

# Space and Earth Informal STEM Education Project



## Summative Evaluations Executive Summary

The NISE Network Space and Earth Informal STEM Education (SEISE) project was funded through the National Aeronautics and Space Administration (NASA)'s Science Mission Directorate (SMD) Science Activation program.

The National Informal STEM Education Network (NISE Network) is a community of informal educators and scientists dedicated to supporting learning about science, technology, engineering, and math (STEM) across the United States. Over 500 NISE Network partner organizations participated in the SEISE project between 2015 and 2023.



### Evaluating the impact of the project

Evaluations were focused on understanding the overall impacts of the SEISE project on professionals' Earth and space work, as well as the impacts of SEISE products on the public's interest, engagement, relevance, understanding of SMD content areas (Earth science, heliophysics, planetary science, astrophysics) and their societal implications. More information about the five summative evaluation studies and the methods they employed can be found in the accompanying reports on:

[nisenet.org/evaluation/summative-evaluation-reports](https://nisenet.org/evaluation/summative-evaluation-reports)

## Project Deliverables

### For the Public



#### Explore Science: Earth & Space toolkits

included engaging, hands-on Earth and space science experiences with connections to science, technology, and society.

To learn more: <https://www.nisenet.org/earthspacekit>



#### Sun, Earth, Universe exhibition

offered activities, games, and graphics that allowed visitors to engage in fun interactive Earth and space science experiences, while using skills essential to STEM learning.

To learn more: <https://www.nisenet.org/sunearthuniverse>



#### Mission Future: Arizona 2045 exhibition

provided an immersive experience integrating authentic Earth and space science, imaginative storytelling, and hands-on activities to explore what Arizona might be like in the year 2045.

To learn more: <https://www.nisenet.org/mission-future-exhibition>



### For Professionals



#### Professional development

included 66 Online Workshops, an in-person Earth & Space Partner Meeting, as well as training resources and materials to help professionals engage the public.

To learn more: <https://nisenet.org/pd>



#### Professional learning community

was a cohort of professionals from 99 informal education organizations, who met monthly to learn about and work together towards making Earth and space science more relevant and inclusive for their communities.

