



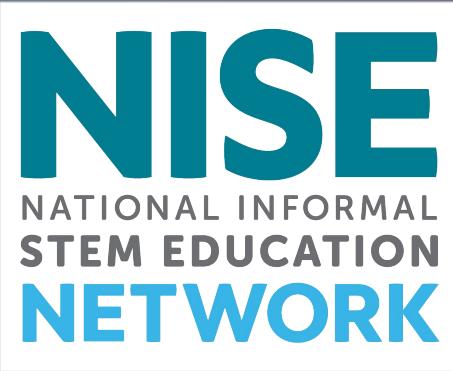
National Aeronautics and
Space Administration

SCIENCE ACTIVATION

**Development Process for the Space and Earth Informal STEM
Education (SEISE) project of the NISE Network**

February 23, 2022





Space and Earth Informal STEM Education Project

Toolkits

Explore Science: Earth & Space toolkits



Exhibitions

Sun, Earth, Universe
exhibitions

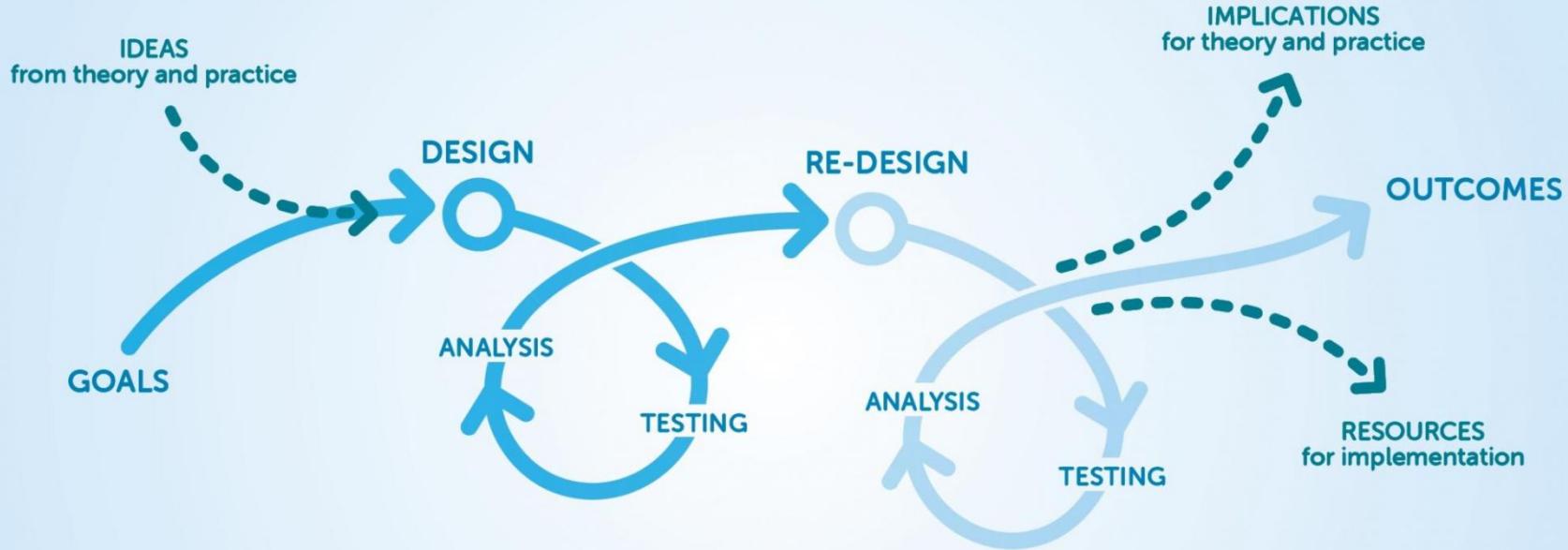


Professional Development





NISE Network educational materials are created through an **iterative, collaborative process** that involves **scientists, informal education professionals, and targeted public audiences.**



A process completely embedded in all our development.





Scientist
Review



Peer
Review



Visitor
Evaluation



Partner
Feedback



Scientist Review



Scientist Review Basics

- Involve subject matter experts (SMEs) **early and often**
- SMEs should review content at defined stages of development, but they should also be **involved at conceptual phases**
- SMEs can help identify **ideas, concepts, and connections** to the science and **communicate excitement**

Scientist Review



***Quick tip:** When SMEs can build on each others comments, in person or online, the review process becomes more focused.



How are SMEs involved?

