



IMPACT PLANNING • EVALUATION • AUDIENCE RESEARCH



SUMMATIVE EVALUATION

CLIMATE CHANGE AND RESILIENCY

Prepared for
Science Museum of Virginia
Richmond, VA

SUMMARY AND DISCUSSION

This report, prepared by RK&A, Inc., presents results from a summative evaluation of five climate change and resiliency programs at the Science Museum of Virginia (SMV). The summative evaluation is the culmination of a three-year grant from the National Oceanic and Atmospheric Administration (NOAA)—front-end and formative evaluations were completed in the two years prior. The five programs tested in the summative evaluation include the Digital Dome’s “Cosmic Climate Cookbook” video; the Extreme Event Challenge; Science on a Sphere; Ready Rowhomes “Preparing for a Wetter, Hotter Virginia” program; and the Climate Connections Lecture Series. The goal of this evaluation is to test the extent to which these programs achieved the intended visitor outcomes defined in SMV’s Impact Framework (summarized below).

SMV IMPACT FRAMEWORK

AWARENESS/KNOWLEDGE/ UNDERSTANDING

Increase participants’ awareness and understanding of:

- Climate change science
- The relationship between natural and human-induced heat-trapping gasses and climate change
- The concept of resiliency relative to climate change impacts in Virginia.

ENGAGEMENT/INTEREST

Increase participants’ interest in:

- Using scientific data to inform personal actions they may take to increase personal and community resiliency.

ATTITUDE

Help participants recognize that:

- Climate change is impacting their lives now and will continue to impact Virginia in the future
- They can do something about becoming ready and resilient to climate change impacts in Virginia.

BEHAVIOR

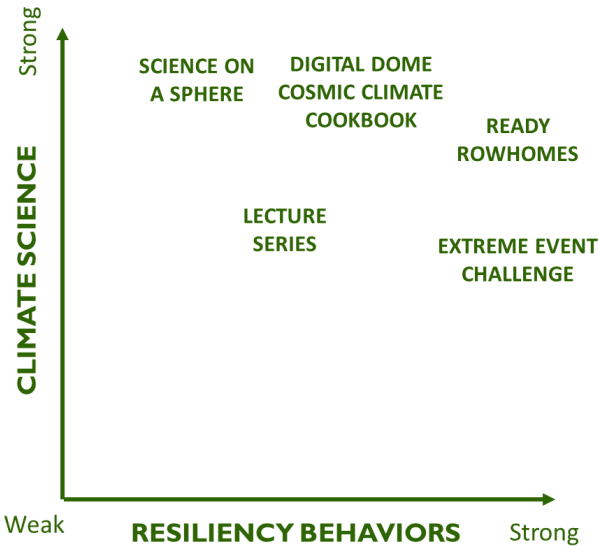
Help participants:

- Make informed decisions and take steps to become more resilient to the effects of climate change in Virginia (thereby increasing the overall resiliency of communities across the Commonwealth)

RK&A conducted observations of each program evaluated, interviewed 52 program participants about their experiences, and interviewed five SMV staff to better understand internal perspectives about the successes and challenges of the programs evaluated. Results indicate SMV has made significant strides in its climate change and resiliency programming over the course of the front-end, formative, and now summative evaluations. As staff explained in interviews, they revised the programs significantly over time to help strengthen the connection between climate change and resiliency for visitors. SMV discontinued some programs (Challenge Lab Water Filtration Activity and the Eco Lab Solitary Bee Nest Activity) when formative evaluation showed that these programs were not contributing to visitors achieving their intended outcomes, and revised others (the Digital Dome Cosmic Climate Cookbook, Extreme Event Challenge, and Science on a Sphere) to strengthen their messaging based on recommendations from the past evaluations.

Overall, summative results indicate that the programs evaluated are largely successful in achieving their intended outcomes, with a few limitations. The Digital Dome video and Science on a Sphere presentation were particularly effective in communicating climate science by translating complex concepts with clear language and data visualizations, while the Extreme Event Challenge and Ready Rowhomes programs were successful at increasing awareness of and interest in climate resiliency behaviors. The Lecture Series demonstrated the reality of climate change through data-driven presentations, although some of these were too academic for a general museum audience. Together, the suite of climate change and resiliency programming offered by SMV provides a complementary balance of climate science and resiliency concepts (see graphic below). One area for continued growth for SMV is working to battle the sense of hopelessness that sometimes accompanies addressing a problem at the scale of climate change. In particular, visitors need help to understand the value of individual action in making an impact on climate change.

