in providing supplementary materials (e.g., books, videos, art supplies) and field trips/field-based explorations to encourage interdisciplinary and multifaceted learning related to climate change.
30. Boards of education should support workforce development and career opportunities in green collar jobs in middle or upper elementary school.
31. School board members should be prepared to ask questions regarding climate change education to evaluate effectiveness, set goals and achieve financial sustainability.

KEY NEED 1: Professional Learning

High-quality professional learning for all teachers and school staff is necessary for implementing effective climate change education.

Professional learning initiatives must be created using research-based frameworks.

As with all new educational initiatives, high quality professional learning for teachers and administrators is essential for successful implementation of K-12 climate change education across content areas. Please note that throughout this report we will use the phrase professional learning to refer to all professional development activities, not just those associated with professional learning communities. Darling-Hammond, Hyland, and Gardner (2017) reviewed 35 methodologically rigorous studies to develop suggestions for effective professional learning. These authors identified seven essential elements[1] to effective professional learning:

1. **Content Focused:** Purposeful and specific disciplinary content.
2. **Active Learning:** Engages teachers directly in trying activities as learners.
3. **Supports Collaboration:** Provides opportunities for teachers to collaborate and share ideas.
4. **Models Effective Practice:** Allows teachers to engage with lesson plans, instructional materials, and curricula as a teacher and student.
5. **Provides Coaching and Expert Support:** Shares expertise about content and evidence-based practices in ways that are tailored to individual teachers' needs.
6. **Offers Feedback and Time for Reflection:** Provides opportunities for teachers to obtain expert feedback and reflect on their experiences.
7. **Is of Sustained Duration:** Allows ample time for teachers to implement, practice, and reflect on changes.

Darling-Hammond *et al's* essential elements of effective professional learning serve as a framework for our recommendations for climate change education training. In a recent study of 164 volunteer K-8 New Jersey teachers, conducted by Dr. Lauren Madden of the College of New Jersey, and funded by the New Jersey Sea Grant Consortium, many reported feeling uncertain about climate change content and their ability to implement climate change instruction in their classrooms (Madden *et al*, 2021).

Further, several teachers reported holding misconceptions related to climate change, and/or conflated climate change with other environmental issues such as marine plastic pollution. These findings suggest that any climate change professional learning for teachers and other school

[1] Darling-Hammond *et al* suggest that effective professional learning includes *most if not all* of these seven criteria.

staff addresses a wide audience of teachers who may or may not feel confident in their own understanding of climate change and ability to teach about it.

Climate change professional learning must include adult-level content knowledge, experiential active learning and opportunities for reflection.

Kamentz (2019) suggests that a vast majority of teachers in the nation report wanting to teach climate change related topics, but few feel they have adequate preparation to do so. We recommend that any professional learning efforts provide adult-level content knowledge in both the science of climate change and the environmental and social justice issues that result from the rapidly changing climate. Attention must also be given to resilience and the social-emotional effects of climate change.

In order to provide a comprehensive understanding of the science and justice issues, instruction on policies related to climate change should also be included in all professional learning initiatives for teachers. There should be clear and explicit instruction on climate change content both in science as well as other content areas, including but not limited to visual and performing arts; comprehensive health and physical education; social studies; world languages; computer science and design thinking; and career readiness, life literacies and key skills. While the New Jersey Student Learning Standards for English language arts and mathematics do not have specific climate change standards, districts should also consider how they can design interdisciplinary climate change units that incorporate relevant ELA and math standards.

Furthermore, experiential learning is essential, and represents a commitment to active learning. It is not enough to simply provide video or text-based resources for teachers. They should have opportunities to interact with data, read and react to policies, synthesize across content areas, and reflect on their own learning experiences. Engaging with authentic problems through a multidisciplinary lens allows teachers to truly grasp the comprehensive nature of climate change and its effects.

Professional learning efforts must include opportunities for collaboration and mentorship.

Likewise, we recommend that climate change education professional development experiences for teachers allow opportunities for collaboration. This can include opportunities to collaborate with teachers from their own schools and/or with others throughout the region and state to share best practices and ideas. These experiences can build relationships that support teachers as they develop their own content knowledge and pedagogical skills. Collaboration with mentors is also key to success.

Professional learning efforts should model effective classroom practices and clarify the disproportionate effects of climate change on vulnerable communities.