To learn more: <https://www.nisenet.org/earthspaceprojects2021>



# Space and Earth Informal STEM Education Project

2016-2023 SEISE Project Reach

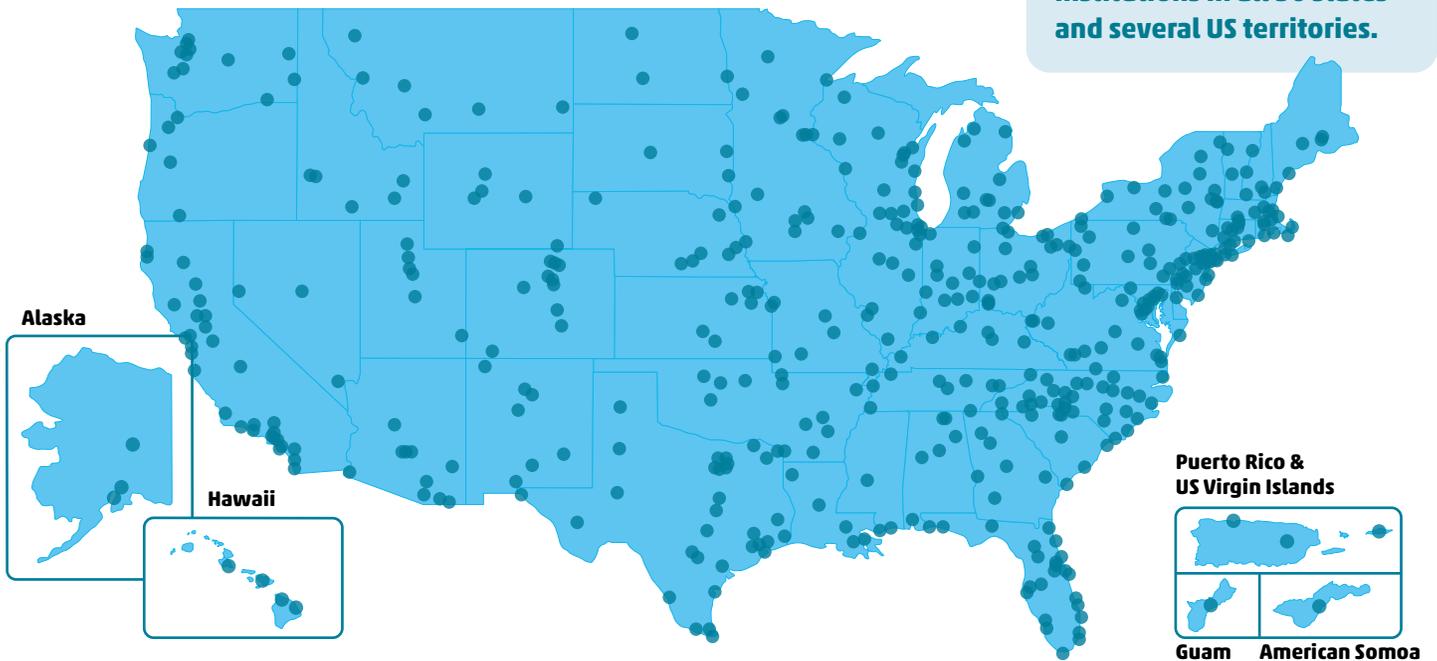


By the end of 2023, the NISE Network SEISE project had reached tens of millions of public participants and thousands of professionals in urban and rural areas.



## Distribution of toolkits and exhibitions

Educational products were awarded to over 500 institutions in all 50 states and several US territories.



Summative evaluation reports:

Anderson, A., Atwood, A., Harvey-Justiniano, S., Kollmann, E. K. (2024). *Space and Earth Informal STEM Education (SEISE) professional learning community summative evaluation*. Boston, MA: Museum of Science, Boston for the NISE Network.

Anderson, A. Harvey-Justiniano, S., Kollmann, E. K. (2024). *Mission Future: Arizona 2045 exhibition summative evaluation*. Boston, MA: Museum of Science, Boston for the NISE Network.

Beyer, M., Anderson, A., Kollmann, E. K. (2021). *Space and Earth Informal STEM Education (SEISE) project professional impacts summative evaluation*. Boston, MA: Museum of Science, Boston for the NISE Network.

King, Z., Velázquez, H., Robertson, S. (2020). *Summative evaluation of the Sun, Earth, Universe exhibition*. St. Paul, MN: Science Museum of Minnesota for the NISE Network.

King, Z., Velázquez, H., Robertson, S. (2019). *Summative study of Explore Science: Earth & Space activity toolkits*. St. Paul, MN: Science Museum of Minnesota for the NISE Network.

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2016-2020 Public Impacts Evaluations  
 Earth & Space Toolkits and Sun, Earth Universe Exhibition

The public impacts evaluations focused on how SEISE educational products may have changed the public’s understanding of NASA SMD content areas, as well as the relevance and interest of space and Earth topics. The summative evaluation studies also focused on how engaging the experiences were for families and explored how experiences may have supported the development of positive science identities. This executive summary highlights main findings from surveys, interviews, and observations.

Engagement with Earth and space products



**96%** of adults reported high levels of enjoyment

**86%** of children reported high levels of enjoyment

**95%** of adults reported high levels of interest

**91%** of adults reported that their group learned something new

**89%** of adults reported high levels of enjoyment

**73%** of children reported high levels of enjoyment

**90%** of adults reported high levels of interest

**80%** of adults reported that their group learned something new



**5½ min.** average dwell time

Visitors spent a lot of time in the 600ft<sup>2</sup> Sun, Earth, Universe exhibition. This dwell time is favorable when compared to other studies of exhibitions across the country, suggesting that visitors were more likely engaged in learning behaviors and had a more in-depth visit.<sup>1</sup>



Increased interest in Earth and space topics

**Explore Science: Earth & Space toolkits**

**Sun, Earth, Universe exhibition**

**85%** of groups reported increased interest

**61%** of children reported increased curiosity

**63%** of groups reported increased interest

**61%** of children reported increased curiosity

**What visitors had to say about the toolkit activities...**

*"[My child is] more interested in the topics now and having lots of fun."*  
 – an adult

*"We are programmed to think of living things on Earth, like plants, but don't think about non-living things. Seeing these [activities] made me think more - not just about living things - but the whole [planet]."*  
 – an adult



<sup>1</sup>Serrell, B. (1998). *Paying attention: Visitors and museum exhibitions*. Washington, DC: American Association of Museums.