PROGRAM STRENGTHS REGARDING CLIMATE SCIENCE AND RESILIENCY



In the discussion below, we explain in detail how each of the programs fared in light of the visitor outcomes identified in SMV's Impact Framework. The framework is guided by the National Science Foundation's Framework for Evaluating Impacts of Informal Science Education Projects categories of awareness/knowledge/understanding; engagement/interest; attitude; and behavior; and we discuss each program with this framework in mind.

The findings presented here are among the most salient. Please read the body of the report for a comprehensive presentation of findings by methodology.

DIGITAL DOME COSMIC CLIMATE COOKBOOK

Visitors responded quite positively to the Cosmic Climate Cookbook video shown in the Digital Dome theater, particularly noting its clear presentation of complex scientific information and its striking visuals displayed on a larger-than-life screen. Both visitors in adult-only groups and groups with children felt the video took a complicated subject like climate science and translated it into terms they could understand by visualizing the data and showing trends over time. As a result, the majority of visitors come away with the understanding that humans have contributed significantly to climate change, one of the intended outcomes from the Impact Framework. Almost one-half of visitors understood that there are certain key elements of the Earth's atmosphere that make it habitable (compared to other planets, like Mars), and that a delicate balance needs to be maintained to keep Earth as a livable planet. Although few visitors used the terms "recipe" or "cookbook" when talking about these ideas, the presentation of this information through the lens of a cookbook appears to have been an effective approach. Notably, staff also expressed a great sense of pride in the production of the Cosmic Climate Cookbook, with one describing it as "the biggest undertaking the museum has ever done," in terms of creating a fully-produced, 30-minute media piece.

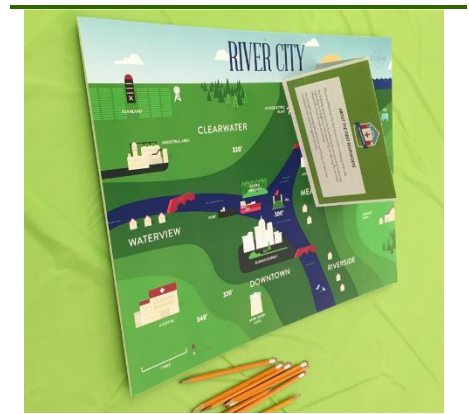


While the video is effective in communicating key climate science concepts, it also generated concerns for some visitors. Based on feedback from the formative evaluation, the museum added additional content about actions people can take to mitigate the effects of climate change, such as recycling and buying local foods. Responses indicate many more visitors came away with ideas about changes they could make to their daily lives to respond to climate change. However, a few visitors said they felt "hopeless" and skeptical that these actions would not have a significant impact. Similarly, information about the effects of climate change, such as rising temperatures and sea levels, made some visitors concerned about what environmental issues future generations will face. Generating a certain level of concern about climate change is necessary, given the urgency of the issue, but climate science communicators also face the challenge of balancing concern with a sense of agency and empowerment that individuals can

make a difference.¹ We know from the front-end and formative evaluations that convincing individuals that their actions matter is a recurring hurdle because climate change is such a monumental challenge to address. As we discuss later, it may help for visitors to have an opportunity to observe the potential impacts of their behavior in order to understand the value of their actions, as became clear in the Ready Rowhomes activity when participants were inspired by the clear impact of adding green infrastructure in the extreme heat and rain simulations. In the context of the Digital Dome, perhaps adding examples of small-scale individual or community initiatives that have seen measurable results in mitigating humans' effects on the environment could serve a similar function—local examples would have the added benefit of making climate change feel like a personal issue rather than a “far away concept.” It may not be feasible to change the Cosmic Climate Cookbook video, but a supplementary discussion with slides following the video could be one way to deliver this additional information to visitors.

EXTREME EVENT CHALLENGE

Findings indicate the Extreme Event Challenge is a fun and social experience for visitors that raises awareness of the many challenges that come into play when responding to an extreme weather event. The presentation before the activity, which provided foundational knowledge on weather, climate, and climate change, helped visitors make the connection between climate change and extreme weather events. This is promising growth, since the formative evaluation of the Extreme Event Challenge found that visitors were struggling to make this connection when the activity was paired with the Science on a Sphere presentation. In interviews, staff discussed an intentional shift to using the word “resiliency” many times during the presentation and discussion, and making explicit the direct links between climate change and extreme weather.



Moreover, both the Extreme Event Challenge activity and the group discussion afterwards helped visitors recognize the importance of emergency preparedness in advance of extreme weather events, both at an individual and community level. For example, assigning various roles to participants (e.g., local government officials, emergency responders, community members) allowed them to understand some of the decision-making around managing resources in an emergency. The discussion afterward provided time for visitors to reflect on the importance of building relationships for strong lines of communication during an emergency.