In order to model effective practice, teachers should interact with curricula and instructional materials they could potentially incorporate into their future classroom practice. Professional learning activities should focus on developmentally-appropriate and grade-level specific activities[2] that consider local and global contexts. This includes emphasizing the disproportionate effects of climate change on communities of color, immigrant communities, and low-income communities. It must be acknowledged that climate change does not affect all citizens equally and the difference in these effects can further marginalize vulnerable communities and populations. Professional learning should focus on how to design learning experiences that focus on age-appropriate messages to children in their classrooms that include solutions to climate-change-related problems, mitigation strategies and hopeful mindsets.

Issues specific to New Jersey, or regions within our state provide context and motivation for teacher and student learning and provide authentic examples students can personally observe. Situating this learning within a global context can help teachers to understand the role that individuals and regions play in these areas. Taking a systemic approach allows teachers to see the connections between cause and effect and the consequences on local and global scales. Interdisciplinary learning strategies that emphasize solution-based approaches, including problem-based learning, the engineering design process and arts-integrated learning foster a more comprehensive and nuanced view of climate-change related problems.

Climate change professional learning should be sustained over a period of three to five years and include multiple opportunities for reflection and revision.

School leadership, including school boards, administrators, and teacher-leaders must be involved in making decisions related to the structure, format and timeframe for professional learning. To be effective, professional learning efforts should be sustained over an adequate period of time of at least three to five years. Feedback from peers, school leaders, community leaders, and experts should be integral to the professional learning experiences to allow teachers opportunities to reflect, grow, and continually improve their classroom practice. All teachers should be provided with planning and preparation time dedicated to climate change education throughout the course of the professional learning implementation to ensure they are able to continuously improve on their practice and planning over time.

Climate change professional learning efforts must be funded in such a way that schools with

2 See *Curricular Resources* section for more guidance on curricula.

more need receive the necessary money and assistance. These efforts should be inclusive of all learners, including those who need additional support and modifications.

It should be acknowledged that not all teachers, schools or districts have the same needs, background knowledge, funding or available materials to implement comprehensive climate change education across all grade levels and content areas. Thus, they have vastly different needs in terms of professional learning. Furthermore, research demonstrates that solution-based learning and STEM/STEAM initiatives often exclude children with special learning needs and English language learners. An equity-driven approach, in which those schools or districts with higher needs are prioritized to receive support in planning professional learning initiatives, should drive decision making in distributing resources, with an emphasis on providing the most support to urban schools. Documentation of needs should be simple and straightforward, and not contingent on competitive processes.

Teachers should have input into which modality (in-person, remote, or hybrid) is used for professional learning efforts within schools and districts.

With regard to modality, teachers should have input into the decision-making process for professional learning planning. Districts, or individual teachers within, may wish to consider online, face-to-face, or hybrid formats, depending on needs, cost, and time available. Research suggests that all modalities of professional learning can be effective, but the content covered, opportunities for collaboration, and teacher preferences are essential for successful implementation. Regardless of format, best practices with respect to collaboration, modeling effective practices, active learning, and reflection should be implemented.

Schools and districts should have access to available professional development resources and tools available for free or at a low cost by reputable organizations. Locally, various organizations provide professional development in this area including: Alliance for New Jersey Environmental Educators (ANJEE), New Jersey Science Teachers Association (NJSTA), New Jersey Council for the Social Studies (NJCSS), New Jersey Audubon, New Jersey School Boards Association/U.S Army, STEAM Tank Entrepreneurial Design Challenge, New Jersey STEM Pathways, the New Jersey School of Conservation, and local colleges and universities[3] such as The College of New Jersey and Rutgers University. Developing partnerships with these organizations and building district-specific plans for utilizing these tools can help create supportive networks and sustainable plans for implementing climate change education across grades and content areas.

[3] NOTE: This is not an exhaustive list of organizations and resources, rather an example of some systems that may currently have the capacity to support this work.