2016-2020 Public Impacts Evaluations

Earth & Space Toolkits and Sun, Earth Universe Exhibition

**Confidence talking about Earth and space**

Visitors reported a statistically significant increase in how confident they felt sharing about specific Earth and space topics (Earth science, heliophysics, planetary science, astrophysics, and their social dimensions) after trying the products.

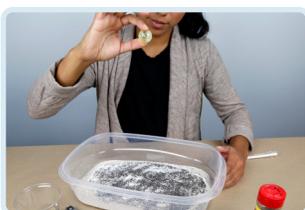


**Relevance of Earth and space content**

**Explore Science: Earth & Space toolkits**

**72%** of adults

reported that they found Earth and space topics more relevant to their daily lives after trying the activities



*"The sand [in this activity] reminds me of the sandbox at our old house."*

*—a child using Exploring the Solar System: Craters*

**Sun, Earth, Universe exhibition**

**56%** of adults

reported that visiting the exhibition made Earth and space topics seem more relevant



*"I have always been curious about the scientific instrumentation carried on board the various spacecraft, which have explored the planets of our solar system. The exhibit covering the sensors of UV, IR, and magnetic fields was very interesting."*

*— an adult*

**Science identities**

The hands-on toolkit activities and the Sun, Earth, Universe exhibition supported positive science identities. Many children and adults reported that they were able to do something hands-on to learn more, work with others, choose ideas to explore, look at something closely, play and use their imagination, and share a discovery—all activities that overlap with doing science in the real world.

When asked, visitors shared ways that these experiences helped them feel like someone who could do or learn about science.



**What visitors had to say about the toolkit activities...**

*"They helped me understand a bit better what scientists do. I can do science. Other scientists go to the moon and bring rocks from the moon."*

*—a child*

*"I feel like opening kids and especially [my] daughters to science is really important. The fact that those experiences apply to all ages; everybody at the table is learning something."*

*— an adult*



Citations:

King, Z., Velázquez, H., & Robertson, S. (2020). *Summative evaluation of the Sun, Earth, Universe exhibition*. St. Paul, MN: Science Museum of Minnesota for the NISE Network.

King, Z., Velázquez, H., & Robertson, S. (2019). *Summative study of Explore Science: Earth & Space activity toolkits*. St. Paul, MN: Science Museum of Minnesota for the NISE Network.

To learn more about Sun, Earth Universe: <https://www.nisenet.org/sunearthuniverse/>

To learn more about the Explore Science: Earth & Space toolkits: <https://www.nisenet.org/earthspacekit/>

2023 Public Impacts Evaluation  
Mission Future: Arizona 2045 Exhibition

Installed at the Arizona Science Center, the *Mission Future: Arizona 2045* exhibition engages visitors in exploring a plausible, place-based future scenario. The exhibition integrates an immersive scenic environment, interactive components, imaginative storytelling, and authentic science to explore what life might be like in Arizona in the year 2045. The public impacts evaluation focused on how this exhibition supported the public’s interest, engagement, and understanding of Earth and space science. This summary highlights the main findings from observations and surveys.

Annual exhibition reach

**>174k** visitors per year

This exhibition is expected to reach approximately 70% of Arizona Science Center’s annual visitation.

Visitors’ experience in *Mission Future*

Visitors thoroughly used the exhibition and reported that they enjoyed the experience.

**15 min.** average dwell time

Visitors spent a lot of time in this 2,500ft<sup>2</sup> exhibition and engaged with many of the available components. Comparing visitors’ use of this exhibition against industry metrics for understanding and comparing visitor behaviors across different sizes and types, *Mission Future* was exceptionally thoroughly used by visitors at the Arizona Science Center.

Visitors enjoyed the exhibition and were particularly drawn to the open-ended interactive elements.