Many said the choice of using a flooding event made the activity feel relevant to the Richmond area because the city is located on a river, another area of growth from the formative evaluation. The current program has added climate data specific to Richmond and explicitly asked visitors to keep in mind that the extreme weather situation could potentially happen to Richmond in the

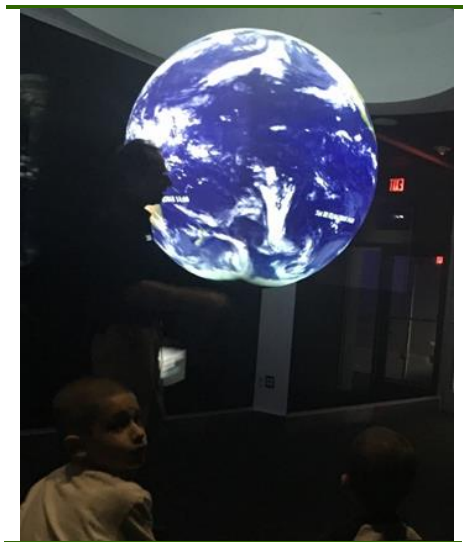
¹ Chadwick, Amy. “Climate Change Communication,”

future. By spelling out the local connections, most visitors were able to recognize ways climate change might impact their lives, whether through creating a preparedness kit for an extreme event, advocating for leadership that values environmental sustainability and emergency preparedness, or anticipating how flooding might impact their property.

The Extreme Event Challenge was an enjoyable and enriching experience for those who attended the program—the museum’s biggest challenge is generating interest in participating in the program. For example, during the April program, only about one-half of those who signed up to participate in the program actually attended, even with the incentive of receiving a free tree to take home with them. During staff interviews, one voiced frustration with marketing efforts within the museum (or lack thereof) for the program. The museum has discussed the potential for marketing the Extreme Event Challenge as a team-building opportunity for local organizations and businesses—we recommend pursuing this avenue, as participants valued the social, team-building, and problem-solving aspects as highlights of the program.

SCIENCE ON A SPHERE

Similar to the Digital Dome, Science on a Sphere offers a highly visual way to communicate to visitors about climate science. Visitors find the sphere an engaging format and said the animations displayed on the sphere make climate change concepts easier to understand. Notably, many visitors said they thought about the evidence scientists use to understand climate change as they viewed the Science on a Sphere presentation, and how climate change science is supported by many different data sets. This is encouraging, as sometimes presenting data to the public can make them feel overwhelmed or confused. Instead, the presentation gave visitors the sense that the data was all building toward scientific consensus around climate change. This supports our findings from the formative evaluation, that effective visualizations like those used in Science on a Sphere can communicate complex ideas and information about climate change and the science behind it by presenting this information in a more easily digestible way. Additionally, the museum strengthened the Science on a Sphere program’s messaging around Virginia’s climate since the formative evaluation, with many more visitors recalling information about Virginia or Richmond’s climate in the summative interviews. Visitors also universally praised the Science on a Sphere facilitator(s) for making the information feel accessible by being approachable and willing to answer any questions the audience had.



Findings indicate that while the Science on a Sphere presentation was effective in communicating climate science, communicating about the personal effects climate change and climate resiliency remains challenging—this supports our findings from the formative evaluation. In particular, participants either did not recall hearing about resiliency behaviors, or, similar to the case with

the Digital Dome’s Cosmic Climate Cookbook, they were skeptical that the solutions offered to mitigate the effects of climate change would make a “meaningful” impact on the problem. The Science on a Sphere presentation is brief, so it seems unlikely that adding more content on resiliency would be feasible or an effective use of time. Instead, this recurring theme of “hopelessness” about individual impact speaks to a larger issue with climate change and resiliency communication. More research may be needed to understand the most effective ways to communicate to the public about the significance and impact of individual and community action on climate change.

Finally, another challenge of the Science on a Sphere program revealed in the observation and staff interviews is increasing attendance, and then keeping visitors through the whole presentation. The location of the Science on a Sphere program is somewhat tucked away, and some visitors said it was difficult to find, which may be leading to low program attendance. Furthermore, one staff member said the presentation seems to work best with young professionals and retirees, but can be too complex for families with young children (who made up the majority of the audience during the observed program). As a result, young families sometimes leave before the presentation is over, and thus, miss out on most of the discussion about resiliency behaviors. The museum may want to consider ways to raise visitors’ awareness of the location of the Science on a Sphere program, and, if young families are an intended audience for this presentation, think about ways to make the presentation more accessible to children.