Benchmarks for Professional Learning:

- Boards of education will include climate change education professional learning for teachers and school staff in strategic plans and budgets.
  - By the end of Year 1, all schools should have a five-year plan for implementing climate change education professional learning.
  - By the end of Year 3, 50% of teachers and school support staff will receive training in climate change education.
  - By the end of Year 5, all teachers and school staff should receive training in this area.
- Boards of education will facilitate discussion and connections between green-collar industries and environmental resources within school communities and school administrators.
  - By the end of Year 1, community assets (e.g. businesses, parks, government agencies, and concerned citizens groups) will be identified by board members and others in the education community.
  - By the end of Year 3, schools and districts should have regular meetings with community stakeholders.
  - By the end of Year 5, relationships between community and school will be strengthened. Student internships, field trips, and guest lectures can ensure that the communication between school and community grows.
- School administrators will identify climate change professional learning needs for teachers and school staff (e.g. content deepening, practical classroom skills, resource identification).
  - By the end of Year 1, a professional learning plan will be created to meet these identified needs.
  - By the end of Year 3, at least 50% of teachers and staff will be provided multiple opportunities to attend professional learning on climate change.
  - By the end of Year 5, all teachers and school staff will engage in sustained professional learning on climate change.
- School administrators will facilitate relationships between teachers of different content areas and grade levels to ensure a well-articulated implementation of climate change education across all grade levels and content areas.

  - By the end of Year 1, a needs assessment identifying places for collaboration will be created.
  - By the end of Year 3, every school will have dedicated time for collaborative planning.
  - By the end of Year 5, ongoing inter-, trans-, and cross-curricular climate change instruction will take place across all grade levels and content areas.
- School administrators will facilitate relationships between faculty and staff to ensure that school-specific climate change issues (e.g. energy conservation) and actions (e.g. composting food waste) are central to place-based instructional efforts in this area.
  - By the end of Year 1, a needs assessment identifying opportunities for collaboration will be created.
  - By the end of Year 3, every school will have school-specific interdisciplinary climate change education initiatives.
  - By the end of Year 5, establish place-based and school-specific climate change learning activities.
- School administrators and their respective school boards will work to identify existing professional development resources from reputable local organizations (e.g. higher education, environmental education professional groups, etc.) to connect teachers to high-quality professional learning opportunities.
- Teachers will attend professional learning to deepen content knowledge and pedagogical skill.
  - By the end of Year 1, 100% of teachers will attend some climate change professional learning to provide a basic understanding of climate change and its effects in New Jersey.
  - By the end of Year 2, school-based teams of teachers (e.g. grade level or content area departments, professional learning communities) will discuss climate change education and further identify needs and opportunities.
  - By the end of Year 5, all teachers will attend climate change professional learning opportunities to expand their understanding past the initial instruction on climate change.

- Teachers will receive professional learning regarding green skills, green-collar jobs, climate change mitigation strategies, and solution-based learning methodologies alongside climate change content.
  - By the end of Year 1, 20% of teachers will receive training in these areas.
  - By the end of Year 3, 50% of teachers will receive training in these areas.
  - By the end of Year 5, all teachers will receive training in these areas.
- School staff will attend professional learning on climate change mitigation strategies, such as waste reduction, composting and energy management.
  - By the end of Year 1, 20% of school staff will receive training in these areas.
  - By the end of Year 3, 50% of school staff will receive training in these areas.
  - By the end of Year 5, all school staff will receive training in these areas.
- Schools will educate families about climate change through reports, community meetings, electronic resources, or other formats best suited to their particular community.

Assessment:

An online survey tool could be used yearly for teachers, school staff, administrators and school board members to document progress with regard to each of these professional development benchmarks. These surveys can also be supplemented with site visits by peers from across the state serving in a "critical friend" role and providing formative feedback.

KEY NEED 2: Curricular Resources

Educators need access to high-quality curricular resources at a variety of entry points.

Curricular resources should be selected using research-based frameworks.

In order to implement climate change education across all grade levels and content areas, teachers need access to high quality curricular resources. The United Nations Educational Scientific and Cultural Organization's (UNESCO) International Bureau of Education offers guidance for what makes a quality curriculum in its report, *Current and Critical Issues in the Curriculum and Learning* (Stabback, 2016). It is recommended that the following criteria guide the process of developing climate change curriculum:

1. **It is planned and systematic.** It is not simply an "add on" to an unconnected lesson.
2. **It is inclusive and consultative.** The voices of teachers, community members, children, and families should all influence decision-making regarding curriculum development or adoption.
3. **It is led by curriculum professionals.** Teacher-leaders, subject matter experts and higher education professionals should be consulted.
4. **It is cyclical in nature.** After teachers and children have a chance to reflect on learning, curriculum should be evaluated and updated accordingly.
5. **It is sustainable.** The cyclical nature of curriculum ensures the process of continuous improvement over time.

