SCIENCE & TECHNOLOGY POLICY INSTITUTE

Summary of the NSF Design and Discovery Forum: Climate Science, Children, and the Media

Lisa M. Van Pay
Rina L. Zhang
Matthew A. Ishimaru

May 2022

Approved for public release;
distribution is unlimited.

IDA Document NS D-33104

Log: H 22-000213

IDA SCIENCE & TECHNOLOGY
POLICY INSTITUTE
1701 Pennsylvania Ave., Suite 500
Washington, DC 20006-5825

The Institute for Defense Analyses is a nonprofit corporation that operates three Federally Funded Research and Development Centers. Its mission is to answer the most challenging U.S. security and science policy questions with objective analysis, leveraging extraordinary scientific, technical, and analytic expertise.

About This Publication

This work was conducted by the IDA Science and Technology Policy Institute under contract NSFOIA-0408601, project NF-20-4895, "FY21 Charting the Course for STEM Education of the Future: Challenges and Enduring Questions" for the National Science Foundation. The views, opinions, and findings should not be construed as representing the official positions of the National Science Foundation or the sponsoring office.

For More Information

Brian L. Zuckerman, Project Leader
bzuckerm@ida.org, 202-419-5485

Kristen M. Kulinowski, Director, Science and Technology Policy Institute
kkulinow@ida.org, 202-419-5491

Copyright Notice

© 2022 Institute for Defense Analyses
730 East Glebe Road, Alexandria, Virginia 22305-3086 • (703) 845-2000.

This material may be reproduced by or for the U.S. Government pursuant to the copyright license under the clause at FAR 52.227-14 [Dec 2017].

Rigorous Analysis | Trusted Expertise | Service to the Nation

Summary of the NSF Design and Discovery Forum: Climate Science, Children, and the Media

A. Background and Motivation

The National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR) engaged the Science and Technology Policy Institute (STPI) to assist in developing the Climate Science, Children, and the Media forum to stimulate a national conversation on the topic of climate science education for children ages 5–11. As communities work to adapt to ongoing changes and mitigate future effects of climate change, there is a growing need to understand how to best communicate these concepts to young learners and inspire the next generation of scientists.

STPI staff members worked with NSF to refine the overall concept, develop the agenda and program format, identify subject matter experts for each session, and aid in execution of the event. The meeting explored the potential for the media industry to collaborate with the scientific community to create content that is scientifically accurate and effectively engages children with climate science. Overarching goals for the forum were to:

- Bring together members of the scientific community, industry, government, education, and philanthropy to share knowledge and strategies to create and distribute content that is scientifically accurate, entertaining, and effective at inspiring public thinking and understanding about climate change.
- Highlight the challenges and opportunities involved in creating compelling stories that consider the lived experiences, preferences, and values of children and families most impacted by climate change.
- Inspire cross-sector partnerships that sustain these activities beyond the forum.

B. Organization and Structure

The forum began with opening remarks by representatives from NSF and the White House Office of Science and Technology Policy (OSTP), followed by five panel sessions in which invited speakers discussed a set of questions relevant to each panel's topic, and ended with closing remarks from NSF. The first four panel sessions consisted of 40–45 minutes of moderated discussion among the panelists followed by a 10-minute Q&A portion during which panelists answered audience questions submitted in the Zoom chat. The fifth panel session consisted of a moderated panelist discussion and did not include

audience Q&A. Each group of panelists self-organized during preparatory sessions in advance of the forum to develop and customize guiding questions for discussion that aligned with their interests and expertise. The event agenda and speaker biographies are included in Appendix A, links to resources shared by the invited speakers and audience members via the Zoom chat are compiled in Appendix B.

Two short video montages produced by Nickelodeon were shown at the beginning of the first and fourth panel sessions. The selected clips exemplified how fiction and non-fiction media content can be used to increase public awareness of issues, as well as to deliver evidence-based information to aid in decision making. Select topics related to early childhood development, reproductive health, and the climate crisis were included in the videos as examples.

During each panel session a graphic illustrator, Karina Branson of ConverSketch, created visual representations of the discussions that took place. A summary of the proceedings of each panel session and copies of the final illustrations are provided below. Videos of each panel session can be viewed on the NSF website at https://www.nsf.gov/ehr/2022CSCMVideo.jsp

C. Opening Remarks

Lori Takeuchi, program director in the NSF EHR's Division of Research on Learning in Formal and Informal Settings, began the forum by welcoming the audience and invited speakers. Sylvia Butterfield, acting assistant director of EHR, introduced Jane Lubchenco, deputy director for climate and the environment at OSTP.

Dr. Lubchenco recounted a personal experience with climate science communication as a grandmother to young grandchildren. She described how her grandchildren noticed the declining population of sea stars at their local beach, a possible effect of climate change. She explained to the children that many people are working to address climate change, and emphasized that mitigating the impacts of climate change will require both individual and collective action. She hoped that the media industry would similarly inspire young learners by telling stories of people working towards innovative solutions to climate change. Dr. Lubchenco noted that children strongly influence the views and behavior of adults in their lives; media strategies that effectively communicate scientific ideas to children may have an impact beyond young target audiences. She concluded her remarks by thanking participants, and provided advice that helped shape the discussion: “Thank you for embracing this challenge and creating compelling content that gives kids agency, tools and hope.”

Alexandra Isern, assistant director of the Directorate for Geosciences at NSF, spoke about how the Nation’s youth are increasingly concerned about climate change. She described how NSF is working to advance climate change solutions and climate resilience

through its investment in research and development and public education activities. NSF strives to increase the diversity and effectiveness of the U.S. STEM (Science, Technology, Engineering, and Mathematics) workforce by sparking young learners' interest in science, in part through partnerships with educational television programs (e.g., *Design Squad*, *Bill Nye the Science Guy*, and *The Magic School Bus*) that effectively engage with children. She described her own experience with science communication and outreach as an Antarctic researcher and challenged the scientific community to inspire the next generation of scientists through storytelling.

Lee Zia, acting director of NSF EHR's Division of Graduate Education, thanked the participants for attending. He explained that the forum was a continuation of a series of events on formal and informal learning convened by EHR. NSF's objective for the forum was to stimulate the STEM education R&D field to dig into issues related to communicating climate science to children, to enable formation of partnerships among the media industry and scientific communities, and lay the foundation for progress in a number of areas.

D. Communicating to Children about Climate Change: A Cross-sectoral Call to Action

The objective of this session was to illustrate the potential of entertainment media in informing children and families about scientific issues, as well as the complex nature of climate science communication. This panel was moderated by Michael Levine, senior vice president of learning and impact at Noggin. After introducing the first video montage highlighting past science-media collaborations, Michael asked each panelist to consider how their work contributes to or generates content that educates children about climate change issues.

Allison Crimmins, director of the Fifth National Climate Assessment, described how the assessment draws upon the work of hundreds of authors to illustrate the observed and projected effects of climate change in the United States. By focusing on local perspectives, the assessment helps people understand how climate change affects their communities as well as identify potential mitigation and adaptation actions. She said informing children about climate change issues is insufficient; they must be empowered to engage with the science as well.

Nathaniel Kendall-Taylor, CEO at the FrameWorks Institute, spoke from his experience as a psychological anthropologist. He warned that poorly designed communication strategies are not only ineffective but can have the opposite effect of what was intended. Science communicators need to consider how kids think about climate issues rather than simply transmitting adult perspectives. Climate change issues are often framed as problems, deficits, and vulnerabilities; Nathaniel recommended a solutions-focused framing of climate change issues that focuses on aspirations and goals designed at the

appropriate developmental level for these young learners. He highlighted the Yale Program on Climate Change Communication's studies of how different sociodemographic groups respond to information about climate change and suggested following the example of young climate advocates who effectively communicate with their peers.

Gary Knell, senior advisor at the Boston Consulting Group, expressed how television is a powerful educational tool that can make complex topics accessible to young learners and inspire them to make a difference. Television shows like *Sesame Street* use developmentally appropriate framing to teach children about public health issues like AIDS, nutrition, and malaria. He suggested that climate science communicators tap into children's inherent curiosity about nature and passion for exploration to capture the attention of young learners.

Laura Schifter, senior fellow with K12 Climate Action with the Aspen Institute, described lessons she learned while working on climate education initiatives for formal learning environments. She also recommended a solutions-based framing of climate issues, noting that a great majority of teens are not learning about climate change adaptation and mitigation strategies in school. Media can help fill these knowledge gaps and create opportunities for young people to advance climate solutions in their communities.

Figure 1 illustrates the key themes discussed during this panel, which included:

1. Communication Strategies Should Be Interdisciplinary and Multi-pronged

Connections to climate change should be woven throughout educational curricula and content designed for young learners—climate-related topics should not be solely reserved for science-focused courses and content. Communications strategies for climate education must be collaborative and collective; content should be designed through interdisciplinary partnerships with climate scientists, developmental scientists, communication scientists, and other stakeholders and should be transmitted through a diverse range of media and messengers.

2. Climate Communications Frameworks Should Focus on Empowering Action

There was a consensus among panelists that climate change education should balance the urgency of the climate crisis with a sense of efficacy in the potential for climate solutions. Communications strategies highlighting opportunities to mitigate and adapt to these challenges, but that do not minimize the gravity of the climate crisis, have been persuasive and engaging for young learners.

3. Solutions Should Include Both Individual and Collective Actions

Panelists agreed that individual and collective actions are both important when discussing climate change solutions. Historically, climate change messaging has focused

on individual behavior, but individual actions should be scaffolded into collective efforts to be most effective. One panelist noted that participation in collective action has the added benefit of improving mental health in a time when climate anxiety is a growing concern among parents and children.

4. The Media Industry Should Make Climate Part of the Narrative

Panelists contrasted climate change with other successful public messaging campaigns (e.g., automobile safety, smoking), commenting that climate change education requires a more involved approach compared to public health issues with relatively simple solutions. Programming that incorporates climate change topics should remain focused on audience engagement and entertainment, not the climate story per se. Science communicators should incorporate climate issues into the narrative within interactive media such as gaming platforms and social media content.

