

2021 | NASA SCIENCE ACTIVATION

IMPACT REPORT

<https://science.nasa.gov/learners>





INTRODUCTION

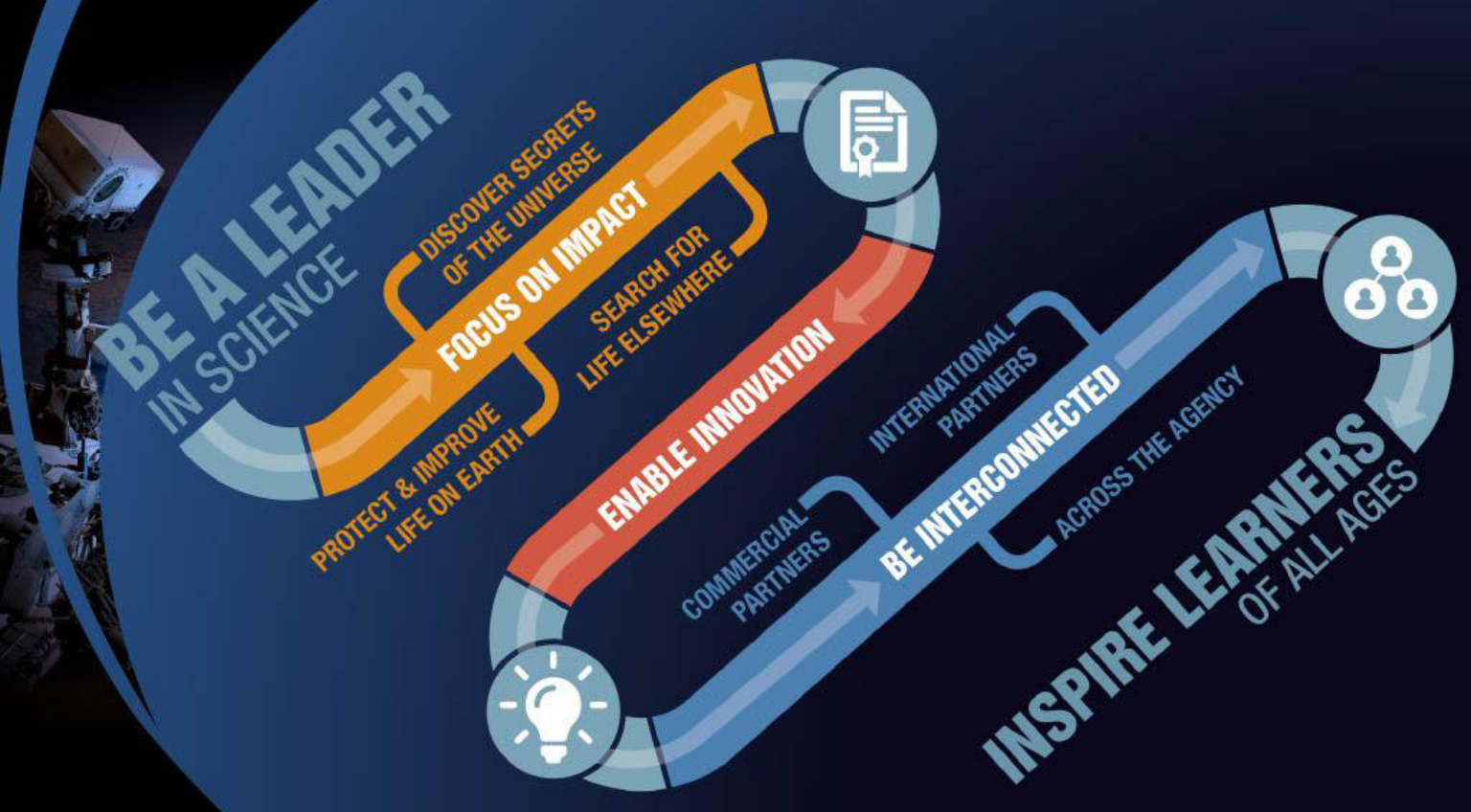
The NASA Science Mission Directorate (SMD) Science Activation (SciAct) program connects NASA Science with diverse learners of all ages in ways that activate their minds and promote a deeper understanding of our world and beyond, with the ultimate Vision:

To increase learners' active participation in the advancement of human knowledge.

This report summarizes the SciAct program approach, provides a snapshot of the program's 2021 impacts, and illustrates how this \$46M program creates impact and value that far exceed its annual expenditures, improving coordination across NASA Science Mission activities and allowing for the increasingly efficient, effective, and sustainable use of SMD Science discoveries and experts for engaging learners.

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THE SCIENCE ACTIVATION PROGRAM

We Connect

A Collective Impact Approach

There are many organizations and programs that aim to inspire a passion for STEM in learners, with the hope that they will eventually pursue future careers in science and technology, but according to research conducted by Kania and Kramer (2011), a single institution is rarely capable of single-handedly facilitating the entire pathway from learning to career opportunities. However, coordinating across many organizations using a “collective impact” approach can help interlink individual programs in a way that is more likely to create pathways to opportunities for learners.



From “Using a Collective Impact Approach to Support Youth Pathways in Technology,” A Case Example by Rafi Santo, New York University (2019). <https://digitalllearningpractices.org/resource/using-a-collective-impact-approach-to-support-youth-pathways-in-technology/>



SciAct models value-based decision making. This has been critical to success during the 2017 Total Solar Eclipse, pandemic, and adapting to community needs.

Since its inception in 2016, the SciAct program has adopted this kind of collective impact, network-of-networks approach. SciAct serves as the “backbone organization” that supports, leads, and coordinates collaboration across a cooperative, nationwide network of competitively selected teams. These teams, made up of community-based learning providers, educators, and experts, work together across a shared set of NASA values and SciAct group norms to connect diverse learners of all ages with NASA Science experts, exciting NASA content, and authentic science experiences. It is through value-based decision making, intentional and independent evaluation, efficient coordination of mutually reinforcing activities, and open and continuous communication that SciAct helps create learner pathways to STEM careers.