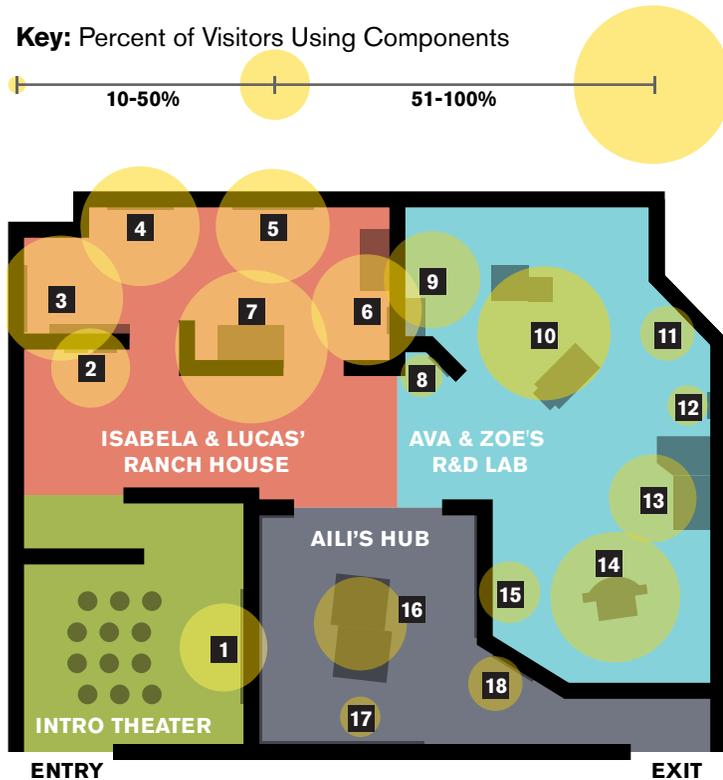
**Augmented Reality (AR) Sandbox**

**87%** of visitors engaged

**Drone Interactive**

**76%** of visitors engaged

*“Our girls were interested in the hands on activities” – an adult*



- |  |   |
|--|---|
| <b>1</b> Introductory Video                | <b>10</b> Drone Interactive                 |
| <b>2</b> Isabela and Lucas Videos          | <b>11</b> Lab View Video                    |
| <b>3</b> Isabela’s Desk, Desert View Video | <b>12</b> Zoe Video                         |
| <b>4</b> Heat and Land Use Interactive     | <b>13</b> Space Station Interactive         |
| <b>5</b> Plan a Community Interactive      | <b>14</b> Personal Spacecraft Interactive   |
| <b>6</b> Lucas’ Desk, Social Media Feed    | <b>15</b> Earth and Space Exploration Video |
| <b>7</b> AR Sandbox Interactive            | <b>16</b> Future Thinker Quiz               |
| <b>8</b> Ava Video                         | <b>17</b> AILI Video                        |
| <b>9</b> Ava’s Desk, Social Media Feed     | <b>18</b> Future Perspective Interactive    |

<sup>1</sup>Serrell, B. (2020). The aggregation of tracking-and-timing visitor-use data of museum exhibitions for benchmarks of “thorough use”. *Visitor Studies*, 23:1, 1-17, DOI: 10.1080/10645578.2020.1750830

2023 Public Impacts Evaluation  
Mission Future: Arizona 2045 Exhibition

Learning about societal content and futures thinking

To what extent did the exhibit increase your feeling that you are...

...someone who thinks about the future and can participate in shaping it. **45%** **36%** **19%**

...motivated to follow up on my own questions or concerns about sustainability and/or climate change. **37%** **30%** **26%**

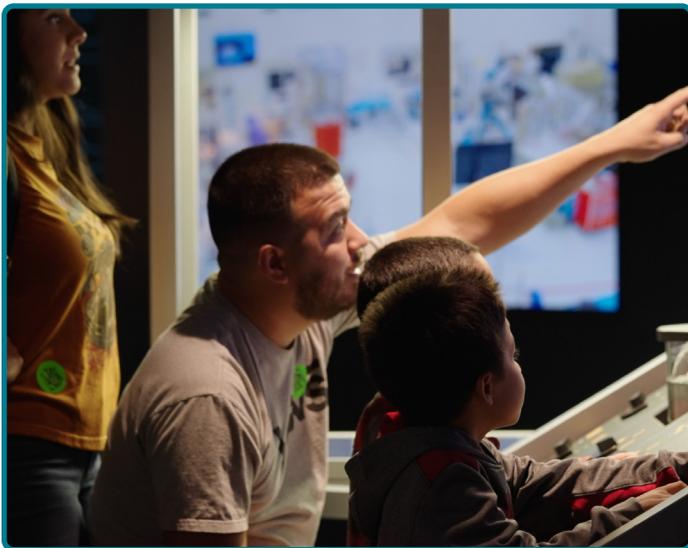
...someone who can learn about and/or participate in current Earth and space science research and discovery. **33%** **43%** **22%**