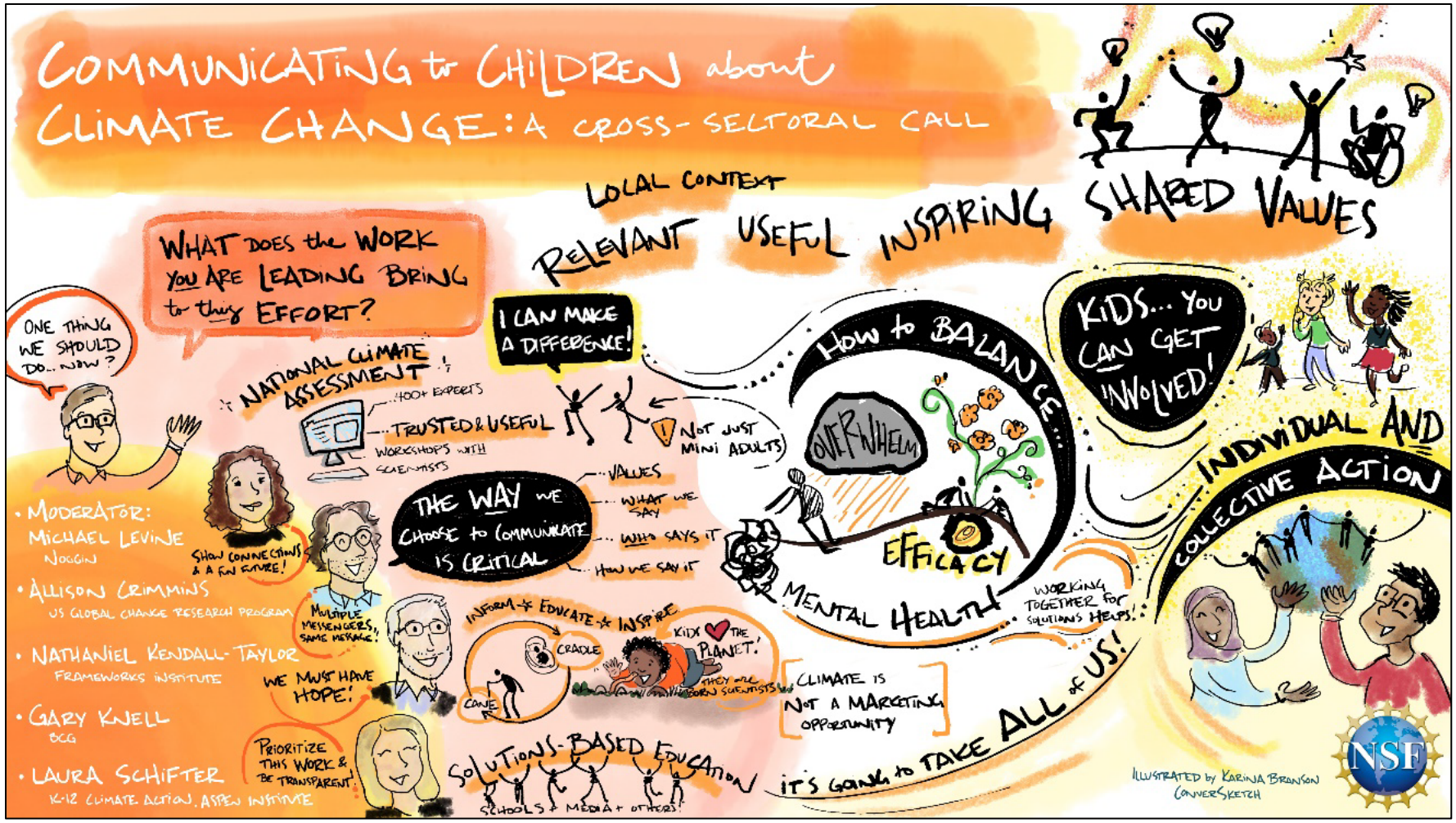

Figure 1. Graphic Illustration of Topics Discussed during "Communicating to Children about Climate Change: A Cross-sectoral Call to Action"

E. Inclusive Science Communication: Creating Compelling Stories Together

The goal of this session was to explore the challenges and opportunities associated with inclusive storytelling. Panelists were asked to discuss their perspectives and share best practices for creating compelling stories that consider the lived experiences, preferences, and values of children and families most impacted by climate change. These frontline communities "…experience the 'first and worst' consequences of climate change"[1] and include communities of color, Indigenous, and low-income communities. Sunshine Menezes, clinical associate professor of environmental communications at the University of Rhode Island (URI) and executive director of the Metcalf Institute, began the panel by emphasizing the importance of engaging marginalized communities in conversations about climate science. Communication practices centered around inclusion and equity represent a major paradigm shift for the scientific community that will require new mindsets and frameworks.

Kevin Clark, a children's media consultant on issues of diversity, content development, and strategy, recounted a conversation he had with his son, who works at an environmental advocacy organization. His son said that conversations around climate change solutions must involve discussions about how uncomfortable we are willing to be, and that this level of discomfort provides a real indication of our willingness for change. Kevin said his son's perspective helped him realize the importance of engaging young people throughout the process of climate change content design and creation, which may lead to uncomfortable conversations but is necessary for effective communication.

Haley Case-Scott, a junior policy advisor for climate and energy at OSTP, is an enrolled member of the Confederated Tribes of Siletz Indians and a descendant of the Yurok Tribe, Klamath Tribes, and the Sakoagan Band of Chippewa Indians. Haley discussed her personal perspectives on Indigenous cultural values, and talked about how that could be used to inform the development of compelling stories for these communities. She spoke about the important role Indigenous Traditional Ecological Knowledge can play in climate change education. Haley highlighted how her community's strong storytelling traditions have shaped her own values and beliefs, and stressed that compelling stories can come from many different places.

Rese (Emily Therese) Cloyd, director of the American Association for the Advancement of Science (AAAS) Center for Public Engagement with Science and Technology, leads the AAAS How We Respond climate communication project. She works to engage communities in conversations about climate change by connecting climate science to real-world effects and documenting the ways in which communities respond to

[1] https://www.georgetownclimate.org/adaptation/toolkits/equitable-adaptation-toolkit/introduction.html

climate change. Rese stressed that media partners should strive to elevate and amplify the voices of community members by letting them tell their stories in their own words and through media formats tailored to the community's preferences.

Dana Williamson, an environmental health fellow hosted at the Environmental Protection Agency's Office of the Science Advisor, Policy & Engagement, spoke about her research on the historical disconnect between scientists and communities most affected by environmental injustice. A former resident of Detroit, Michigan—a city with a history of environmental inequity, she is personally motivated to uplift communities disproportionately affected by environmental degradation. Dr. Williamson explained that scientists must understand a community's values and needs and address underlying issues of inequity to build sustainable and effective partnerships.

Alicia Torres, a communication scientist with extensive experience in child development, is senior director of communication science and Hispanic outreach at Child Trends, a research organization focused on evidenced-based solutions for improving the lives of children and youth. She said that information sources vary widely between socioeconomic groups. People with lower levels of educational attainment tend to rely on local TV news for information. Messages should be tailored to the medium and audience to ensure that they reach and resonate with communities most impacted by climate change. She noted there are opportunities to use television to initiate a two-way conversation through ongoing audience research efforts. She is working to bring child development scientists together with climate and communication scientists to create a science-based roadmap for parenting during the climate crisis—with a focus on Latino families.

Figure 2 illustrates key themes discussed during this panel, which included:

1. Parental Figures Have a Sizable Role in Educating Children about Climate Change

Communication strategies for children should consider parental engagement to both help educate young audiences and inform adults in their lives about actions they can take to mitigate and adapt to climate change. Parents, grandparents, and other adults will play a significant role in preparing children for the impacts of climate change and many are increasingly interested in learning how to address these challenges.

2. Consider the Role of Indigenous Traditional Ecological Knowledge (ITEK) and Community Participation in Reaching Audiences

The value of ITEK should be emphasized but not exploited. In 2021, the Biden Administration recognized the contributions of ITEK to "scientific, technical, social, and economic advancements of the United States and to our collective understanding of the

natural world."[2] However, media creators should avoid extractive relationships—where the community that provides a resource does not benefit—and instead promote participation and consent from Tribal communities when developing content that draws upon ITEK.

3. Incorporate Social and Historical Context into Climate Change Communications

Panelists stressed the importance of social and historical context when developing effective communication strategies. Creators should seek to understand historical injustices that inform a community's response to climate change messaging and incorporate interdisciplinary perspectives when designing media messaging.

4. Empower Local Creators

Media creators should amplify local voices within communities most affected by climate change. Communication strategies that impose outside perspectives on marginalized communities can be well intentioned but are often ineffective. Relationships built with marginalized communities should be valued and preserved; organizers should not "helicopter out" once a project has concluded but should strive to support sustainable, community-led initiatives.

5. Approaches to Climate Change Communication Should Be Developmentally Appropriate

Different stages of childhood require different approaches; content designed for adolescents may not be effective for an 8-year-old. Content creators should consult with child development experts to ensure that climate change messages are audience-appropriate and engaging for different age groups.

---

[2] https://www.whitehouse.gov/wp-content/uploads/2021/11/111521-OSTP-CEQ-ITEK-Memo.pdf

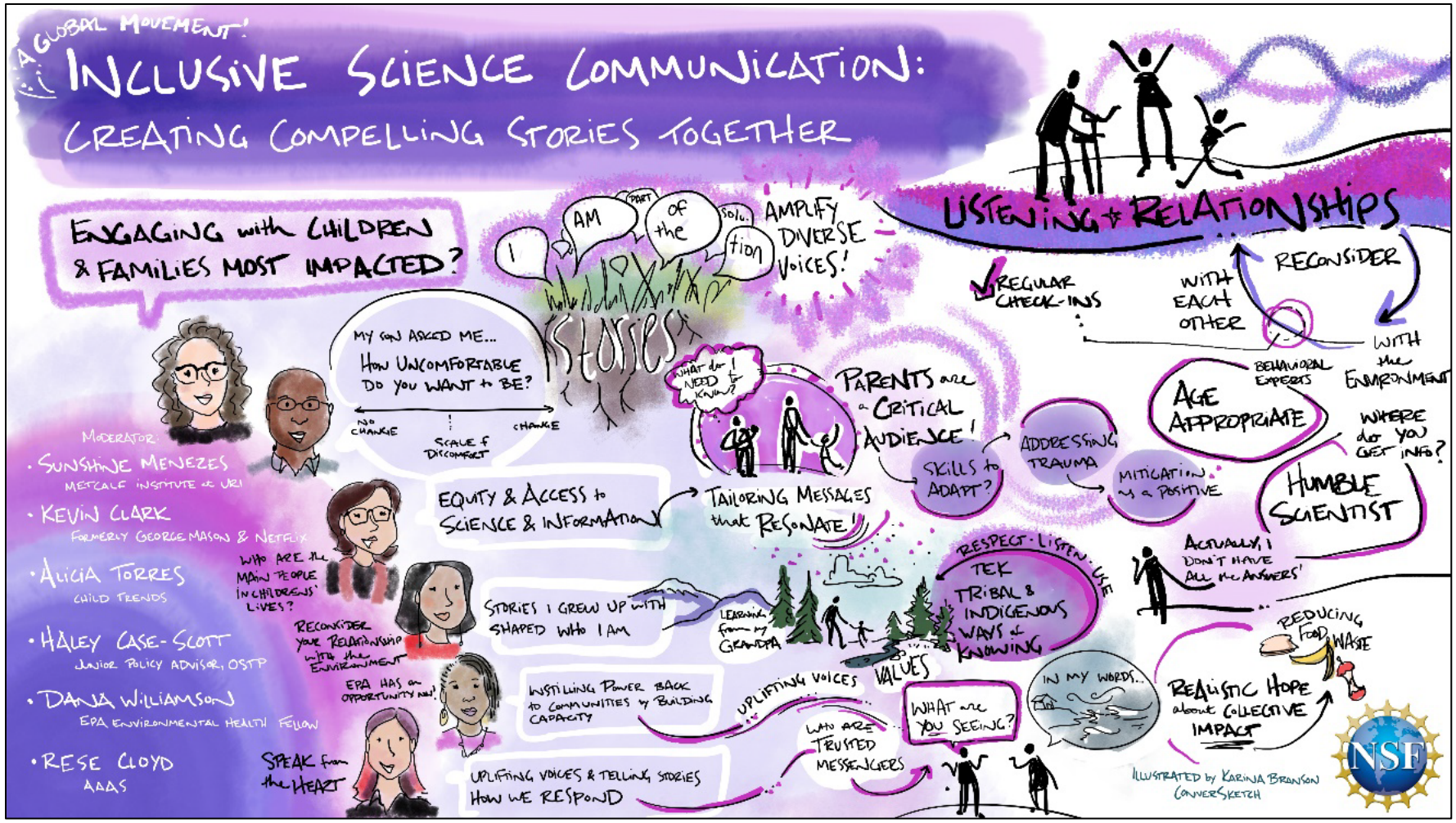

Figure 2. Graphic Illustration of Topics Discussed during "Inclusive Science Communication: Creating Compelling Stories Together"

F. Sharing the Science: What Do Kids Need to Know? What Do Producers Need to Know?

In this session, a group of physical and social scientists considered what climate change concepts are most important for children to learn. Panelists described past experiences communicating climate science to their own children and the public at large, and identified ways in which the scientific community can inform the media industry's climate communication strategies. Anya Kamenetz, an author and journalist covering education for NPR, moderated the third panel. She began by contrasting the danger posed by climate change with the danger involved in everyday activities for children, such as playing near a road. She asked panelists to reflect on these differences and why talking about climate change with children can be difficult.