We Reach and Engage Learners Across the Nation and Beyond

As shown in the 2020 reach map on page 4, the Science Activation project teams reach and engage learners in all 50 states, Washington DC, and 4 US Territories (PR, USVI, Guam, American Samoa). In 2020 alone, SciAct facilitated 22 million learner interactions in the United States.



23,000,000
learners

reached worldwide!
112 countries, 22
million in the U.S.



72
peer-reviewed
publications



350
hands-on
toolkits

developed and
distributed to science
centers and museums



421
subject matter
experts

ensure accurate
and timely science
content

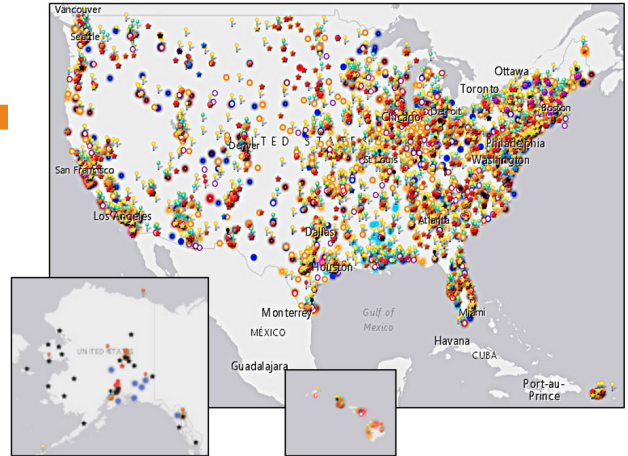


43
teams

including 1100
volunteers hosting
over 50,000 events
since 2016

We Leverage Partnerships and Collaboration

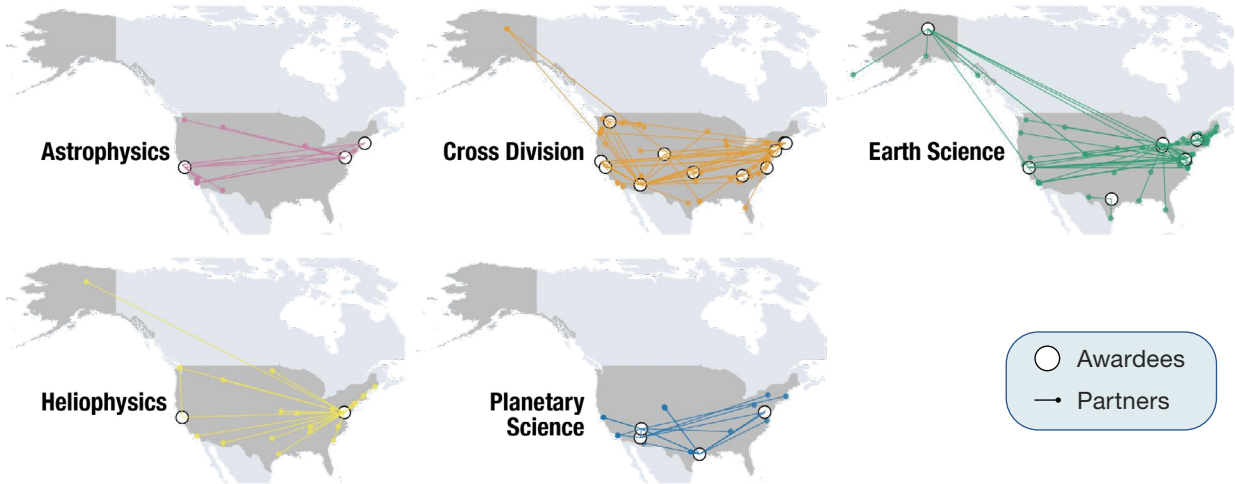
SciAct achieves its impressive reach and engagement goals in two primary ways. First, the program leverages partnerships and cross-collaborations within the program to ensure project teams benefit from each other's assets and expertise as well as that of existing NASA infrastructure teams. This reduces any duplication of effort and promotes efficiency while putting great minds together to accomplish shared goals. In addition, project teams engage in strategic partnerships with community-based and audience-based organizations outside the SciAct program to support existing institutional, state, and local efforts. Leveraging partnerships and collaborating both internally and externally amplifies SciAct's impact for learners across the Nation.



2020 Reach Map



NASA SciAct supports dynamic and deep collaborations among and across SciAct project teams (shown in orange text) and infrastructure teams (shown in blue text). In 2021, there were 91 collaborations across 41 teams. These cross-collaborations extend the reach and impact of projects across the portfolio.



The SciAct program efficiently extends its reach through strategic partnerships with community-based and audience-focused organizations that support institutional, state, and local efforts. Each awardee selects and develops those relationships that help them best achieve their objectives and meet the needs of diverse learners. Since the beginning of the SciAct program in 2016, these partnerships have increased by 20%, with the teams having worked with over 268 active external partners in 2021.