**A lot** **Somewhat** **A little** **Not at all**

Visitors felt the exhibition increased their confidence in their ability to learn about or to shape the future.

*"I really enjoyed imagining I was in the future." – an adult*

Learning about societal connections with Earth and space science



**93%**  
of visitors

reported learning about how people and communities choose to explore Earth and space science, and develop solutions for the future.

**93%**  
of visitors

learned about many career opportunities in fields related to Earth and space science.

Inclusion of Spanish text and subtitles

Visitors felt that including both Spanish text and subtitles alongside English labels made *Mission Future* feel inclusive and welcoming.

Spanish speakers appreciated having bilingual text or felt that it was helpful, while English-only speakers either reported that bilingual labels did not impact their experience, or made the exhibition feel inclusive or accessible.



*"[having Spanish available] was cool! Being bilingual I really appreciated it."*  
– an adult

## 2016-2020 Professional Impacts Evaluation Professional Development

The professional impacts evaluation was a longitudinal study focused on professionals' content understanding, use of SEISE products, public engagement practices, and partnerships with respect to Earth and space science. This executive summary highlights the main findings from surveys and interviews.



### Knowledge of Earth and space topics and use of products

Professionals' confidence in facilitating the Earth and space content areas significantly increased with their involvement in the project and most reported using SEISE materials for presenting all content areas.

All partner institutions used their toolkit beyond the required event. Toolkits were most frequently used for brief table top activities and K-12 school outreach.

## Impact on informal STEM practices and partnerships

The SEISE project has significantly increased partners' confidence in their ability to address societal content, discuss common misconceptions, and use non-NISE Network materials for Earth and space.

**93%**  
of professionals

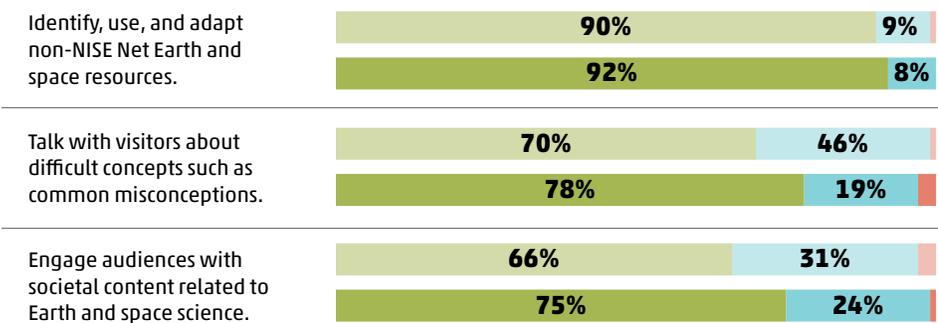
collaborate with community organizations and/or subject matter experts



**91%** Community collaborations

**83%** Subject matter expert collaborations

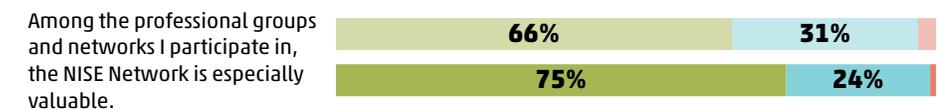
### For STEM practices I feel confident in my ability to...



*"The biggest thing is being able to share that resource of how to actually interact with guests and share knowledge...being able to share that with our industry partners has just made it much easier for them to feel comfortable and confident being part of the program because it gives them that support and that piece that they can learn from."*

– a museum professional

### Value of the SEISE project



## Value of the SEISE project to professionals

Overall, professionals valued the opportunities offered by the project and showed significant growth in being able to meet, learn from, or share with others.