Claudia Benitez-Nelson, an associate dean, Carolina distinguished professor, and oceanographer at the University of South Carolina, studies biogeochemical cycles in the ocean, among other topics. Claudia spoke about how scientists who study climate change often discuss these topics mostly with other scientists, a very different environment from communicating with kids. She said children can inspire new ways to have conversations about difficult topics such as climate.

John Fraser, a conservation psychologist, architect, and educator, serves as president and CEO of Knology.org, a social science think tank. He was actively involved in the research behind the National Network for Ocean Climate Change Interpretation[3] and is a frequent commentator in the media on climate trauma and how to talk with youth about climate change. John spoke about the emotional labor involved in talking about climate change with children, comparing it to discussing the death of a pet or loved one, because caregivers must first navigate their own sense of loss and help children find agency to process their grief.

Kate Marvel, a climate scientist at Columbia University and the NASA Goddard Institute for Space Studies, studies climate change through her research on climate models, observations, and paleoclimate reconstructions. Kate said that as a scientist, she views climate change as a whole-of-society issue rather than a purely scientific issue. She also spoke about competing media narratives, such as messaging that denies the existence of climate change or claims that humanity is doomed and it is too late to prevent catastrophe. She said neither of these narratives are supported by evidence from the physical sciences.

Judith Van Hoorn, professor emerita at the University of the Pacific, uses her expertise in early childhood development and education to study the global impacts of the climate crisis on children. Her research in peace psychology examines adolescents'

---

[3] NNOCCI.org

responses to rapid social change. Judith spoke about the connection between talking with children about climate change and inspiring them to love nature and to care for the planet. She emphasized the importance of starting those conversations early, with children as young as five.

Figure 3 illustrates key themes discussed during this panel, which included:

1. Tell the Truth without Terrifying

Panelists emphasized the importance of avoiding inspiration of excessive fear and anxiety about climate change, especially in young children. They noted that before the age of approximately 11, children have limited understandings of cause and effect for complicated issues. Panelists mentioned that many children, even those as young as three, have heard about climate change. Many children have experienced the effects of climate change, even if they don't know about it. Panelists suggested discussing climate change in terms of solutions and concrete actions individuals and communities can take. They also recommended incorporating discussions about climate justice.

2. Frame Climate Change for Children with Age-appropriate Analogies

Panelists spoke about encouraging in children a love for the Earth and a recognition that all human activities and Earth systems are connected. They suggested explaining that the climate is changing and carbon dioxide produced by humans is primarily responsible. Children should know about the main sources of emissions—transportation, heating, and electricity production—and should be taught about what they can do in their own lives to help. A planet sick with a fever or covered in a blanket that is too warm were mentioned as useful analogies that kids can understand. Panelists also noted the need for children to hear directly from scientists and to engage interactively through play, questioning, and informal education.

3. Shifting Baselines Shape Children's Perspectives

Because children have only experienced a climate that is changing dramatically, it can be difficult to communicate to them what is normal and what is not. Panelists spoke about the capacity of children to grapple with impressively complex ideas, an ability that grows over time. They emphasized the use of metaphors, as well as the role of the media and other resources that can help inform kids. Panelists suggested encouraging parents to listen to children and be mindful of their perspectives and reactions when discussing climate issues.

4. Employ Narratives about Communities Adapting to Climate Change

Panelists spoke about the importance of taking collective action and engaging whole communities in adapting to climate change. Communities affected by climate change

should be included in discussions about mitigation and their firsthand experiences should be sources of knowledge for policymakers and the media. The panelists also emphasized the roles that grandparents and members of intergenerational families and communities can play in helping children adapt and learn about the climate.

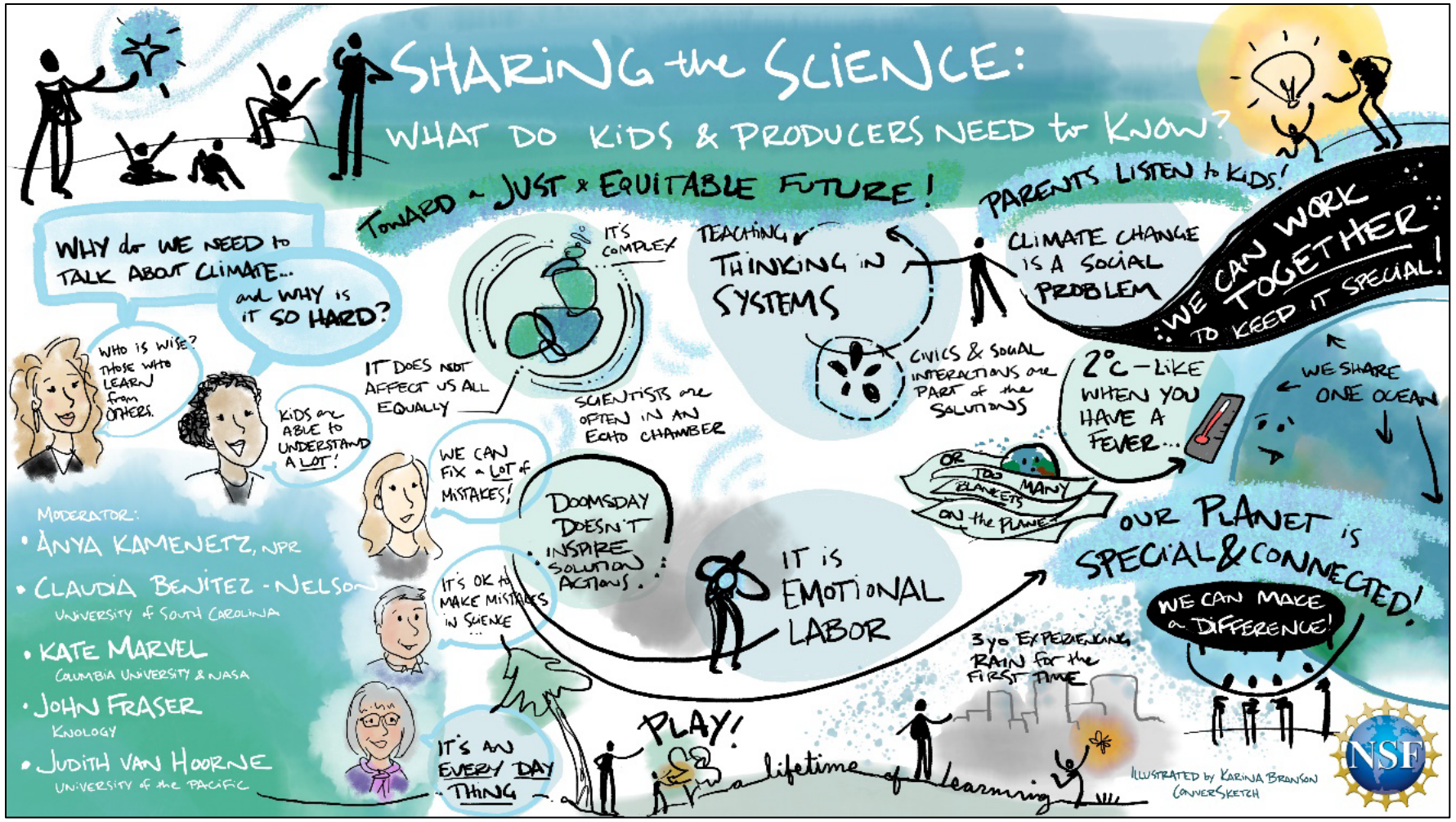

Figure 3. Graphic Illustration of Topics Discussed during "Sharing the Science: What Do Kids Need to Know? What Do Producers Need to Know?"

G. What Works? Successful Science-Media Collaborations

The fourth session explored examples of science-based media collaborations. Panelists spoke about science-media communications efforts they contributed to and identified strategies for success. Gary Knell, former CEO of National Geographic Society, NPR, and Sesame Workshop moderated this panel session titled, "What works? Successful science-media collaborations." He briefly summarized major themes of the preceding panels, highlighting the importance of communications frameworks, inclusive communication strategies, and incorporating developmental and scientific perspectives.

Marc Etkind, associate administrator for the Office of Communications at NASA, spoke about NASA's engagement activities, STEM, and climate change research. Over a million students were engaged with the recent Perseverance's landing on Mars and countless children have learned about NASA's major accomplishments like the Mars Ingenuity helicopter, Artemis lunar exploration program, and the launching of the James Webb Space Telescope. NASA educational outreach initiatives have included collaborations with numerous documentary projects, television programs, and feature films. NASA's extensive climate research activities, combined with the agency's strengths and established partnerships in media messaging, make it well suited to participate in science-media collaborations focused on climate change.

Amy Friedman, head of kids and family programming at Warner Bros., spoke based on her extensive experience in the media industry, noting that children and adolescents broadly are concerned about environmental issues. Amy walked through general media strategies for engaging with different age groups. She recommended harnessing the inherent curiosity of the youngest audiences (2–5 years old) by integrating basic understanding and real-world images of climate change into content. Children 6–11 years old are not passive receivers of content, and prefer more interactive, online media sources like YouTube. Teenagers are most concerned about impact and accountability; rather than trying to convince teenagers of the need for environmental action, content producers should elevate young voices to better understand their feelings and perspectives about climate change.

Patti Miller, chief executive officer of Too Small to Fail, an initiative of the Clinton Foundation that promotes early childhood development, described her work on communications strategies that educate parents about the need to talk, read, and sing to young children (0 to 5 years) to improve early brain development. A key strategy is to engage parents through the media they already use or watch; the initiative has embedded messaging into over a dozen popular television series, including primetime dramas, telenovelas, and competition cooking shows with varying degrees of success. Through these efforts, they learned that repetition of clear, specific messages is most effective in reaching parents. She also emphasized that education initiatives like Too Small to Fail

should "stay in their lane" when partnering with media and trust the expertise of media producers in designing content that will appeal to existing audiences. In other words, the educational experts should provide the evidence and specific messages that can help inform, while the media partners should identify opportunities to work that information into narratives that will resonate with their audiences.

Marisa Nightingale, a media strategist who translates complex health information into compelling story material, outlined lessons she learned from her extensive experience working with content creators. Long-form, serialized television provides unparalleled opportunities to tell complicated stories that raise public awareness of complex issues like climate change. Extended storylines allow media creators to depict stories that unfold over time and include many entry points and perspectives. The democratization of content creation also provides new opportunities to broaden the reach and impact of media messages through transmedia strategies that communicate to audiences over multiple platforms.