- Helped in the creation of a learning framework guiding all development
- Suggested existing activities for adaptation, assisted in brainstorming concepts to feature
- Reviewed drafts of all materials—especially image & multimedia selection—for accuracy
- Offered valuable connections to NASA science for content and possible extensions

Scientist Review



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How are SMEs involved?



*Valuable suggestions for the IR and UV setup and testing substrates in Using Tools to Detect the Invisible.



*Adding black and white drawing paper to better demonstrating the use of filters in Exploring the Universe: Filtered Light.

Peer Review



Peer Review Basics

- Many voices should provide input including **front-line staff**
- **Prototypes** are the basis of peer review
- **Don't just discuss**, present prototypes virtual or live
- **Formalize** peer review through the use of forms to capture feedback
- **Don't forget to include peers** out of the development process to test prototypes

Peer Review



***Quick tip:** Bake-in methods to automatically capture peer comments such as google forms or other online resources.



How does peer review work?

- Developers shepherd an activity or component through the entire process
- Rough prototypes are demonstrated to the entire team for comment through a standardized google form organized by the learning framework—**not all prototypes survive review**
- Comments, and formative evaluation results, are used to revise product and finalize a draft of all required guides
- Materials are reviewed and test driven by educators removed from the development process

Peer Review



How does peer review work?

Some important topics covered during peer review

**Safety and suggested
risk mitigation**

**Inclusive audiences
design**

**Format, relevance,
and appropriateness**

**Ease of sharing,
reproducibility &
adaptation**

**Universal design &
accessibility**

**Professional
development
facilitation & training**

Full list: nisenet.org/development_process-more

Vistor Evaluation



How does evaluation help?

Formative evaluation

- Formative instruments shape prototype testing and peer feedback based on audience experiences
- Evaluators were embedded in the development teams and created tools to be used in prototyping by multiple museums
- Evaluators summarized results for single products and also conducted further evaluation with whole toolkits or exhibition prototypes

Vistor Evaluation



How does evaluation help?

Summative evaluation

- Final materials underwent summative evaluation to insure all project deliverables were accessible, engaging, and educationally effective.
- A diverse subset of partner museum across the country hosted evaluators for the summative evaluation of the Explore Science: Earth & Space toolkit and the *Sun, Earth, Universe* exhibition
- Summative report established connecting between project goals, learning framework, and the set of final educational materials

Partner Feedback



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What do partners say?

- A subset of the hundreds of NISE Network partner museums were including the toolkit peer review and the soft roll out of *Sun, Earth, Universe*
- Partners provide valuable feedback on the use of products of time—what runs out, what break, and what tips and tricks emerge
- Partner also send in great examples of local customization.
- Changes made in physical materials when possible—often communicated in digital formats



Partner Feedback



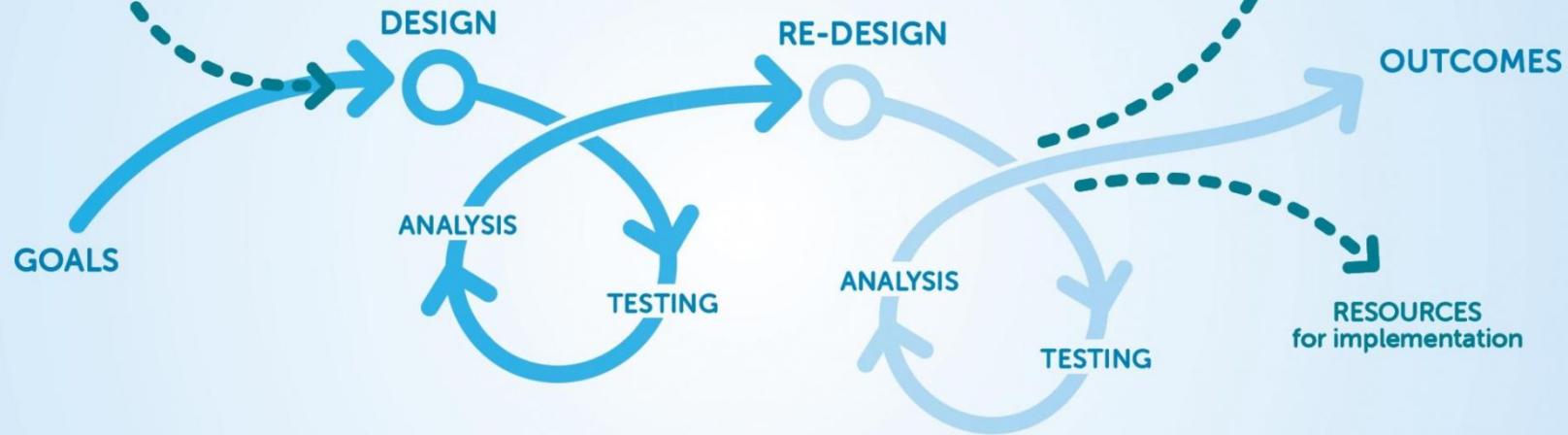
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What do partners say?