We Inspire Learners and Scientists

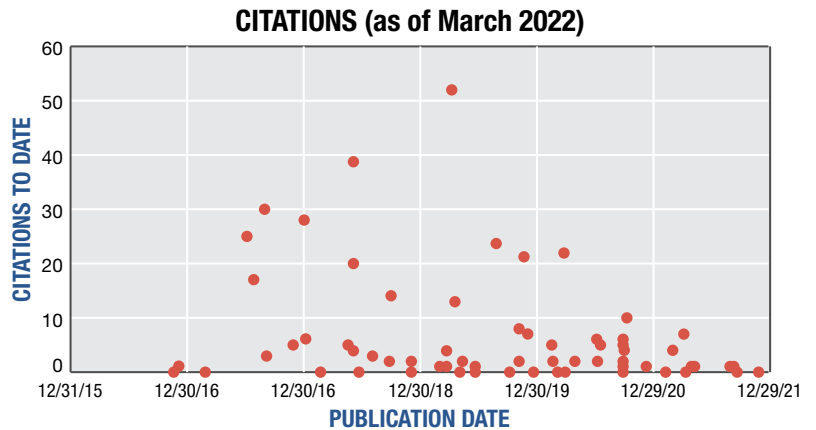
NASA and NASA-funded scientists work with Science Activation, both behind the scenes and interacting directly with learners, to share the story and adventure behind NASA Science. Throughout 2021, more than 400 subject matter experts participated in and helped produce compelling, innovative, and accurate Science Activation events and products—giving learners the opportunity to learn from and work hand-in-hand with real scientists in inspiring and engaging ways.



We Innovate Evidence-based Learning Solutions

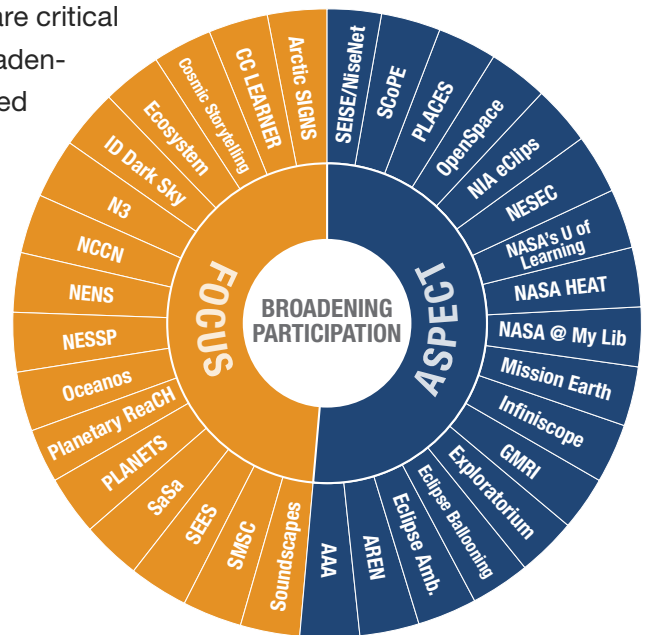
Since SciAct began, our teams have published 81 peer-reviewed papers documenting evidence-based solutions for reaching and motivating learners of all ages so that others can benefit from our lessons learned. To date, these publications have been cited at least 433 times and the portfolio has an h-index of 12.

To explore the range of SciAct peer-reviewed publications, visit: <https://science.nasa.gov/learners/publications>.



We Empower Broadening Participation

Diversity, equity, inclusion, and accessibility (DEIA) are critical values that underscore SciAct’s commitment to broadening participation. With over half of its portfolio focused directly on broadening participation as its primary goal (and the other half with broadening participation-focused aspects), SciAct supports NASA’s 2020–2024 Vision for Scientific Excellence Priority 4 Strategy to “increase the diversity of thought and backgrounds represented across the entire Science Mission Directorate portfolio through a more inclusive environment.” The entire SciAct portfolio aims to better serve groups historically underrepresented in STEM fields by delivering activities and experiences to learners of many backgrounds and leveraging scientist-educator partnerships that demonstrate diverse, broad, and deep national education and communications impacts. SciAct is bringing new learners into the process of science via projects



Since the start of 2021, more than half of SciAct teams focus their efforts on broadening participation by underserved communities. The rest of the SciAct portfolio incorporates broadening participation in some aspects of their work, while otherwise focusing on science content or broader audience segments.

and activities specifically designed to support multilingual, indigenous, rural, immigrant, refugee, disabled, and other disadvantaged, under-served, and under-represented communities, which also closely aligns with our national agenda for STEM education in its priority to increase diversity, equity, and inclusion in STEM.

THE SCIENCE ACTIVATION PROJECT TEAMS

Learn more about each Science Activation Project Team via the following compilation of recent 2021 two-page snapshots.

Project Name	NASA Science Mission Directorate Division Supported	Page
AEROKATS and ROVER Education Network (AREN)	Earth Science	8
Airborne Astronomy Ambassadors (AAA)	Astrophysics	10
American Museum of Natural History: Open Space	Cross-cutting	12
Arctic and Earth STEM Integrating GLOBE and NASA	Earth Science	14
Cosmic Storytelling with NASA Data	Astrophysics	16
Eclipse Soundscapes: Citizen Science Project	Cross-cutting	18
GLOBE Mission Earth (GME)	Earth Science	20
Learning Ecosystems Northeast	Earth Science	22
NASA Community College Network	Cross-cutting	24
NASA Earth Science Education Collaborative	Earth Science	26
NASA eClips 4D	Cross-cutting	28
NASA Heliophysics Education Activation Team (NASA HEAT)	Heliophysics	30
NASA Infiniscope	Planetary Science	32
NASA SMD Community of Practice for Education	Cross-cutting	34
NASA's Neurodiversity Network	Cross-cutting	36
NASA's Universe of Learning	Astrophysics	38
NASA@ My Library	Cross-cutting	40
Native Earth Native Sky	Cross-cutting	42
Navigating the Path of Totality	Heliophysics	44
NISE Network SEISE	Cross-cutting	46
Northwest Earth and Space Science Pathway	Cross-cutting	48
PLANETS	Planetary Science	50
Planetary Resources and Content Heroes (ReaCH)	Planetary Science	52
Smoky Mountains STEM Collaborative	Cross-cutting	54
STEM Ecosystems	Cross-cutting	56
STEM Enhancement in Earth Science	Earth Science	58
Student Airborne Science Activation	Earth Science	60