Seeta Pai, executive director of education at Boston-based public media producer GBH, spoke about her organization's efforts to provide free resources to underserved and marginalized communities. She stressed the importance of including young and diverse voices in media messaging and events like this forum, and empowering young people to use their unique strengths to educate others. Content creators should think beyond video media for communicating climate change topics to children; GBH is working with local communities to build interactive simulations and games that allow children to understand climate impacts and possible solutions. Although the impact and effectiveness of climate change education activities can partly be measured by determining whether audiences understand and retain information, content designers should also understand whether audiences change their behavior in response to the knowledge that is transmitted.

Figure 4 illustrates key themes discussed during this panel, which included:

1. Model Desired Behavior through Storytelling

One panelist identified modeling of positive behaviors as a proven strategy that can lead to behavioral changes in adult audiences. Fictional television storylines in which characters model how "talking, reading, and singing" to a baby benefits the child's development positively influences audiences to "talk, read, and sing" with their own babies in real life. Panelists suggested engraining a sense of optimism and specific depictions of what a "successful" climate future would look like into storytelling.

2. Harness Interactive Learning Opportunities

The moderator stated that the market size of the video game industry is currently larger than video media, suggesting that there may be opportunities to tap into the

popularity of interactive media to communicate ideas around climate change. NASA is engaging in immersive visual media at educational sites; there may be opportunities to engage audiences with more experiential depictions of the effects of climate change. NASA partners with PBS in creating interactive activities that allow students to use NASA and other Federal agency data to explore scientific concepts. GBH produces *Molly of Denali*, a children's television series co-produced with Alaska Native communities that is also integrated with libraries in Indigenous communities, a podcast, and lesson plans for teachers to incorporate in their own classrooms.

3. Include Assessment and Evaluation of Climate Literacy

Panelists discussed assessment and evaluation tools for determining the effectiveness of educational media and considered when summative or formative assessment strategies should be used. Content creators or partners should attempt to understand what audiences already know using formative assessment to inform content and message design. Summative assessment is often challenged by the need to use self-reported data.

4. Promote Climate Storytelling and Awareness within Large Media Organizations

Panelists gave advice on how individuals working in the public or private sector can support climate-focused storytelling within their organizations. Organizations should also support climate-focused issues in ways that best leverage their resources and capabilities, for example, in considering climate impacts in their daily operations or when developing plans for on-location video shoots. Employees can use information sessions, content seminars, or engagement with senior leadership to encourage organizations to keep climate issues in mind at all levels.

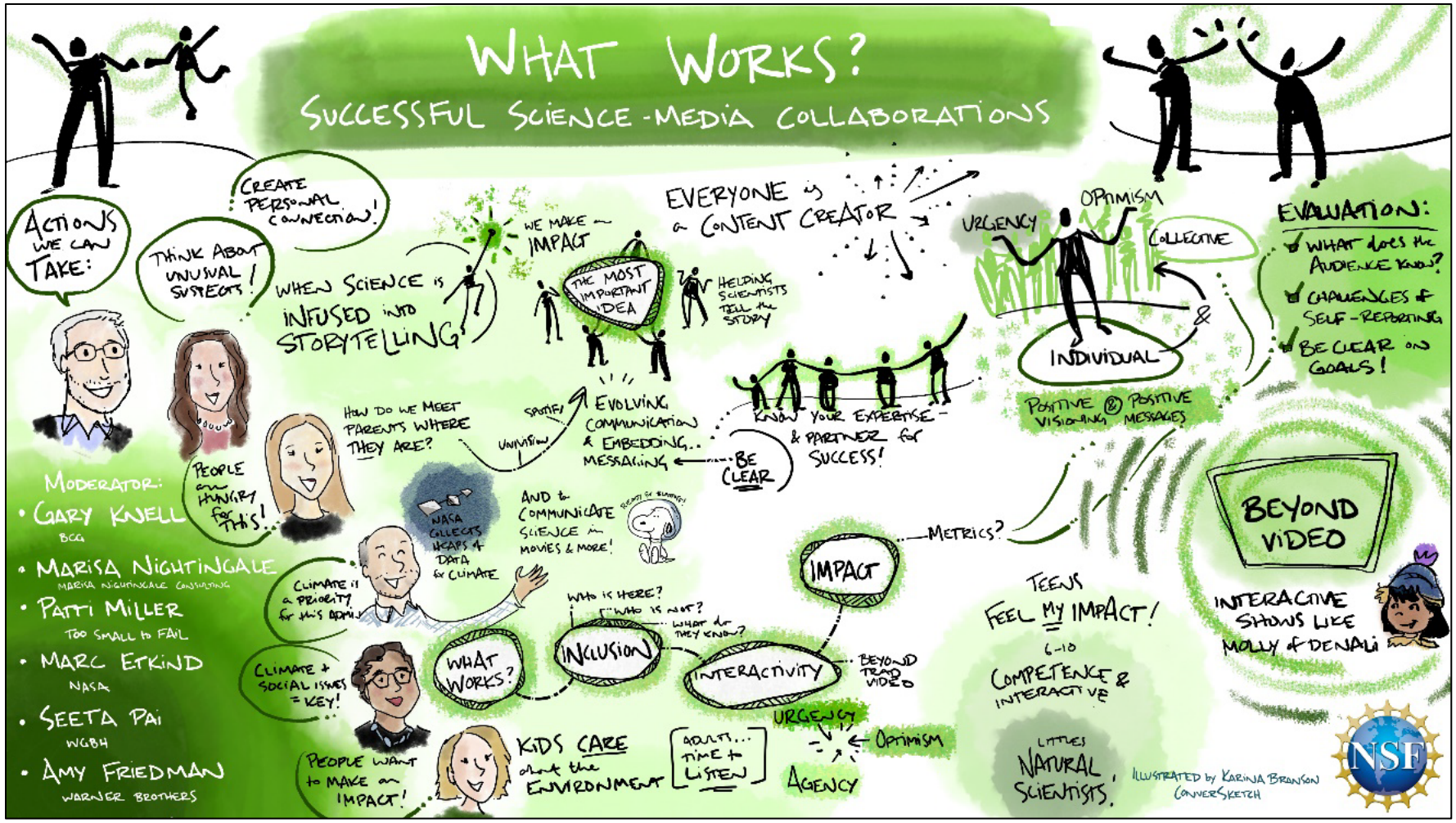

Figure 4. Graphic Illustration of Topics Discussed during "What Works? Successful Science-Media Collaborations"

H. Taking Action

The final session aimed to synthesize the messages of the previous panels; discuss current work by governments, media, and nonprofit organizations; and consider concrete next steps for individual and collective action. Jean-Claude Brizard, president and CEO of Digital Promise, moderated this session. Digital Promise is a global, nonpartisan, nonprofit organization focused on accelerating innovation in education. Jean-Claude formerly served as chief executive of Chicago Public Schools and superintendent of schools for the Rochester City School District in New York. Jean-Claude spoke about his young sons and their interests in science and climate change. He began by asking panelists about the role of government and philanthropy in climate education.

Carrie McDougall, senior education program manager in the National Oceanic and Atmospheric Administration (NOAA)'s Office of Education Environmental Literacy Program, spoke about the role of government, which she said should include providing coordination, developing guidelines, and consistently providing funding support for climate-related activities. Her office at NOAA provides grants and in-kind support for programs that educate and inspire people to use Earth system science to improve ecosystem stewardship and increase resilience to environmental hazards. She said that reliable and accessible government funding allows organizations and individuals to spend more time developing effective materials. Because no government agency is explicitly charged with funding climate change education research, funding is often inconsistent. Carrie highlighted NOAA partnerships with philanthropies that support climate change research and education.

Anuragini Nagar, director of programs at Sesame Workshop India, helped conduct a 10,000-participant study on how children in Delhi perceive climate and environmental issues and worked on designing hyperlocal campaigns where children and stakeholders can find solutions to these issues. She leads strategy, delivery, operations, and monitoring for the India branch of Sesame Workshop. Anuragini spoke about engaging children in Delhi to ask them about their own environmental priorities. Children as young as six were aware of the environment and what adults are doing to it. She encouraged participants to engage with children and listen to their interests and priorities when developing climate education curricula and materials.

Caryl M. Stern, an activist, executive, and author with extensive experience in international development and philanthropy, is executive director of the Walton Family Foundation and previously served for 14 years as president and CEO of UNICEF USA, work that took her to more than 30 countries to support emergency relief efforts for children affected by disasters. Caryl began by suggesting that government should act as a collaborator and convener. Solutions to climate change issues should be found through collaboration with affected communities, close to the point of impact. The role of

philanthropy should be to amplify the stories of those communities, such as by bringing them to the media, which can incorporate climate change messages into programming. Caryl emphasized the importance of collaboration between government, nonprofits, and the media.

Figure 5 illustrates key themes from this panel discussion, which included:

1. Combat Climate Despair

Panelists said that all kinds of organizations involved in climate education need to combat climate despair. Mainstream media coverage of climate data and disasters is often accurate but can have negative effects on audience mental health over time. Panelists recommended focusing on progress at the local and grassroots level, rather than national failures. They also suggested that negative feelings about climate change could be channeled into collective political action.

2. Connect with Children

Panelists consistently returned to the theme of meaningfully engaging children in climate change action. Work from Sesame Workshop India helped children in Delhi, spurred by issues of water, air, and noise pollution near their homes, bring their concerns to their local councilor. Panelists spoke about the integral role of teachers as role models to engage with science and climate action, but emphasized that teachers often lack the tools and support they need to do that work.

3. Promote Consistent Action

Climate change has become a politically divisive issue in the United States. Panelists suggested that Federal action on climate might be insulated from political pressures so that it can continue to work consistently. Panelists also expressed hope that a youth-led movement on climate is emerging that may be able to build momentum and carry on climate work with urgency and consistency.