Multiple entry points must be available to teachers when selecting climate change curricula. Teachers should have opportunities to refine and modify curricular selections over time.

To implement K-12 climate change education across the curriculum, teachers need access to instructional materials they can implement as-is or with minimal modification. These instructional resources should build upon existing strengths and programs currently used in schools.

For example, tried and true materials focused on teaching about weather can be modified to differentiate between weather and climate. This sort of work allows teachers and schools to use a cyclical approach to integrate up-to-date credible research into their daily practice. The practice of regularly reflecting upon experiences and updating curricula based on the latest research leads to sustainable curriculum development.

Curricular resources should be easily searchable, retrievable, and developed by educational professionals.

Curricular resources should be organized in a well-curated and easily searchable database to minimize time spent searching and ensuring a systematic planning approach to curriculum development and implementation. Teachers should be able to search by type, grade level, and content area as well as for multidisciplinary tools, activities, lessons and units. All recommendations on the database should be professionally vetted tools, in an effort to follow the lead of curriculum professionals. Professional organizations' endorsements are one mechanism for ensuring high-quality materials. These may be national, regional or local organizations. Other mechanisms for ensuring content accuracy include expert review by content area and pedagogical experts in environmental education.

Nontraditional curricular resources should be valued alongside standard lessons and units.

Curricular tools should be viewed as broadly as possible. Resources such as children's books, arts-based resources, virtual field trips, videos, webinars and games should be included. As teachers accrue experience teaching about climate change, they can submit exemplar curricular tools to be included among the resources. Educators need adequate time and funding[4] for familiarization with new curricula and classroom materials.

Resources should include a variety of structures from scripted to open-ended. Curricular resources should include opportunities for differentiation and inclusion.

Resources should include multiple entry points to allow for all teachers to adapt them to their unique needs. For example, a teacher less familiar with climate change might be more comfortable using a fairly scripted single lesson plan, while a teacher confident in their ability to teach about climate change might be more interested in some general topics for a project-based learning activity they can personalize for their own classroom. Providing shorter, scaffolded, and more straightforward structured plans provides all teachers appropriate tools for enacting climate change education and allows the opportunity for success to be an impetus for further exploration in future iterations. Kwauk and Winthrop (2021) provide a multitude of examples around the globe of successful problem-based learning activities empowering students to develop solutions within their own contexts and communities, suggesting that these types of experiences should be encouraged and evolve over time as teachers and students become more comfortable teaching about climate change.

4 See *Professional Learning* section for more on this concern.

Curricular resources should include relevant and fact-based information regarding the disproportionate effects of climate change on vulnerable communities and emerging career paths for students to pursue.

Curriculum resources should acknowledge and address the disproportionate negative effects of climate change experienced by low-income communities, communities of color, and immigrant communities within our state and around the world. Kwauk and Winthrop (2021) reported on many disproportionate adverse effects on low-income communities from school closures due to climate-related natural disasters (flooding, drought, wildfire, etc). Hopeful mindsets, climate change mitigation strategies, and solution-based learning should be central themes in curricular materials. These should also include examples of "green collar" industries and career paths that provide concrete and specific guidance for how this hopeful mindset can manifest. Other strategies for mitigating the effects of climate change—for example, installing rain gardens to lessen the effects of more frequent storms and precipitation—can provide meaningful and tangible examples of solutions for students of all ages to observe. Ensure that any examples provided or challenges given to children are developmentally appropriate and understandable by the students at the target grade level. Curricular resources, even those intended for use in science classes specifically, should directly address the scope of climate change problems and solutions beyond science alone. For example, directly addressing the economic benefits of mitigation strategies can add relevance to engineering design challenges related to carbon capture and sequestration. Using examples of youth climate activists such as Greta Thunburg can help students contextualize science content with respect to civic engagement and action.