*We received incredible feedback from our long-time partners at Port Discovery Children's Museum in Baltimore on the durability of *Sun, Earth, Universe* including the Design, Build, Test spacecraft components.

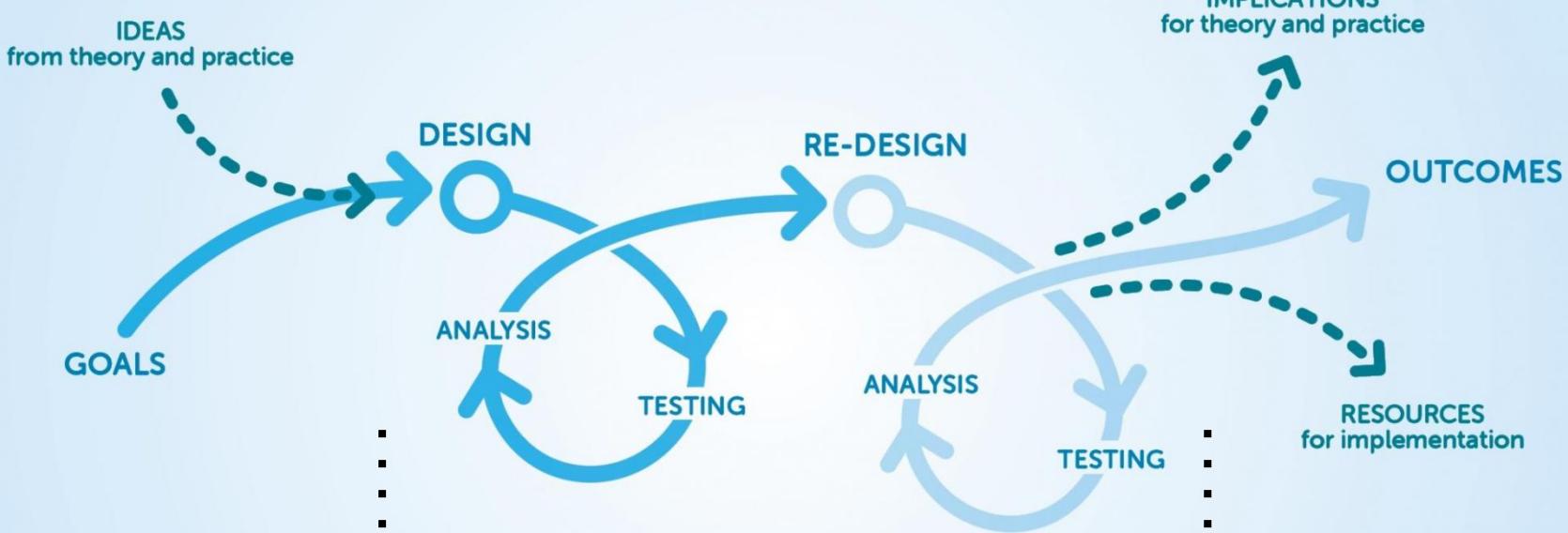
IDEAS
from theory and practice



IMPLICATIONS
for theory and practice

OUTCOMES

RESOURCES
for implementation



Input

Interactive Design and Testing

Output

Scientist
Review



Peer
Review



Peer
Review



Vistor
Evaluation



Vistor
Evaluation



Scientist
Review



Partner
Feedback



Thank You



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Explore Science: Earth & Space Toolkits

2017

9 hands-on activities



Observe the Sun



Stomp Rockets



Bear's Shadow



Nebula Spin Art

2018

10 hands-on activities



Static Electricity



Star Formation



Solar Eclipse

2019

11 hands-on activities



Early Explorations



Temperature Mapping



Orbiting Objects



Filtered Light

2020

15 hands-on activities



Design, Build, Test



Asteroid Mining



Craters



Hide and Seek Moon



Investigating Clouds

Sun, Earth, Universe Exhibitions



Sun, Earth, Universe ² exhibitions are on display at museums across the United States (52 copies).

nisenet.org/sunearthuniverse