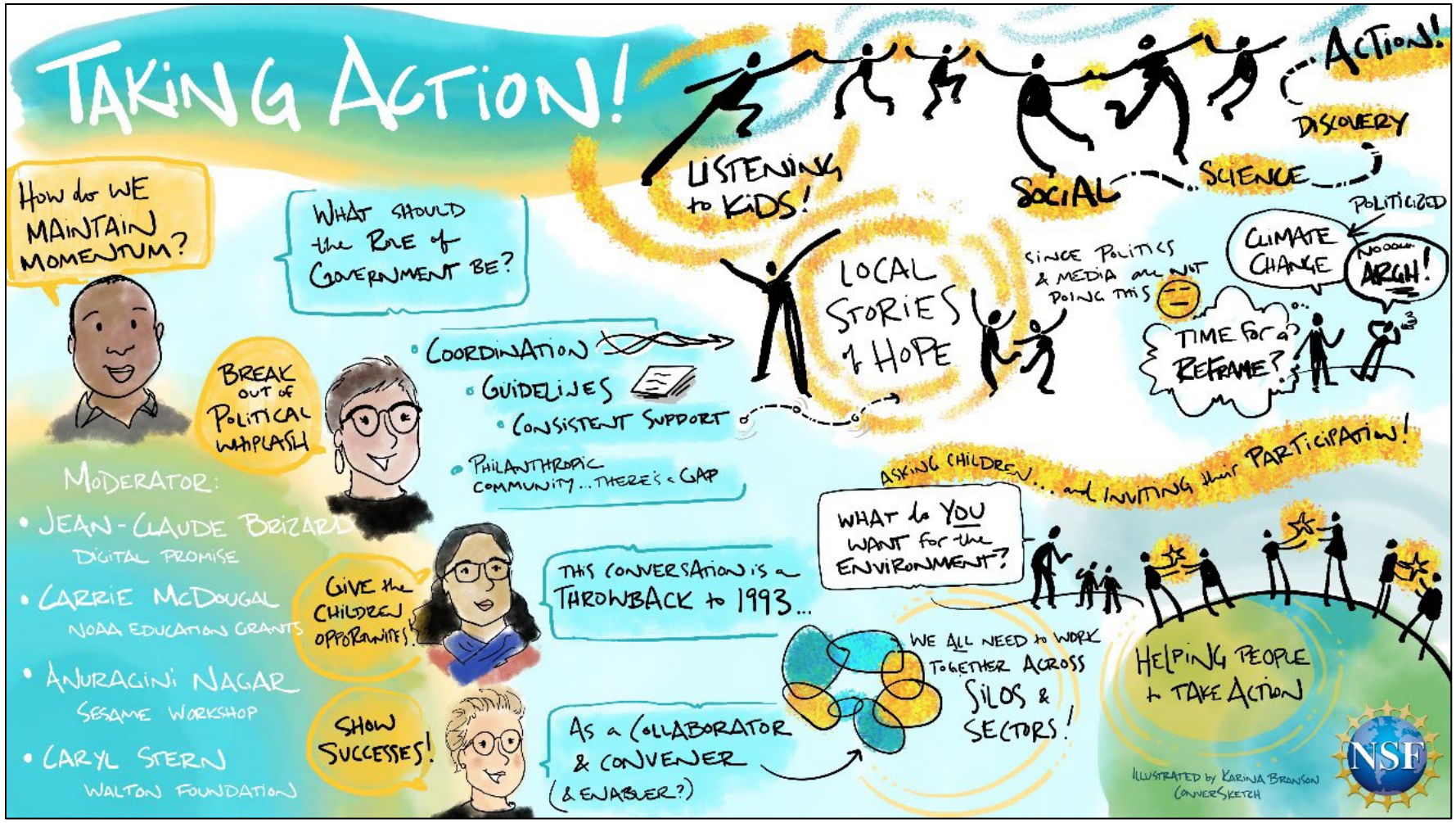

Figure 5. Graphic Illustration of Topics Discussed during "Taking Action"

I. Concluding Remarks

Elizabeth VanderPutten, acting division director for the NSF EHR Division of Research on Learning in Formal and Informal Settings, concluded the event by recounting how the Climate Science, Children, and the Media forum had come about. She cited the forum as one example of the power of individual and collective action and drew analogies between the process of developing the event and the central topic of designing climate change communications for children.

Elizabeth described how Lori Takeuchi convened and collaborated with a diverse group of stakeholders from government, education, and the media industry during the development and organization of the forum. Although efforts to advance diversity, equity, and inclusion are never complete, Elizabeth noted that the many communities represented by the forum's invited speakers and audience was impressive.

She highlighted Karina Branson's graphic illustration work as an exciting example of effective and creative communications, and said persistence was key to the integration of novel messaging strategies into the event. Flexibility in the event's design also enabled its success; although the event was originally conceived as an in-person gathering, the pivot to a virtual platform allowed for wider participation and ultimately created less greenhouse emissions as no travel was required.

She thanked the invited speakers, moderators, and audience for their participation throughout the day and their high level of engagement during the panels and within the Zoom chat (see Appendix B for a listing of resources discussed within the chat). She ended her remarks by asking the audience to continue the work of bringing together the scientific community, the public, and the media industry to address climate change issues in order to make a better world for future generations. Lori Takeuchi then closed the session by thanking all involved and identifying opportunities for audience members to remain engaged with the topic of the forum through follow-on activities.

Appendix A. Agenda and Speaker Biographies

February 11, 2022 11:00 am-4:00 pm ET

The National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR) invites you to participate in a forum to stimulate a national conversation on the topic of climate science education for children ages 5–11. As scientists continue to study Earth's changing climate and determine how society can both adapt to ongoing changes and mitigate future effects of climate change, there is a growing need to understand how to best communicate these concepts to young learners and inspire the next generation of scientists. This meeting will explore the potential for the media industry to collaborate with the scientific community to create content that is scientifically accurate and effectively engages children with climate science.

During this forum, panels of invited speakers and audience members will explore:

- What media producers need to know about communicating climate science and the impacts of climate change
- How to meaningfully engage historically underserved and underrepresented families in the creation of climate science-themed media
- Successful science-media collaborations

The event will encourage cross-sectoral conversation and result in the identification of specific opportunities for meaningful and effective collaboration. The purpose of the event is to purpose is to stimulate the field and explore potential partnerships, not to give advice to NSF.

Forum Agenda

(*all times listed in ET*)

11:00-11:10 Welcome and opening charge
11:10-12:10 Communicating to children about climate change: A cross-sectoral call to action

15-minute break

12:25-1:15 Inclusive science communication: Creating compelling stories together
1:15-2:05 Sharing the science: What do kids need to know? What do producers need to know?

15-minute break

2:20-3:10 What works? Successful science-media collaborations
3:10-3:50 Taking action
3:50-4:00 NSF concluding remarks
4:00 Adjourn

Opening and closing speakers (in order of appearance)

Lori Takeuchi

Lori Takeuchi is a program director in the Division of Research on Learning in Formal and Informal Settings at the National Science Foundation. Dr. Takeuchi conducts research on how children use media across the various settings of their lives and the implications these tools hold for their learning and development. She previously served as deputy director and head of research at the Joan Ganz Cooney Center at Sesame Workshop, before which she spent a decade producing geoscience software for K12 classrooms. She began her career at Thirteen/WNET managing its instructional television department. Dr. Takeuchi holds a PhD in the learning sciences from Stanford University.

Sylvia (James) Butterfield

Sylvia Butterfield is the acting assistant director of the National Science Foundation (NSF) Directorate for Education and Human Resources (EHR), which is devoted to providing "the research foundation to develop a diverse, STEM literate public and workforce ready to advance the frontiers of science and engineering for society." Dr. Butterfield has served at NSF for 20 years, in roles including deputy assistant director of EHR, director of the Division of Human Resource Development, and program director, among others. Before NSF, Dr. Butterfield served as director of education at the National Aquarium in Baltimore, and as a consultant for science education radio, youth publications, and museums. Dr. Butterfield holds a BS in biology from Loyola University, an MS from Johns Hopkins, and a PhD in science education from Morgan State.

Jane Lubchenco

Jane Lubchenco, deputy director for climate and the environment at the White House Office of Science and Technology Policy, is a marine ecologist and environmental scientist with expertise in the ocean, climate change, and interactions between the environment and human well-being. She has served as the undersecretary of commerce for oceans and atmosphere, the administrator of the National Oceanic and Atmospheric Administration (NOAA) and the first U.S. State Department science envoy for the ocean. She has taught at Harvard and Stanford Universities and is currently on loan to the White House from Oregon State University, where she is a distinguished university professor. Dr. Lubchenco is an elected member of the National Academy of Sciences and has received numerous awards, including 23 honorary degrees and a MacArthur ('genius') Fellowship.

Alexandra Isern

Alexandra Isern is assistant director of the Directorate for Geosciences at NSF, where she has served in various roles within three divisions of the directorate, including leading the Surface Earth Processes and Antarctic Sciences Sections and serving a two-year stint with the National Science Board. Her research primarily focuses on climate-driven evolution of carbonate platforms and reefs. Dr. Isern received her BS in geology from the University of Florida, her MSc in oceanography from the University of Rhode Island, and her PhD in geochemistry from the Swiss Federal Institute of Technology, Zurich.

Lee Zia

Lee Zia is acting director of the Division of Graduate Education (on detail from his position as deputy division director of the Division of Undergraduate Education) within the Directorate for Education and Human Resources at NSF. He served as the lead program director for the NSF National Science, Mathematics, Engineering, and Technology Education Digital Library (NSDL) Program from its inception in FY 2000 to its sunsetting in FY 2010. He holds a PhD in applied mathematics from Brown University.

Karina Branson

Karina Branson is a graphic recorder. She will be listening to each session and creating a digital illustration in real-time, which can be viewed in her Zoom video feed. Participants may pin her video at any time to see the visual as it's emerging, and the graphic will be shared at different points throughout the day to provide a visual summary of the proceeding sessions.

Elizabeth VanderPutten

Elizabeth VanderPutten is acting division director of the NSF Division of Research on Learning in Formal and Informal Settings (DRL), where her permanent position is deputy division director. She served as a program officer in DRL for several years and before that as a branch chief in the Division for Information Systems, a division of Administrative Services at NSF. Dr. VanderPutten directs NSF investment in projects to improve the effectiveness of STEM learning for people of all ages and promotes innovative research, development, and evaluation of learning and teaching across all STEM disciplines. She holds a PhD in educational policy from the George Washington University.

Session 1 11:10–12:10 pm ET

Communicating to children about climate change: A cross-sectoral call to action

Michael Levine (Moderator)

Michael Levine is senior vice president of learning and impact at Noggin, Nickelodeon's early learning and family support platform. A childhood learning and social policy expert, he leads Noggin's curriculum development, partnerships, thought leadership, and philanthropy. Previously, he was the chief knowledge officer at Sesame Workshop and founding executive director of the Joan Ganz Cooney Center, an independent research lab focused on the challenges and opportunities around educating children in a rapidly changing media landscape. Dr. Levine received his BS from Cornell University and PhD in social policy from the Florence Heller School at Brandeis University.

Allison Crimmins

Allison Crimmins is director of the Fifth National Climate Assessment, which will produce an authoritative report designed to help Americans understand and prepare for the impacts of climate change. Ms. Crimmins is a highly regarded climate scientist with

more than a decade of Federal service and expertise in assessing domestic and international climate impacts and mitigation benefits, particularly on health and economic damages. She is detailed to the White House Office of Science and Technology Policy from the Environmental Protection Agency (EPA) Office of Air and Radiation. She has an MS in oceanography from San Francisco State University and an MPP from the Harvard Kennedy School.

Nathaniel Kendall-Taylor

Nat Kendall-Taylor serves as CEO at the FrameWorks Institute. Dr. Kendall-Taylor oversees the organization's research-based approach to strategic communications, which uses methods from the social and behavioral sciences to measure how people understand complex sociopolitical issues and tests ways to reframe them to drive social change. Prior to joining FrameWorks, his research focused on understanding the social and cultural factors that create health disparities and affect decision-making. He holds a BA from Emory University and master's and doctoral degrees from UCLA.

Gary Knell

Gary Knell is a senior advisor at Boston Consulting Group with four decades of experience in leading iconic media, education, and social impact organizations. He previously served as CEO of the National Geographic Society and chairman of National Geographic Partners, a joint venture with Disney that manages National Geographic television, print and digital media. He has served as president and CEO of NPR and Sesame Workshop, where he led transformational changes for the purpose of achieving their important missions, inspiring global audiences through the power of storytelling. He earned a BA from UCLA and a JD from Loyola Law School.