Benchmarks for Curriculum:

- Over the course of five years, school administrators should allow teachers multiple entry points to implementing climate change education in their classrooms, with the goal of engaging in interactive problem-based learning approaches related to climate change.
  - School administrators should ensure that curricular resources are equitable and inclusive of all learners regardless of learning differences, developmental level or language.
  - Teachers should have input into deciding which curriculum should be adopted.
  - Facilities professionals should support teachers and students in using the

school building itself as a living laboratory. Energy use, food and water waste, use of space, climate control, and vendor selection provide rich and meaningful place-based phenomena for examining climate change, its impacts and mitigation strategies.

- Children should have input into to which climate-related phenomena are explored more deeply in their schools and classrooms.
- Families should be involved in curriculum implementation, especially when they can provide mentorship to students engaged in projects or as an audience to which students can present their work.

Assessment:

Districts should self-assess progress on each of these curriculum benchmarks yearly via an online survey. Time will be dedicated to schoolwide professional development to reflect on progress with respect to each benchmark and allow time to identify areas in which additional work is needed.

KEY NEED 3: Community-Based Climate Change Education

Climate change education initiatives should consider school-specific context.

Climate education initiatives should connect global issues with those in local communities.

All curriculum and professional development resources should be created within the context of local communities with clear and direct connections to global issues. Unsustainable human impacts on Earth are the leading cause of climate change.

This bigger picture view can aid teachers in viewing the phenomenon of climate change and serve as a grounding point for lessons and activities. Cloud (2014) offers one framework for viewing these contextual factors and implementing education for sustainability within a classroom setting, mindful that climate change is the result of human action. This framework also acknowledges that humans have agency and can learn to mitigate the effects of climate change and have positive impacts on the communities and systems in which they live.

Place-based approaches with local and regional examples should be prioritized in all curricular and professional learning efforts.

Research suggests that place-based approaches to climate change education are most likely to help individuals observe direct effects of human impact on their environment and spark change in attitudes and behaviors (Khadka et al, 2020).

We suggest that specific lessons and activities should center on the effects of climate change observed at the school and community level (e.g. harmful algal blooms, air quality monitoring, or sea level rise) both with respect to professional learning materials and curricular resources. These direct effects add salience and a sense of place in a way that discussing polar bears that live on melting icebergs, for example, do not. Exposure and connection to local community issues helps young children make sense of broader global effects.

To further connect individual teachers and students to local effects of climate change, we suggest helping teachers to identify lists of municipal resources, such as recycling centers or energy cogeneration plants, to better understand climate change mitigation at the local level. Assisting teachers and students in partnering with organizations such as colleges and universities, government agencies and environmental organizations can help produce a multifaceted view of climate change itself, its effects and strategies for combating it.

All voices in a community including those of families, children, teachers, business owners and community organizations should be considered in climate change education initiatives.

Decision-making with regard to curriculum adoption and professional development should

provide for the opportunity for all school community members to provide input.

One specific example for collaborating with community partners at the middle and secondary levels is to allow students to work with businesses regarding long-term plans for sustainability or climate change mitigation. Younger children could focus on letter-writing campaigns or visits to local organizations to better understand the role they play within communities and how climate change affects their work.

Decision makers should solicit and carefully consider the voices and views of children in conversations about climate change.

To start, teachers and students can generate lists of questions for their administrators, school leaders, local government and the business community to create a clearer understanding of how these entities are interrelated and can work together to address climate change.

Further, elements of school leadership often considered outside of teaching and learning, such as school finance and grounds/facilities management, can become part of the conversation with teachers and children to gain a better understanding concerning the local effects of climate change and strategies to address them.

A state-supported youth climate corps could ensure that comprehensive statewide initiatives keep youth voices central in all discussions.

Solutions for mitigating climate change have the potential to yield considerable financial impacts on all systems, including schools, as well as students seeking career paths.

Climate change should be explored as an issue relative to the systems within which it exists: economic, environmental, social, and political decisions contributed to the current state of our climate. Efforts to mitigate climate change within schools should be part of efforts related to teaching and learning. For example, school-based waste reduction initiatives should be included in curricular and professional development efforts to connect the physical place of a school to the learning activities going on within that space.

Benchmarks for Community-Based Climate Change Education Initiatives:

- School and district leaders should identify supportive organizational systems to assist in planning and implementation of climate change education such as: Sustainable Jersey for Schools, National Wildlife Foundation's EcoSchools,

and the U.S. Department of Education's Green Ribbon Schools. Teachers and administrators should have adequate time and resources to participate in such programs.