EARTH SCIENCE

Science Activation

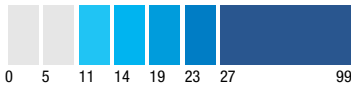
AEROKATS and ROVER Education Network (AREN)



PI: Andy Henry
 INSTITUTION: Wayne RESA
<https://science.nasa.gov/science-activation-team/resa>

AUDIENCE AGE

11+



LEARNING CONTEXTS



INFORMAL/
OUT OF SCHOOL

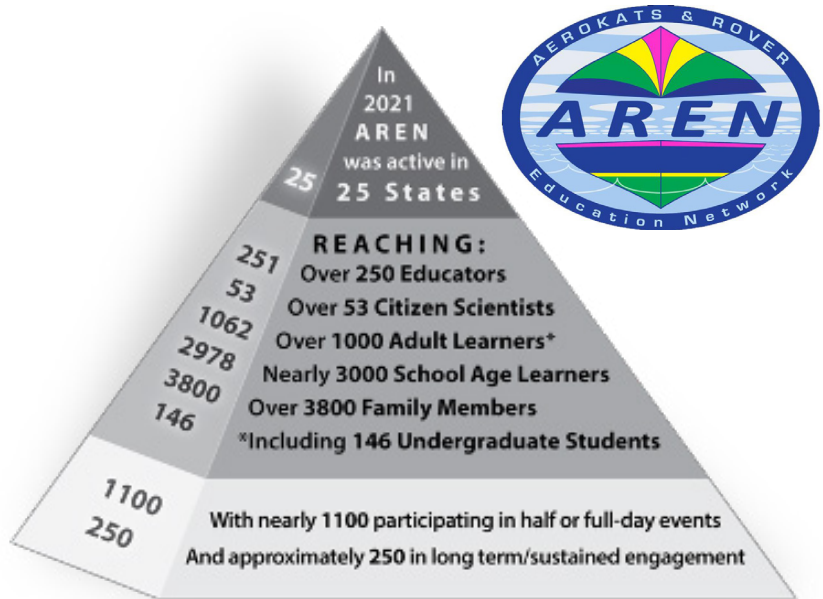


CITIZEN
SCIENCE



FORMAL
EDUCATION

The AREN Project introduces learners of all ages to the world of NASA remote sensing through novel NASA technologies, science, and operations concepts. Low-cost instrumented kite-borne platforms, called Aeropods, allow learners to conduct local-scale remote sensing missions and to collect remote in-situ measurements of atmospheric phenomena. Instrumented remote controlled watercraft called AquaROVERS are used to conduct water quality investigations remote from shore, and instrumented remote controlled TerraROVERS, allow users to conduct measurements of surface conditions in terrestrial environments.

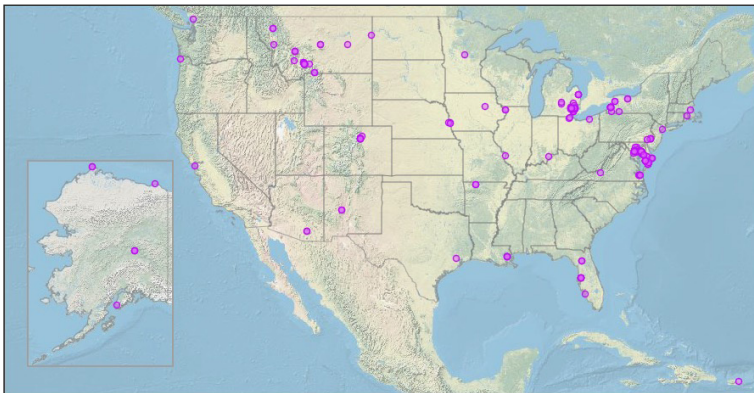


“ AUDIENCE QUOTE: “I used the manual image classification exercise you provided. ... They are doing a great job of working together and helping each other understand, while completing individual projects that prevent copying. It’s been a fun way to expose them to the real-world use of geometry and science, and is much less stressful for them than a comprehensive final exam. Thanks so much for being such wonderful resources for me and my classes. We appreciate you!”

—Teacher, Henryville, IN

★ Key 2021 Accomplishments

- Collaborative launch of the TerraROVER platform with GLOBE Mission Earth in support of Surface Temperature/Urban Heat Island Campaign
- Launch of first AREN Summer Institute (virtual) featuring extended Professional Development model and geographically distributed educator cohort; will continue throughout the year
- Onboarding of new team members
- Initiated several programs with new partner schools
- Upward Bound at UMES — now collaborating with UC Boulder program
- Camp AREN at USF
- Inclusivity Camp at MSU
- Collaborated with GME and Arctic Earth & SiGNS on Broadening Participation in Engineering group
- Supporting program at Northwest Indian College (NWIC) focusing on tribal energy sovereignty



AREN Project Reach 2019–21



TerraROVER Training with GLOBE Mission Earth

⚙️ Key Partners Active in 2021

SciAct Collaborative Partners

- GLOBE
- Arctic Earth and SiGNS
- GLOBE Mission Earth

Organizational Partners/External

- 3-D Thursdays – Rural Education Network (Arens)
- AmericaView (UT/LA)
- American Kitefliers Association
- Brave Hearts (VA)
- EarthViews
- National Park Service
- Rouge Education Project (MI)
- SABENS Group (NH)

University Partners (External)

- Northwest Indian College (WA)
- Oklahoma State University (OK)



Top: AeroROVER launch with Rouge Education Project; **Middle:** Aeropod flight at Shumate Middle School, MI; **Bottom:** Aeropod launch over ice at Earthquake Lake, MT

ASTROPHYSICS

PLANETARY SCIENCE

Science Activation

Airborne Astronomy Ambassadors (AAA)