Laura Schifter

Laura Schifter is a senior fellow with the Energy and Environment program at the Aspen Institute, where she leads the K12 Climate Action initiative. Dr. Schifter is an expert on Federal education policy and special education and coauthor of the book *How Did You Get Here? Students with Disabilities and Their Journey to Harvard*. She is a lecturer on education with the Harvard Graduate School of Education and a fellow with the Century Foundation. Dr. Schifter earned an EdD in education policy, leadership and instructional practice and an EdM in mind, brain, and education from Harvard Graduate School of Education.

Session 2 12:25–1:15 pm ET
Inclusive science communication: Creating compelling stories together

Sunshine Menezes (Moderator)

Sunshine Menezes is a clinical associate professor of environmental communications at the University of Rhode Island (URI) and executive director of the Metcalf Institute, which fosters informed public conversations about science and the environment through professional development for journalists, scientists, and other science communicators. Dr. Menezes' work spans oceanography, environmental policy, and inclusive science

communication. She holds a BS in zoology from Michigan State University and a PhD in oceanography from URI.

Haley Case-Scott

Haley Case-Scott is a junior policy advisor for Climate and Energy at the White House Office of Science and Technology Policy. Ms. Case-Scott was previously a grassroots organizer with Beyond Toxics, an Oregon environmental justice organization devoted to empowering frontline and impacted communities. She holds a BA in political science with a minor in Native American studies from the University of Oregon.

Kevin Clark

Kevin Clark is a children's media consultant on issues of diversity, content development, and strategy. Dr. Clark previously served as the director of preschool animation at Netflix and as a professor of learning technologies and director of the Center for Digital Media Innovation and Diversity at George Mason University. His research has focused on the role of interactive and digital media in education, broadening participation in STEM, and issues of diversity in children's media. He holds both a BS and MS in computer science from North Carolina State University and a PhD in instructional systems from Pennsylvania State University.

Rese Cloyd

Rese (Emily Therese) Cloyd is the director of the American Association for the Advancement of Science (AAAS) Center for Public Engagement with Science and Technology and the leader of AAAS's How We Respond climate communication project. Prior to joining AAAS in 2016, she led engagement and outreach for the U.S. Global Change Research Program and the Third National Climate Assessment. She holds an MPS in conservation biology from the SUNY College of Environmental Science and Forestry and a BS in plant biology from the University of Michigan.

Alicia Torres

Alicia Torres, serves as senior director of communication science and Hispanic outreach at Child Trends, a research organization focused on evidenced-based solutions for improving the lives of children and youth. Dr. Torres has more than 20 years of experience in planning and implementation of inclusive public understanding of STEM initiatives. For the past five years she has led the Child Trends News Service project—a partnership between child development scientists and local TV news to produce news reports in English and Spanish featuring actionable science-based parenting behaviors associated with positive child outcomes. Each report generates more than 50 million views, on average. Previously, she served as the director of the Media and Government Relations Directorate at the American Institute of Physics where she led collaborations across STEM education and professional associations, the news media and producers of popular culture. Dr. Torres has conducted extensive audience research to inform the development of effective and inclusive communication messages for reaching and engaging under-resourced and communities of color, with a focus on Latinos—building knowledge and value for STEM in ways that lead to the adoption of science-based practices. She earned her BA, MA, and PhD from the University of Texas-Austin, where

her early training was in mathematics and her doctoral work focused on strategic communication and mass media studies.

Dana Williamson

Dana Williamson is an environmental health fellow hosted at the Environmental Protection Agency's Office of the Science Advisor, Policy & Engagement. Her research has focused on capacity building efforts within communities that are threatened with varying degrees of environmental injustice. She earned both her MPH and PhD in behavioral sciences/health education from the Rollins School of Public Health, Emory University and is a graduate of the Robert Wood Johnson Foundation Health Policy Research Scholars program.

Session 3 1:15–2:05 pm ET
Sharing the science: What do kids need to know? What do producers need to know?

Anya Kamenetz (Moderator)

Anya Kamenetz is an author and journalist covering education for NPR. Ms. Kamenetz has written several books on families and media, student loans, and innovations to address cost, quality, and access in higher education. She was named a 2010 Game Changer in Education by the Huffington Post and won 2009, 2010, and 2015 National Awards from the Education Writers Association. During her tenure, NPR Ed won a 2017 Edward R. Murrow award for Innovation. She is currently writing a book on children and COVID. Ms. Kamenetz graduated from Yale University.

Claudia Benitez-Nelson

Claudia Benitez-Nelson is an associate dean and Carolina distinguished professor at the University of South Carolina. Her research focuses on the biogeochemical cycling of phosphorus and carbon and how these elements are influenced by climate change. She is a diverse scientist, with expertise ranging from radiochemistry to harmful algal bloom toxins, and is highly regarded for her cross-disciplinary research. Her many research honors include the Early Career Award in Oceanography from the American Geophysical Union and Fulbright and Marie Curie Fellowships. Dr. Benitez-Nelson earned a BS in chemistry and oceanography from the University of Washington and a PhD in oceanography from the Woods Hole Oceanographic Institute/MIT Joint Program.

John Fraser

John Fraser is a conservation psychologist, architect, and educator serving as president and CEO of Knology.org, a social science think tank. He was actively involved in the research behind the National Network for Ocean Climate Change Interpretation (NNOCCI.org) and is a frequent commentator in the media on climate trauma and how to talk with youth about climate change. He is a past president of the American Psychological Association's Division 34: Society for Environment, Population, and Conservation Psychology. Dr. Fraser is also editor-in-chief of *Curator: The Museum Journal*, a founding editorial board member for *Museums & Social Issues*, and the series

editor for Springer Nature's Psychology and Our Planet. Dr. Fraser earned a PhD in environmental studies from Antioch University.

Kate Marvel

Kate Marvel is a climate scientist at Columbia University and the NASA Goddard Institute for Space Studies. Her research uses climate models, observations, paleoclimate reconstructions, and basic theory to study climate change. Her work has identified human influences on present-day cloud cover, rainfall patterns, and drought risk. She is also interested in future climate changes, particularly climate feedback processes and the planet's sensitivity to increased carbon dioxide. Dr. Marvel writes the "Hot Planet" column for Scientific American and was named one of "15 Women Who Will Save the World" by Time Magazine. Before becoming a climate scientist, she received a PhD in theoretical particle physics from Cambridge University, where she was a Gates scholar.

Judith Van Hoorn

Judith Van Hoorn is professor emerita at the University of the Pacific and has expertise in early childhood development and education. Her work currently focuses on the global impacts of the climate crisis on children. Dr. Van Hoorn writes widely on children's play, including *Play at the Center of the Curriculum (ed.1-6*) and, recently, *The Gift of Play.* Her research in peace psychology examines adolescents' responses to rapid social change. Dr. Van Hoorn has been active in the American Psychological Association and received APA's Presidential Citation for Outstanding Psychologists. She advises organizations that work to improve the lives of children and families.

Session 4 2:20–3:10 pm ET
What works? Successful science-media collaborations

Gary Knell (Moderator)

See bio on page 4

Marc Etkind

Marc Etkind is associate administrator for the Office of Communications at NASA where he directs internal and external communications and serves as a senior advisor to agency leaders. Mr. Etkind has more than two decades of experience in development, production, and management for science and nature-based programming organizations including Discovery and Animal Planet. His credits include *Scientific American Frontiers*, *MythBusters*, and *How It's Made*, as well as exhibits for the Museum of Science and Industry in Chicago. Etkind also has worked as a researcher for the U.S. Fish and Wildlife Service's Faulkner Island Tern Project and the Yale School of Medicine. Mr. Etkind earned an AB in biology from Brown University.

Amy Friedman

Amy Friedman is the head of kids and family programming at Warner Bros. She has extensive experience in children's media across genres, demographics, and formats. Ms. Friedman previously spent more than two decades at Nickelodeon, where she served as senior vice president for original programming and creative director of Noggin and Teen Nick. At Nickelodeon, she was architect of The Big Help, a global multi-year multi-platform campaign for service aimed at children. Ms. Friedman holds a BA and an MA from the University of Pennsylvania.

Patti Miller

Patti Miller is the chief executive officer of Too Small to Fail, an initiative of the Clinton Foundation to promote early childhood development. Ms. Miller previously served as Vice President of Public Policy at Sesame Workshop, the nonprofit producer of *Sesame Street*. She promoted the Workshop's mission in Washington, D.C., at the White House, Capitol Hill, and executive agencies, on topics including the role of media in early childhood education and childhood obesity prevention, and parental engagement in children's learning. Ms. Miller holds an MA in education from Stanford University and a BA in mass communications from UC Berkeley.

Marisa Nightingale

Marisa Nightingale is a media strategist with a talent and passion for bringing social issues to life in pop culture to shift public conversations and drive action. She has extensive experience translating complex health information into compelling story material and helping media leaders integrate social issues seamlessly and accurately into their work. She has served as senior media advisor and senior director of the National Campaign to Prevent Teen and Unplanned Pregnancy and is the architect of its nationally recognized entertainment media program. Ms. Nightingale holds a BA in English literature from Yale University.

Seeta Pai

Seeta Pai is executive director of education at Boston public media producer GBH. Dr. Pai has over two decades of experience in research and strategy in children's media and education. She served as vice president of research at Common Sense Media, leading national studies on children's media and technology use. She also led initiatives producing resources on digital learning and educational technologies for schools and families. She has held teaching and research positions at UC Berkeley and Harvard, and is the author of numerous articles and reports on children and media. Dr. Pai holds a BA from Bangalore University and EdM and EdD degrees from the Harvard Graduate School of Education.

Session 5 3:10–3:50 pm ET
Taking Action

Jean-Claude Brizard (Moderator)

Jean-Claude Brizard is president and CEO of Digital Promise, a global, nonpartisan, nonprofit organization focused on accelerating innovation in education. He formerly

served as chief executive of Chicago Public Schools and superintendent of schools for the Rochester City School District in New York. Under Mr. Brizard's leadership, both the Chicago Public Schools and the Rochester City School District saw substantial improvements in student performance. He holds a BA and MEd from Queens College and an MA in educational administration and supervision from the City University of New York.

Carrie McDougall

Carrie McDougall is a senior education program manager in NOAA's Office of Education Environmental Literacy Program, which provides grants and in-kind support for programs that educate and inspire people to use Earth system science to improve ecosystem stewardship and increase resilience to environmental hazards. Dr. McDougall began at NOAA through a Sea Grant Knauss Marine Policy Fellowship. She earned a BS from UCLA and a PhD in ecology, evolution, and marine biology from UC Santa Barbara, where she studied bioluminescence and was involved in marine science education and outreach.

Anuragini Nagar

Anuragini Nagar is director of programs at Sesame Workshop India, where her work has included a 10,000-participant study on how children in Delhi perceive climate and environmental issues and designing hyperlocal campaigns where children and stakeholders can find solutions to these issues. She leads strategy, delivery, operations, and monitoring for the India branch of Sesame Workshop. She was previously senior manager for strategic investment and youth at the Centre for Catalyzing Change, a New Delhi-based nonprofit devoted to improving the conditions of girls and women. Ms. Nagar holds a BA in history from Delhi University.

Caryl Stern

Caryl M. Stern is an activist, executive, and author with extensive experience in international development and philanthropy. She is executive director of the Walton Family Foundation and previously served for 14 years as president and CEO of UNICEF USA, work that took her to more than 30 countries to support emergency relief efforts for children affected by disasters. She was invited to present at the White House's inaugural summit on The United State of Women and was named one of "25 Women Changing the World in 2017" by People Magazine. Dr. Stern earned a BA in studio art and an MA and PhD in college student personnel administration.