*"When I went to the conference in Phoenix that opened my eyes to the other ways that we could be expanding the use of the NISE kits and hearing what other people were doing really helps me come home and rethink how we can use ours."*

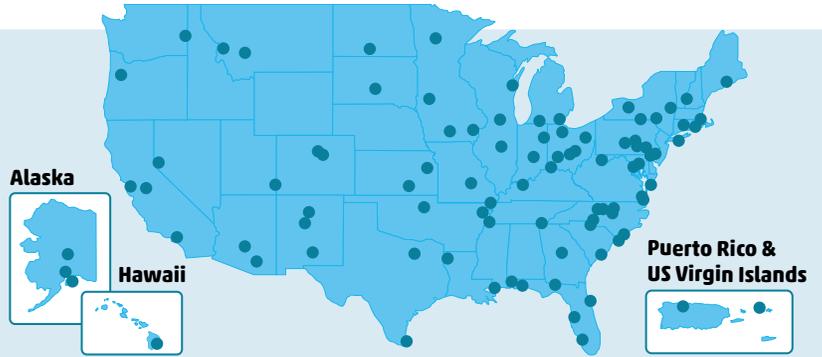
– a museum professional

2021-2022 Professional Impacts Evaluation  
Earth & Space Project-Based Professional Learning Community

The Earth & Space Project-Based Professional Learning Community (PLC) met online monthly to learn and work together on local projects to make Earth and space science more relevant and inclusive for groups who are underserved or under-represented in STEM. The program culminated in a virtual convening where members presented their project work. The professional impacts evaluation was focused on PLC members' use and understanding of practices for engaging diverse public audiences in Earth and space science. This summary highlights the main findings from surveys and interviews.

Program reach

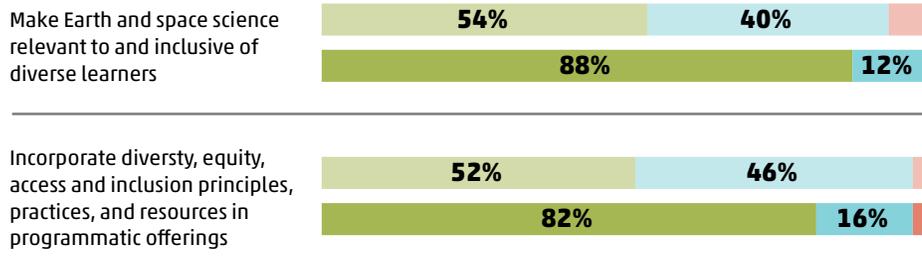
**164** professionals  
**99** informal education organizations



Practices and partnerships to broaden participation

PLC members reported being significantly more confident using diversity, equity, access, and inclusion (DEAI) practices to engage audiences in Earth and space science after participating in the PLC. Through the program, they were also able to explore and implement partnership-related practices.

As part of my Earth and space science education efforts, I feel confident in my ability to...



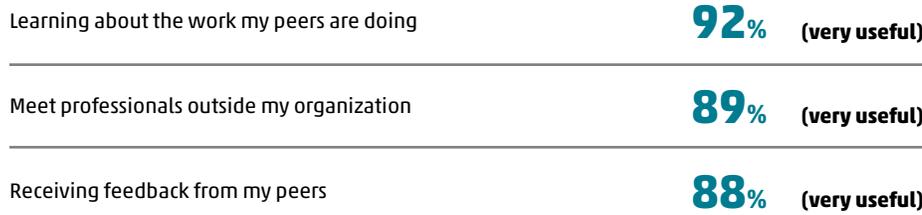
"[The PLC] has given me tools to help me make better connections with our partner and more inclusive language to use in our communications."  
- a professional



Value of interactive community

PLC members highly valued the interactive community aspects of the program, particularly being able to interact and learn from each other.

How valuable were the following aspects of the professional learning community?



"I think that the most valuable thing about participating in the PLC was the opportunity to network with other professionals and learn about their projects. All of the feedback and discussion I think strengthened each person's project and, at least for me personally, helped to spark some ideas for the future."  
- a professional