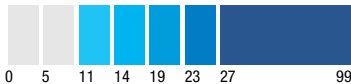
PI: Dr. Dana E. Backman

INSTITUTION: SETI Institute

<https://www.seti.org/aaa>

AUDIENCE AGE

11+

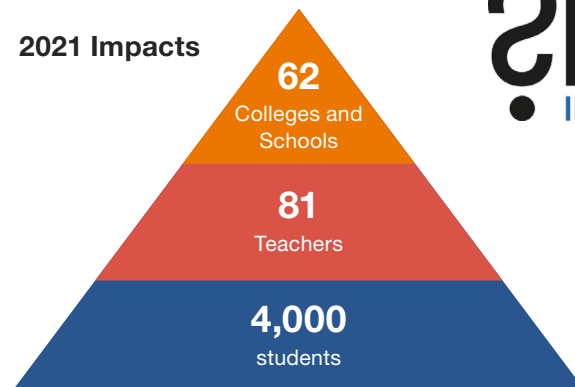


LEARNING CONTEXTS

FORMAL
EDUCATION

The Airborne Astronomy Ambassadors (AAA) project aims to measurably enhance student STEM learning & engagement in selected school districts and community colleges via professional development for science teachers, including participation in science flights on NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA).

2021 Impacts

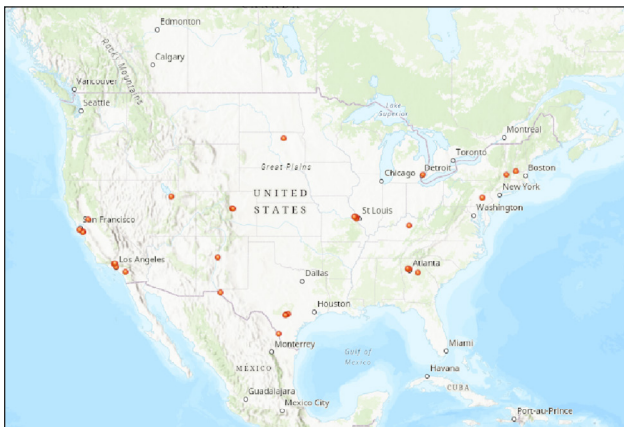


““ AUDIENCE QUOTE: “Participating in AAA changed the trajectory of my life, professionally and personally. Because of my AAA experience, I eventually took a full-time STEAM administrator position in a charter school network, developing & leading aerospace projects. The ripple effect continues, with more than 1,500 students immersed in introductory aeronautics, 2,500 delving into microgravity experiments, and 9 student-authored experiments conducted on the ISS. In my leadership role I’m now encouraging other teachers to apply to be Airborne Astronomy Ambassadors

—Kathleen Fredette

★ Key 2021 Accomplishments

- Cycle 9 (2021) cohort of 30 educators (14 middle school, 8 high school, and 8 community college) from 10 states were selected by peer panel review of applications. This was the 1st year in which middle school and community college teachers were eligible to apply.
- Brief window of opportunity during June & July allowed 13 Cycles 7 & 8 teachers to have their STEM immersion experiences including SOFIA flights.
- Added a new project component, Astronomy Academy, providing access to NASA subject matter experts & resources for a wider set of teachers than those on track to be Airborne Astronomy Ambassadors. The Astronomy Academy component was pilot tested in the Cobb County (Georgia) and Ft. Zumwalt (Missouri) school districts.
- A 4th edition of the SOFIA Science Case Studies student Reader was produced and delivered to Cycle 9 teachers for distribution to their students as a key component of the AAA electromagnetic spectrum and infrared astronomy curriculum; translation consultant produced a Spanish version.



AAA 2020 Reach map

⚙️ 2021 Partners

- SOFIA mission
- 62 schools & colleges in 13 states

AAA video highlights: <https://www.youtube.com/watch?v=DAVHlckNNd4>



AAA curriculum workshop spectroscopy demonstration



AAAs being briefed by instrument scientist during SOFIA flight.



AAA teacher in classroom post-flight

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

American Museum of Natural History: Open Space



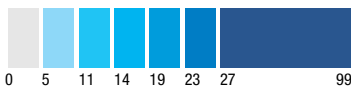
PI: Dr. Rosamond Kinzler

INSTITUTION: American Museum of Natural History

<https://science.nasa.gov/science-activation-team/openspace-project>

AUDIENCE AGE

5+



LEARNING CONTEXTS



DIGITAL LEARNING



INFORMAL/ OUT OF SCHOOL

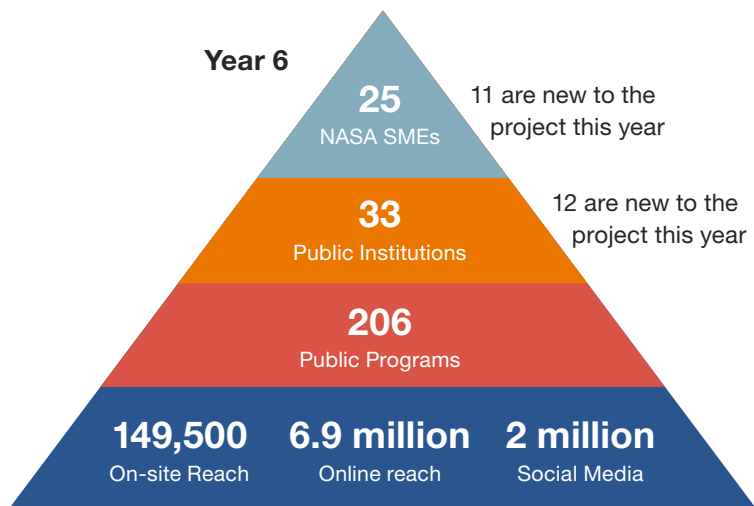


HOME/FAMILY



FORMAL EDUCATION

OpenSpace is open source, interactive data visualization software that enables exploration of the known universe and portrays our ongoing efforts to explore space. The project team is working to expand the number of informal science institutions using OpenSpace to engage their audiences and collaborating with NASA SMEs to incorporate new satellite, mission, and simulation data into the software.