Appendix B. Chat Resources

Welcome and opening session

Panelist Resources

Advancing Informal STEM Learning (AISL):
https://beta.nsf.gov/funding/opportunities/advancing-informal-stem-learning-aisl

Other Resources

Stories of how youth are affected by and responding to climate change:
https://yaleclimateconnections.org/topic/youth/

Climate education resources developed by Phil Bell at the University of Washington:
https://www.climetime.org

Communicating to children about climate change: A cross-sectoral call to action

Panelist Resources

K-12 Climate Action: https://www.k12climateaction.org/,
https://www.k12climateaction.org/blog/climate-action-plan-2021

"For Gen Z, climate change is a clear and present danger to our planet":
https://www.usatoday.com/story/opinion/2020/10/07/climate-change-gen-z-urgent-threat-our-planet-column/3636669001/

From Laura Schifter: K-12 Climate Action Plan 2021:
https://www.k12climateaction.org/blog/climate-action-plan-2021

From Seeta Pai: Rachel Carson's Silent Spring video:
https://www.pbslearningmedia.org/resource/envh10.sci.life.eco.silentspring/rachel-carsons-silent-spring/

From Nathaniel Kendall-Taylor: We have research on our website (frameworksinstitute.org) that might be helpful and then I think the Yale Program on Climate Communications is an amazingly valuable source on these issues of public thinking and framing.

Other Resources

Girl Scouts "World Thinking Day," an event focused on climate change and impact on women: https://www.girlscouts.org/content/dam/girlscouts-gsusa/forms-and-documents/For-Girls/think-global/DBJWorld_Thinking_Day_2022.pdf

The 2018 National Climate Assessment. A go-to resource on the state of climate science for the nation until the next one is released in 2023: https://nca2018.globalchange.gov

NASA resources, many geared towards children: https://climatekids.nasa.gov, https://earthobservatory.nasa.gov/blogs/eokids

International Day of Women and Girls in Science: https://www.un.org/en/observances/women-and-girls-in-science-day

NOAA videos from 2014 about the National Climate Assessment 3: https://vimeo.com/channels/nca/videos

NASA Earth science resources involving the International Space Station, with many hands-on opportunities for youth: https://www.nasa.gov/station

Training on metaphors and messages that work best with museum audiences about climate change from National Network for Ocean and Climate Change Interpretation, which is funded by NOAA and NSF: https://climateinterpreter.org/training

Classroom resource for educators: Columbia Climate School - The Earth Institute - EI Live K12: https://www.earth.columbia.edu/videos/channel/k12-education

The MY HERO Project provides media arts training to youth so they can share their environmental hero short films, art stories. Their online media library is filled with short films made by professionals and students from around the world. https://myhero.com/climate-change-resources, https://myhero.com/slater

The United Nations 17n Goals for Sustainability and Development: https://sdgs.un.org/goals

NPR TED radio hour piece on the idea of "Playtivism" - https://www.npr.org/2022/02/11/1079873883/yana-buhrer-tavanier-can-social-activism-be-playful

'Young Voices for the Planet,' where kids lead efforts to help the climate and video pieces are produced on each effort: https://www.youngvoicesfortheplanet.com/

The Clara Lionel Foundation, a foundation started by Rihanna, funded a group of organization who are doing work in climate justice: https://claralionelfoundation.org/news/clf-commits-approximately-15m-to-18-grassroots-organizations-on-the-frontlines-of-climate-justice-in-partnership-with-start-small/

A website with a climate blog and educational resources: https://climateinterpreter.org/

Greta Thunberg on AGU Sharing Science: https://blogs.agu.org/sciencecommunication/2021/08/13/antarcticlog-climate-hope-via-greta-thunberg/

A blog post on the international young activists' work to deal with climate change in their own backyards: https://blogs.agu.org/sciencecommunication/2021/03/05/antarcticlog-sannas-reindeer/

Climate change conversation tools from FrameWorks: https://www.frameworksinstitute.org/issues/climate-change-and-environment/

A Scientific American article about educators dealing with children who are falling victim to conspiratorial information: https://www.scientificamerican.com/article/schoolkids-are-falling-victim-to-disinformation-and-conspiracy-fantasies/

"Plausibility reappraisals and shifts in middle school students' climate change": conceptionshttps://www.sciencedirect.com/science/article/pii/S0959475213000285?casa_token=TQtJ8pH_oGsAAAAA:t6mWC4jl1vruOke5GWinqzTKJQlwSR0xvfNMLQzxGtvo-89tOlgZ7mECKILrQ4mbx2QeMhfZZw

CLIMATE ALIVE!: NOAA's Ocean Today Program videos featuring NOAA Climatologist Tom DiLiberto that help kids make sense of wild weather and introduce the science of climate change: https://oceantoday.noaa.gov/climate-alive-wild/welcome.html

Maine climate ed bill being considered now: https://legislature.maine.gov/bills/getPDF.asp?paper=HP1409&item=1&snum=130

A FrameWorks report: Expanding Our Repertoire: Why and How to Get Collective Climate Solutions in the Frame: https://www.frameworksinstitute.org/publication/expanding-our-repertoire-why-and-how-to-get-collective-climate-solutions-in-the-frame/

Sesame Workshop in India community level campaigns with children: https://indianexpress.com/article/parenting/events-things-to-do/sesame-workshop-india-rolls-out-mera-planet-mera-ghar-initiative-to-help-kids-voice-climate-concerns-7490655/

"Evaluating sources of scientific evidence and claims in the post-truth era may require reappraising plausibility judgments": https://www.tandfonline.com/doi/full/10.1080/00461520.2020.1730181?casa_token=tA-Efbj_no4AAAAA%3A1cdeICqBjfF0x3G00-T5bkOe2q5DEfFmK5QGj3ytskczmfX5MDZmNguJmHYuUv0Rm-B0iW9EWjXw0A

Understanding Science: online resources about the process of science published by Berkeley: https://undsci.berkeley.edu

Champions of Coastal Resilience: A professional development program in Hawai'i that helps teachers engage their students in storytelling/film editing to discuss climate

change related impacts to their community shorelines. Using multiple lenses - personal, family, cultural, and overlaying with NOAA data visualization tools like sea level rise viewer. Funded in part by NOAA B-WET program: https://www.learningendeavors.org/programs

Full Option Science System (FOSS) course for children "Observing Nature": https://www.fossweb.com/module-summary?dDocName=G6130546

Elmo's teaching basic concept of air: https://fb.watch/b6jYC1cyEY/

NPR survey: Most Teachers Don't Teach Climate Change, 4 Out of 5 Parents Wish They Would: https://www.npr.org/2019/04/22/714262267/most-teachers-dont-teach-climate-change-4-in-5-parents-wish-they-did

Video about NCSE Teacher Ambassador Melissa Lau: https://www.youtube.com/watch?v=h-mPa0LT-oQ

Climate anxiety article in the New York Times: https://www.nytimes.com/2022/02/06/health/climate-anxiety-therapy.html

A survey conducted in the largest school district in the US - NYC - showed that teachers want to teach about climate change but they don't have the proper training, time, resources and support: https://static1.squarespace.com/static/6001a539f8f42f6c20a08362/t/61d7371b336fc71c4a409186/1641494299699/CRETF+ClimEd+Survey+2021.pdf

National Geographic project on citizen science species counting: https://www.nationalgeographic.org/projects/bioblitz/

Boston area citizen science bioblitz planned for the spring: https://www.zoonewengland.org/protect/here-in-new-england/boston-area-city-nature-challenge/

A study on the children's science podcast Brains On! with recommendations for media producers about how to address challenging and scary topics with children: https://www.brainson.org/story/2020/10/13/brains-on-coronavirus-research

Earthinators: a youth-led whole-of-nation movement to get every Indians on board; getting everyone motivated to help transform India into a glowing global city of sustainability. https://sites.google.com/view/earthinators, https://www.linkedin.com/company/earthinators, https://twitter.com/earthinators, https://www.facebook.com/earthinators, https://www.instagram.com/earthinators, https://www.youtube.com/channel/UCAYeL82hCc775o0JW3XBruQ

Inclusive science communication: Creating compelling stories together

Panelist Resources

From Rese Cloyd: Here are the stories that we developed for How We Respond https://howwerespond.aaas.org/communities/

From Rese Cloyd: I wrote a short thread that points to several of the stories and resources we developed as a part of the How We Respond program https://twitter.com/EngageClimate/status/1492173456301080579

From Sunshine Menezes: Highly recommend the Doug Medin & Megan Bang paper, the culture of science communication (https://doi.org/10.1073/pnas.1317510111) for more thoughts on this, and especially how we represent the natural world

Other Resources

An inclusive science communication starter kit created by the Metcalf Institute and collaborators: https://metcalfinstitute.org/metcalf-releases-inclusive-scicomm-starter-kit/

A report from AAAS: "How We Respond: Communities and scientists taking action on climate change": https://howwerespond.aaas.org/

"Local Climate Experts: The Influence of Local TV Weather Information on Climate Change Perceptions" (2016): https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4638344/

Article from Yale Climate Connections "How to talk with kids about climate change": https://yaleclimateconnections.org/2020/08/how-to-talk-with-kids-about-climate-change/

Climate Central Media Library, an independent organization of leading scientists and journalists researching and reporting the facts about our changing climate and its impact on the public: https://medialibrary.climatecentral.org

"Weather Girls" on the Big Screen: Stereotypes, Sex Appeal, and Science" (2014): https://journals.ametsoc.org/view/journals/bams/95/3/bams-d-12-00079.1.xml

A survey conducted at Sesame Workshop India with 6-10-year-olds: https://fb.watch/b6jYC1cyEY/

Article about kids teach parents about climate change - by learning about climate change in class, interviewing their own families, and hosting community meetings: https://yaleclimateconnections.org/2018/08/kids-teach-parents-about-climate-change/

A series of webinars on preserving and applying traditional knowledge: http://indigenouseducation.org

Article on indigenous knowledge by Robin Wall Kimmerer: https://emergencemagazine.org/feature/corn-tastes-better/

From Kathryn Lanouette: https://www.whitehouse.gov/wp-content/uploads/2021/11/111521-OSTP-CEQ-ITEK-Memo.pdf

Native Skywalkers, a website about indigenous astronomy: https://www.nativeskywatchers.com/

Native Earth, Native Skies - NASA-funded award to Oklahoma State University to increase understanding and interest in STEM by middle school students in the

Cherokee, Choctaw and Chickasaw Nations by developing holistic curriculum that interweaves Native American stories and language with STEM principles: https://education.okstate.edu/research/centers/native-earth-native-sky/

North American Association for Environmental Learning early learning resources: https://naaee.org/our-partners/nonprofits/children-and-nature-network

Podcast episode on climate change and women of color: https://t.co/tjiF7MyTn2, https://twitter.com/ourbodypolitic/status/1483518470272831488?s=27

Global Learning and Observations to Benefit the Environment (GLOBE), an earth systems measurement partnership between NASA, NSF and NOAA: https://www.globe.gov/

GLOBE citizen science measurement app, including a clouds and climate challenge and a toolkit for informal educators and activities for families: https://observer.globe.gov, https://observer.globe.gov/toolkit, https://observer.globe.gov/do-globe-observer/do-more/family-science

A multimedia library aimed at students and teachers: https://myhero.com/explore

---

Sharing the science: What do kids need to know? What do producers need to know?