- Districts should evaluate and consider supportive educational frameworks to guide curricular decision making, such as the Cloud Institute's framework, the United Nations' Sustainable Development Goals, or the North American Association for Environmental Education (NAAEE) framework for environmental education.
- School boards and administrators should identify community-based resources to support climate change education initiatives.
  - By the end of Year 2after climate change standard implementation, schools and districts should have initial meetings with local stakeholders.
  - By the end of Year 3, regular meetings between these communities should take place, including and highlighting economic savings and career opportunities for students.

KEY NEED 4: Support from Boards of Education and School Administration

Effective leadership support from boards and administrators for climate change education is essential.

The role of a board of education is not to run the schools, but to see that they are well run. In order to accomplish this, a board writes and adopts policies. Policies are the written expression of the board's desires for the district's students. A board of education is a policy-making body and sustainability and climate change policies can be part of every school district in New Jersey.

School boards should ensure communication regarding climate change is accurate, straightforward and inclusive of career pathways and financial benefits to mitigation efforts.

Effective communication between all stakeholders in schools and communities represents one role of the school board. The board can work to ensure that the district has a clear, nonpartisan and understanding of climate change and communicates to the greater community the impacts that it will have on the district and its children. In other words, the communication must not be too complicated, and should be presented as opportunities for the community and its children. That common language describing climate change should be created in such a way that the benefit to children is evident, as is the need for the community to support implementation. One example of the benefit of understanding climate change would be the emerging green collar careers related to climate change and the enormous opportunities for students to learn about these career pathways. These opportunities should be communicated to the entire school community, including families and all staff members.

School districts should incorporate climate change education goals in their strategic plan, including professional learning, curriculum, engagement with the community, and identifying resources and funding.

A school district strategic plan should include strategies for implementing climate change education goals, including identifying resources and funding, curriculum development and professional learning plans that include resources and professional organizations which support training teachers as well as other staff members. Such professional learning would also include training for board members so they can be informed on how to make the best decisions when approving curricula that implements the climate change standards and other climate change related topics. In addition, there should also be training for facility directors, nurses, guidance counselors, support staff, students and families.

A district strategic plan could also include climate change goals, and include strategies for engaging the community and for soliciting the views of students on the topic of climate change.

Boards of education should support workforce development and career opportunities in green collar jobs in middle or upper elementary school.

School boards should support the work of connecting schools with opportunities to green collar careers for students starting at middle school. Both non-college bound and college pathways should be made available to every district in New Jersey. Distribution of this information should not be limited to the school district. It should include New Jersey Parent Teachers Association (NJPTA), New Jersey Education Association (NJEA) and every educational leadership organization in the state. It should align with the New Jersey Energy Master Plan and many other green collar trades, including green building, design and architecture as well as business and agriculture (food security) and transportation industries.

We will need a sustainable workforce to address climate change and currently there is limited information about career pathways in the green industries in schools.

School board members should be prepared to ask questions regarding climate change education to evaluate effectiveness, set goals and achieve financial sustainability.

Board members should be provided with guiding questions for the governing areas of a school district so they can recognize high-quality content and key components of climate change education.

In addition, boards would benefit from guidance on topics such as developing districtwide sustainability goals, communicating with the public, green purchasing, and green facilities and grounds practices.

Board members should be prepared to ask questions and request periodic reports from the superintendent about the progress the district is making in meeting the climate change education benchmarks.

Measures of effectiveness of climate change education can vary, but can include: implementation of curricular materials, time devoted to climate change education efforts in the classroom, identifying and nurturing partnerships within schools and between schools and communities, and school-based climate change mitigation projects such as installation of green infrastructure, and others.

Afterword

The climate crisis remains one of the most critical threats to the planet, and its effects are especially pronounced in New Jersey. The need to develop solutions to this crisis is urgent. Research demonstrates that even a small increase in access to climate change education can result in carbon emission reduction on the order of tens of gigatons. New Jersey sits at the forefront of change with its bold and ambitious commitment to ensuring that all children learn about climate change from the earliest stages of their education and from a multifaceted perspective. Preparing children and teachers with high-quality instruction about climate change will ensure our state is ready to staff green-collar jobs of the future. With these well-prepared citizens of the future, New Jersey will have set the stage for 100% clean energy in 2050.

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