READY ROWHOMES

Interviews with participants in the Ready Rowhomes program, “Preparing for a Wetter and Hotter Virginia,” indicate the program clearly communicates climate science and resiliency concepts. In particular, responses indicate that the presentation at the beginning of the program provided key foundational knowledge about climate change using data points specific to Richmond, as well as identifying some characteristics of urban environments that make them more susceptible to flooding (e.g., a concentration of paved surfaces) and heat islands (e.g., lack of tree canopy). The maps of Richmond showing heat islands were memorable for participants, and a few vividly recalled hearing about how these heat island areas also overlap with areas with higher instances of health vulnerabilities.

The Ready Rowhomes activity using model homes to test the effects of green infrastructure on extreme rain and heat events provided “convincing” evidence to participants of the benefits of adding green infrastructure to buildings. Participants appreciated the hands-on nature of the activity, the clear and observable results, and the fact that they could easily apply these concepts in their own homes and communities. In this way, the Ready Rowhomes activity stands out

because participants felt empowered that they could take and apply the actions they heard about to make a difference they felt was meaningful—something that the Digital Dome program and Science on a Sphere struggled to do. Staff posit, and we agree, that “doing and seeing” (i.e., participants simulating climate resiliency actions and immediately observing the stark results those actions could have) helped drive home the impact personal actions can have and was a convincing motivator for behavioral change.

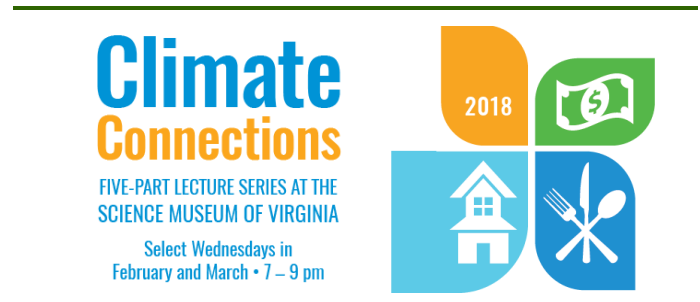
While the results of the Ready Rowhome program were promising, it should be noted that the interview sample size is small and participants of the program were members of an Urban Gardener program at Lewis Ginter Botanical Garden—a program that fosters community organization around urban greening and beautification—rather than the general museum visitor population. Individuals in the Urban Gardener program are already taking action toward environmental projects in the community, and thus may be predisposed to adopt other resiliency actions. Museum visitors may not have the same enthusiasm as the participants interviewed, but nevertheless, the program seems to have a high potential for communicating the impact of climate resiliency behaviors, like adding green infrastructure, on the environment.

CLIMATE CONNECTIONS LECTURE SERIES

Visitor response to the lecture series was positive overall, with some caveats. Interviews indicated that visitors enjoyed the use of data in the lectures because it grounded the presentations in facts, and data visualizations made concepts easier to understand. Many visitors underscored that the information they heard during

the lecture reiterated that climate change is “real” because it was supported by data—a key outcome in the Impact Framework. Findings from the lecture series (and other programs evaluated in this report) indicate presenting data is important, particularly when communicating to climate change skeptics, because it helps to assuage concerns that a presenter is just “being political” or pushing an “agenda.” A few visitors pointed out that presenting data allows visitors to draw their own conclusions, rather than trusting in someone else’s interpretation.

It is also promising that many visitors made connections to how climate change affects Virginia, with flooding being the most commonly cited effect on the local environment. It is not surprising that flooding was top of mind for visitors, not only because one of the lectures was specifically about flood hazards in Virginia, but also because we know from the front-end and formative evaluations that flooding is one of the effects of climate change visitors are already more conscious of (likely due to Virginia’s coastal location). However, findings indicate the lectures also communicated other effects of climate change on Virginia, such as effects on local fish populations and farming.



Inclusion of data in the lectures was a strength, but also a distinct weakness of some of the lectures. Visitors complained that certain presenters sometimes got “too far down in the weeds” with the details of the data and communicated at a technical level above that of the general public they were presenting to. When the lectures went into too much detail, visitors tended to lose sight of why the information should matter to them. Conversations with staff after the observed lecture indicated they agreed that lecture was not as accessible and relevant to visitors as they anticipated. One visitor made a valuable suggestion that the museum may want to provide more explicit guidance to presenters about considering their audience and the information the museum wants visitors to leave with, such as “Why is this information important to me?” Science communication is not easy, especially when focusing on a complex and politically-charged issue like climate change. Striking a balance between providing data and keeping the information accessible is a constant challenge, but an important one for helping visitors feel like they are shaping their own conclusions about the reality of climate change and its impact on their lives.