TOTAL ACTIVITY, YEARS 1-6

NASA SMEs	Public Institutions	Public Programs	On-site Reach	Online Reach	Other Online Reach
82	33	384	1,106,900	11,955,400	5,044,000

“**AUDIENCE QUOTE:** “[The best part of OpenSpace was] seeing how the huge amount of data can be compiled into an image of the world that we can fly around and zoom into.”

★ Key 2021 Accomplishments

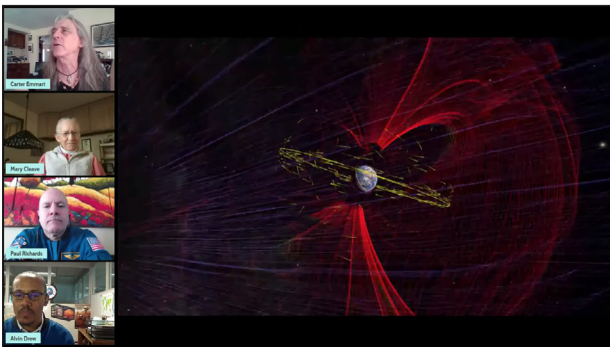
- Released 3 major and 2 minor updates of OpenSpace software
- Engaged 25 NASA SMEs in public programming, formal education settings, research capacity, and to collaborate on software development
- 12 new users successfully installed and/or using OpenSpace
- 206 public programs and 4 exhibits reached 149,300 on-site and 305,200 online



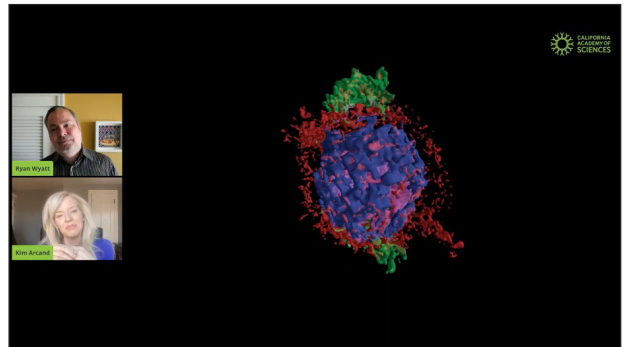
OpenSpace interns in the Astronomy & Astrophysics Lab at the North Carolina Museum of Natural Sciences.



Presenting OpenSpace to students at the Houston Museum of Natural Science.



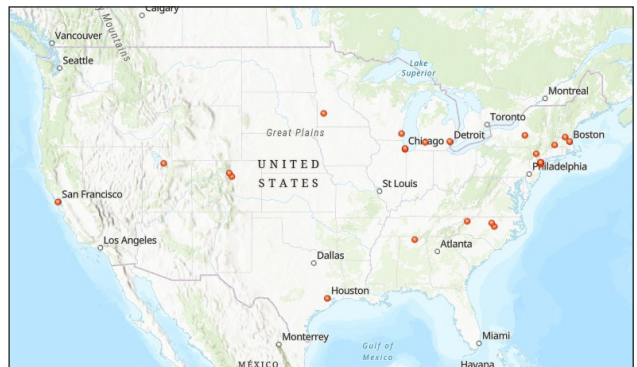
Screenshot from “Making Our Way to Mars,” livestream with NASA astronauts Mary Cleave, Paul Richards, and Alvin Drew for the Mars 2020 Perseverance landing.



Screenshot from “Cosmic Conversation” livestream from California Academy of Sciences featuring Dr. Kimberly Kowal Arcand.

🧩 Funded Partners

- Adler Planetarium
- California Academy of Sciences
- Denver Museum of Nature & Science
- Houston Museum of Natural Science
- New York University
- North Carolina Museum of Natural Sciences
- University of Utah



Reach map

EARTH SCIENCE

Science Activation

Arctic and Earth STEM Integrating GLOBE and NASA

PI: Dr. Elena B. Sparrow

INSTITUTION: University of Alaska Fairbanks

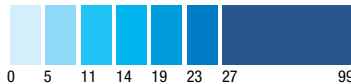
<https://science.nasa.gov/science-activation-team/arctic-earth-signs>

Educators, community members, and youth are engaged in STEM, climate learning and action through multiple knowledge systems, interdisciplinary approaches, and, Indigenous, GLOBE and NASA, science and resources.