Panelist Resources

From Sunshine Menezes: Related to inclusive science communication, generally, check out the resources we've collected at this link, and don't miss the "Inclusive SciComm Resources" via the blue button on that page. It leads to a crowdsourced Google doc with TONS of additional resources. https://inclusivescicomm.org/resources/

From Laura Schifter: Sharing a blog by a student in KY about engaging students in climate change through art: https://www.k12climateaction.org/blog/artistic-engagement-in-schools-prepares-students-for-climate-action

Other Resources:

A children's media program about the environment from Argentina: https://www.youtube.com/watch?v=SNR97-o-NOI

A PBSKids TV show Elinor Wonders Why game on exploring nature sights and sounds: https://pbskids.org/elinor/games/elinor-nature-sights-and-sounds

A PBSKids SciGirls citizen science themed game: https://pbskids.org/scigirls/games/creature-features

The Understanding Global Change Project emphasizes systems thinking in Social Studies and History curricula: https://ugc.berkeley.edu/

A Super Bowl ad about the environment: https://www.youtube.com/watch?v=tIp251KCz6k

The 2009 USGCRP Climate Literacy: The Essential Principles of Climate Science is an interagency guide that provides a framework and essential principles for formal and informal education about climate change: https://www.globalchange.gov/browse/educators

A systems modeling tool to allow students to express their ideas about systems and construct a computational simulation of their ideas without needing to write code: https://sagemodeler.concord.org

A National Network for Ocean and Climate Change Interpretation guide on Framing with Explanatory Metaphors: https://climateinterpreter.org/sites/default/files/resources/framing_with_explanatory_metaphors_handout.pdf

Growing Up Boulder, a city resource for children in Boulder, CO: https://www.growingupboulder.org/

CLIMATE ALIVE!: a NOAA's Ocean Today Program featuring NOAA Climatologist Tom DiLiberto that help kids make sense of wild weather and introduce the science of climate change - https://oceantoday.noaa.gov/climate-alive-wild/welcome.html

NASA resource for kids: https://climatekids.nasa.gov/

Cornell geothermal project: https://deepgeothermalheat.engineering.cornell.edu/

An article on low-carbon electricity in Ithaca, NY: https://www.washingtonpost.com/climate-solutions/2021/11/03/ithaca-new-york-decarbonize-electrify/

An article by Anya Kamenetz on the importance of play: https://www.npr.org/2022/02/10/1079406041/researcher-says-rethink-prek-preschool-prekindergarten

Science education resources from Full-Option Science System at Berkeley: Everyday Outside Challenge (K-5) https://www.fossweb.com/delegate/ssi-wdf-ucm-webContent?dDocName=G6128883, Creating a sit spot project (middle school) https://www.fossweb.com/delegate/ssi-wdf-ucm-webContent?dDocName=G6687565

A standard framework on anti-bias education: https://www.learningforjustice.org/frameworks/social-justice-standards

National Girls Collaborative Project, a hub for STEAM resources: https://ngcproject.org

A podcast on food and climate: https://soundcloud.com/user-337207863

PBSKids Cyberchase Green It Up: https://www.wnet.org/education/greenitup

What works? Successful science-media collaborations

Panelist Resources

From Anya Kamenetz: Wow in the world: a podcast for 5–11-year-olds: https://tinkercast.com/shows/wow-in-the-world/

From Michael Levine, Noggin/Nickelodeon: FrameWorks has a slew of materials on framing successful communications work: www.frameworks.org

From Michael Levine, Noggin/Nickelodeon: NASA and Noggin have a partnership that will results in two new games later this year—one featuring a rocket scientist.

From Michael Levine, Noggin/Nickelodeon: To see an exchange between 5-7 year olds and the astronauts in the ISS see this link: https://www.nasa.gov/stem-ed-resources/lift-off-to-the-international-space-station-with-noggin.html?utm_source=stemexpress&utm_medium=email&utm_campaign=stemjune102021

From Marc Etkind: A NASA graphic novel: https://www.nasa.gov/specials/calliefirst/

Other Resources

NASA Science Mission directorate: https://science.nasa.gov

Shifted Space, a transmedia project about space junk: https://www.shiftedspace.org/

Wow in the World: a science and technology podcast for children: https://tinkercast.com/shows/wow-in-the-world/

The Geena Davis Institute on Gender in the Media: https://seejane.org

An NSF funded collaboration with Latinx families, Univision, and Literacy Partners to develop a five-episode telenovela that will share activities families can use to spark children's interest in science. https://www.edc.org/edc-use-themed-telenovela-enhance-informal-science-learning-latinx-families

A Minecraft map about deforestation: https://www.minecraft.net/en-us/article/free-climate-futures-map

A National Academies program to connect scientists with media: http://scienceandentertainmentexchange.org/

The Arctic Climate Game Jam: https://climategamejam.org/

A collection, based on the PBSKids show Molly of Denali, of videos, digital games, lessons, teaching tips, and activities that educators can utilize in the classroom: https://pbslearningmedia.org/collection/molly-of-denali/

Learning with Media, One Adventure at a PBS KIDS program Molly of Denali teaches children about informational text. Two new studies show that it works: https://edc.org/learning-media-one-adventure-time

Classroom resources from PBS: https://pbslearningmedia.org/collection/universe/home/

An article from the Sierra Club about using the show Molly of Denali to teach children about climate change: https://www.sierraclub.org/sierra/2021-6-winter/critic-s-notebook/children-s-programming-needs-tackle-climate-change

Resources on climate from PBS: https://pbslearningmedia.org/collection/universe/topic/weather-climate/

A series of reports on child-parent engagement about Covid-19 research: https://www.brainson.org/story/2020/10/13/brains-on-coronavirus-research

Research tied to the CPB-PBS Ready to Learn initiative, including Elinor Wonders Why: https://ny.pbslearningmedia.org/resource/go-and-explore-pilot-study/elinor-wonders-why-rtl-2015-2020-initiative/

The Norman Lear Center, which conducts impact studies of media and entertainment: https://www.mediaimpactproject.org /

#AntarcticLog comics: https://blogs.agu.org/sciencecommunication/2021/10/08/antarcticlog-kids-are-our-climate-future/

NASA resources on climate: https://climate.nasa.gov

The 2015-2020 CPB-PBS Ready To Learn Initiative: https://whyy.pbslearningmedia.org/collection/rtl2015/

Taking Action

Panelist Resources

From Carrie McDougall: NOAA's education resources supporting climate resilience: https://www.noaa.gov/office-education/elp/resilience-hub

From Jean-Claude Brizard: "Climate Change Enters The Therapy Room": https://www.nytimes.com/2022/02/06/health/climate-anxiety-therapy.html?referringSource=articleShare

From Jean-Claude Brizard: Bandura, A., & Cherry, L. (2020). Enlisting the power of youth for climate change. American Psychologist, 75(7), 945–951. https://doi.org/10.1037/amp0000512

From Jean-Claude Brizard: White House Fact Sheet: Lifting America's Game in Climate Education, Literacy, and Training: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/climateed-dec-3-2014.pdf

From John Fraser [Knology]: These kids are taking on the "system" to eliminate plastics through policy change http://www.cafeteriaculture.org/about.html

From Marisa Nightingale: Check out East Los High on Hulu - innovative transmedia and storytelling that made a positive impact.

Other Resources

Digital Promise: https://digitalpromise.org/

Capita work on climate and early adulthood: https://www.capita.org/climatechange

The Tri-Agency Climate Education (TrACE) Collaboration: https://cleanet.org/trace/index.html

Children, clean air, and potable water in India: https://www.instagram.com/p/CZZUFk0hrev/?utm_source=ig_web_copy_link

A Scientific American article about children and climate change: https://www.scientificamerican.com/article/children-change-their-parents-minds-about-climate-change/

Community actions to combat climate change in India: https://timesofindia.indiatimes.com/blogs/voices/community-actions-to-combat-climate-change/

Young Voices for the Planet: https://www.youngvoicesfortheplanet.com/

Climate solutions videos from the Cayuga Nature Center:

Inventing Tomorrow, a documentary on children and climate. Includes classroom activities: https://www.inventingtomorrowmovie.com/

Global Warming's Six Americas: https://climatecommunication.yale.edu/about/projects/global-warmings-six-americas/

Article about Sesame Workshop India work on climate: https://indianexpress.com/article/parenting/events-things-to-do/sesame-workshop-india-rolls-out-mera-planet-mera-ghar-initiative-to-help-kids-voice-climate-concerns-7490655/

Smart By Nature: Schooling For Sustainability: https://www.ecoliteracy.org/book/smart-nature-schooling-sustainability

Helping kids understand the value of air: https://www.instagram.com/p/CWXRXP8IUfD/?utm_source=ig_web_copy_link

The Sustainable Development Goals: https://www.globalgoals.org/

NCTE resources for teaching about climate: http://bit.ly/InterdisciplinaryClimate

Peer teaching about climate in India: https://www.instagram.com/p/CZ1hJDHP1Wv/?utm_source=ig_web_copy_link

A NASA community of practice for educators formal and informal: https://nasacentral.force.com/cop/s/

A Berkeley resource for ocean literacy: https://mare.lawrencehallofscience.org/

A free weekly online NASA newsletter of education opportunities: https://www.nasa.gov/stem/express

NOAA Ocean Today video content to promote ocean literacy for middle schoolers:
https://oceantoday.noaa.gov/

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
XX-05-2022	FINAL	02-11-2022 -- 04-28-2022

4. TITLE AND SUBTITLE

Summary of the NSF Design and Discovery Forum: Climate Science, Children, and the Media

5a. CONTRACT NUMBER
NSFOIA-0408601

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Van Pay, Lisa M.
Zhang, Rina L.
Ishimaru, Matthew A.

5d. PROJECT NUMBER
NF-20-4895

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

IDA Science and Technology Policy Institute
1701 Pennsylvania Avenue, NW, Suite 500
Washington, DC 20006-3602

8. PERFORMING ORGANIZATION REPORT NUMBER
IDA Document NS D-33104

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

10. SPONSOR/MONITOR'S ACRONYM(S)
NSF

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited (11 July 2022).

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR) engaged the Science and Technology Policy Institute (STPI) to assist in developing the Climate Science, Children, and the Media forum to stimulate a national conversation on the topic of climate science education for children ages 5–11. As communities work to adapt to ongoing changes and mitigate future effects of climate change, there is a growing need to understand how to best communicate these concepts to young learners and inspire the next generation of scientists. Overarching goals for the forum were to: • Bring together members of the scientific community, industry, government, education, and philanthropy to share knowledge and strategies to create and distribute content that is scientifically accurate, entertaining, and effective at inspiring public thinking and understanding about climate change. • Highlight the challenges and opportunities involved in creating compelling stories that consider the lived experiences, preferences, and values of children and families most impacted by climate change. • Inspire cross-sector partnerships that sustain these activities beyond the forum.

15. SUBJECT TERMS

climate change; climate science education; education; government; industry; media; philanthropy; scientific community; young learners

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			VanderPutten, Elizabeth
Unclassified	Unclassified	Unclassified	Same as Report	45	19b. TELEPHONE NUMBER *(Include area code)* 703-292-5147

Reset

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18