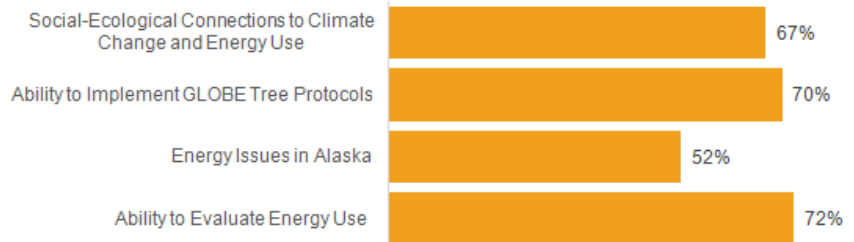
AUDIENCE AGE

All Ages

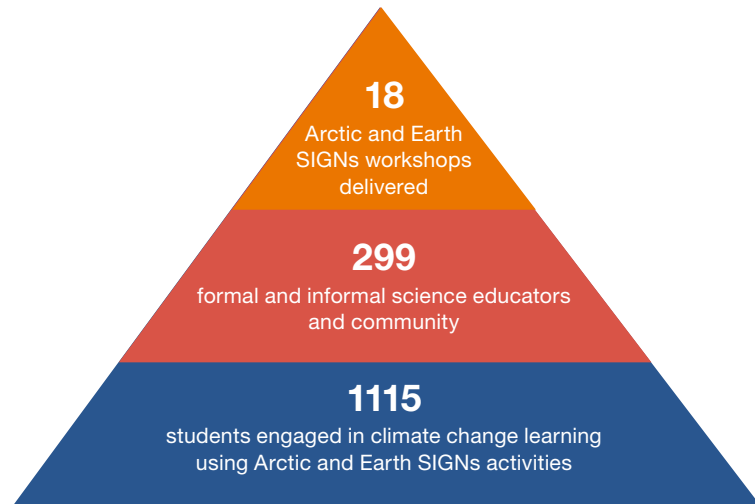


LEARNING CONTEXTS

- DIGITAL LEARNING
- NEIGHBORHOOD/COMMUNITY
- INFORMAL/OUT OF SCHOOL
- HOME/FAMILY
- CITIZEN SCIENCE
- FORMAL EDUCATION

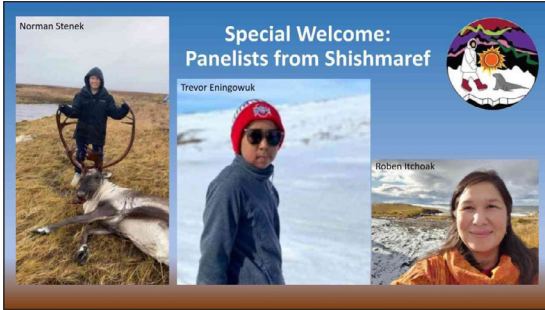


Percent of Climate Change and Energy Connections in my Community participants who reported increased knowledge of course topics (n = 27)



“EDUCATOR QUOTE: *“This project meets my needs by ‘the acceptance and inclusion of all voices in the discourse about science, climate and indigenous knowledge... I am inspired, refreshed, newly energized!’”*

—L.J.



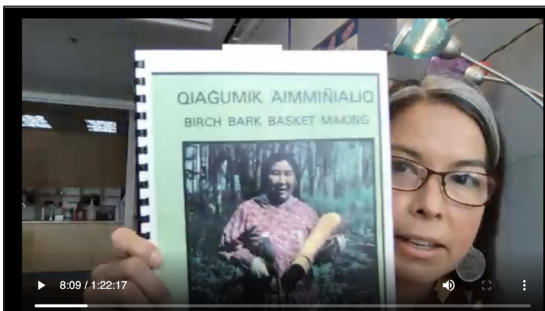
Shishmaref, AK students and teacher shared who they are and where they live.



Shishmaref students presented their GLOBE investigation to an international audience in October, 2021.



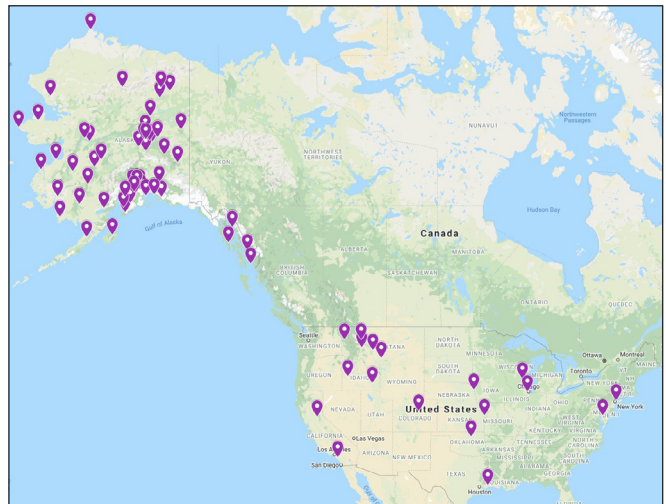
Elders Marie Dayton and Clara Anderson showed their distinct languages on the Alaska Native Language Map as Elena Sparrow and summer campers look on.



Educator Maxine Dibert shared the Association of Interior Native Educators birch bark basket curriculum at the Feb. 2021 professional development workshop.

★ Key 2021 Accomplishments

- **Conducted** online courses, training and follow-up support for educators and community members including families
- **Piloted** teacher and parent user friendly curricular materials i.e., Learning from K’keeyh (Birch) and GLOBE Grandma
- **Hosted** three summer youth camps
- **Expanded** the Climate Research Intensive for first generation college students to 3 locations
- **Tested** with educators, the co-developed rubric for reviewing the Learning from K’keeyh curriculum
- **Applied** AE SIGNs learning model to new projects



Reach map: adults reached thru online and in-person programs in 2021 <https://bit.ly/AESIGNsMAP>

⚙️ Key Partners

- Association of Interior Native Educators
- GLOBE
- NASA Langley Research Center
- Renewable Energy of Alaska Program
- Santa Ana Community College-MESA
- UAF Climate Scholars’ Program
- UAF 365 Smart Academy
- Alaska Climate Center

AE SIGNs video:
<https://youtu.be/uOaOn6WILMI>

ASTROPHYSICS

EARTH SCIENCE

PLANETARY SCIENCE

Science Activation

Cosmic Storytelling with NASA Data



PI: Dr. Alyssa Goodman

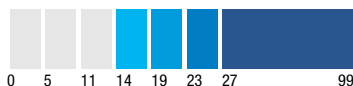
SCIENCE PI: Dr. Patricia Udomprasert

INSTITUTION: Harvard University

<https://science.nasa.gov/science-activation-team/astro-camp/cosmic-storytelling-with-nasa-data>

AUDIENCE AGE

14+



LEARNING CONTEXTS

DIGITAL
LEARNINGINFORMAL/
OUT OF SCHOOLFORMAL
EDUCATION

The world is fast-becoming a place driven by data. To address dire shortages of data competency in the workforce, industry leaders are urgently calling for educational pathways that teach people how to engage with data. The Cosmic Data Stories (CosmicDS) team will facilitate the development of online resources that will teach people how to interact with and learn from data, through “data stories” told by NASA astronomers.

Contributors 5



Software
Development
By the
Numbers

Languages



- Jupyter Notebook 85.2%
- CSS 10.9%
- Python 1.9%
- Vue 1.7%
- Jinja 0.3%



“**EDUCATOR QUOTE:** “The emphasis on truly understanding uncertainties puts this above the usual cut of Hubble Law labs. That’s not where non-science major labs usually go.”

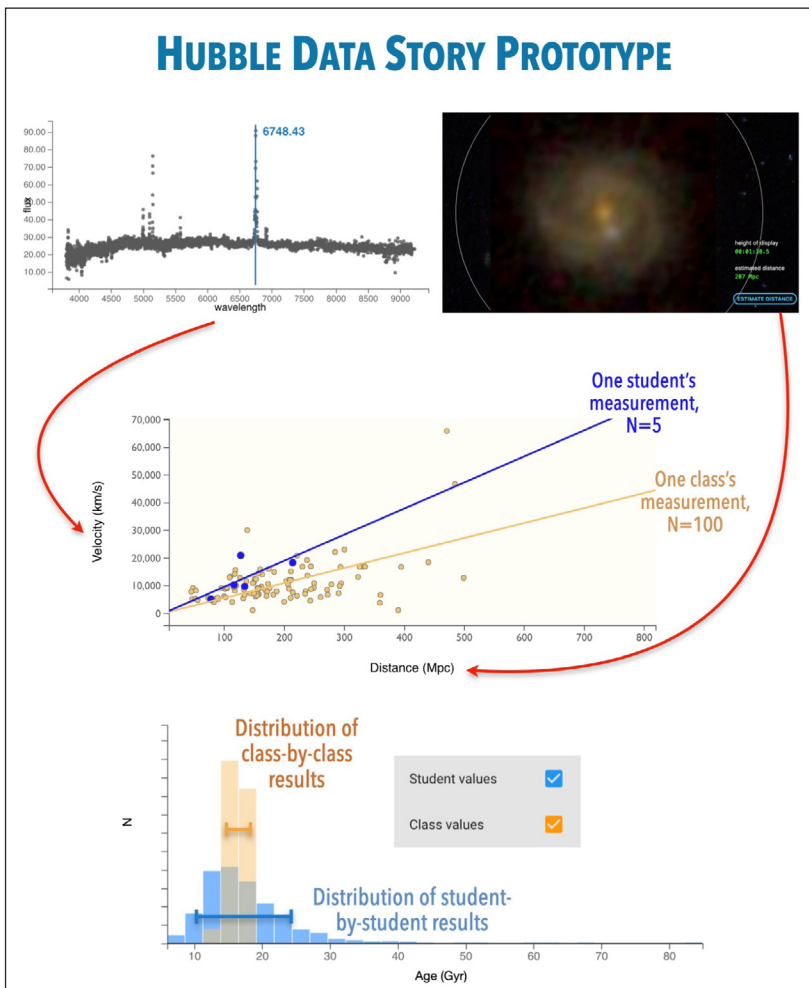
—Astronomy 101 Educator

“The design of this lab allows students to take ownership of their measurements and data, which will help them feel invested in what they’re doing”

—High School Educator

★ Key 2021 Accomplishments

- Built software infrastructure for Cosmic Data Stories, integrating key functionality of glupyter and WorldWide Telescope into web interface that can be customized by the user-experience/design team
- Prototype Hubble Data Story under development—see screenshots below
- Engaged high school and college educators to provide feedback on prototype, and to pilot test in early 2022
- Recruited SMEs with expertise in extragalactic astronomy to help assemble required galaxy data for Hubble prototype and to vet scientific accuracy of content



🧩 Key Partners

- Smithsonian Astrophysical Observatory
- SMEs in UCLA Department of Astronomy
- NASA Community College Network
- Local high school teachers in the Greater Boston Area

TOP: Students will make their own measurements of galaxy velocity and distance based on spectra and image data from the Sloan Digital Sky Survey.

MIDDLE: Students will use their measurements for 5 galaxies to estimate the age of the universe using the Hubble Law (blue), and then aggregate all galaxy measurements from their class to obtain a new age estimate (orange).

BOTTOM: By comparing the distribution of age estimates for individual students vs. entire classes, students can understand how including more data can reduce random uncertainties in scientific measurements.



Students' use of real data to answer a significant question (e.g., how old is the universe?) will be situated within a story that sets their measurements in historical and modern scientific context.

EARTH SCIENCE

HELIOPHYSICS

Science Activation

Eclipse Soundscapes: Citizen Science Project



PI: Dr. Henry "Trae" Winter

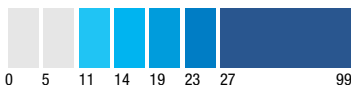
INSTITUTION: ARISA Lab, LLC

<https://science.nasa.gov/science-activation-team/eclipse-soundscapes>

The Eclipse Soundscapes: Citizen Science project (ES:CSP) will create an authentic learning experience that utilizes Subject MatterExperts and evidence-based practices to increase the understanding of the scientific process and address accessibility challenges, specifically those experienced by people who are Blind or Low-Vision (BLV). ES:CSP will answer scientific questions about the impact of the 2017, 2023, and 2024 solar eclipses on U.S. eco-systems using soundscapes.

AUDIENCE AGE

11+



LEARNING CONTEXTS



CITIZEN SCIENCE

Advancing National Educational Goals

Engaging participants in inclusive learning experiences that promote accessibility skill development for STEM careers



Diversity of Thought Discussion: How can physics be more accessible?

Male (54%); White (69%); BA degree(50%); English fluency (100%); No disability (85%); Undergrad (62%), Physics (69%)

Increased **interest in learning how to make STEM more accessible**

Increased **knowledge on how to make STEM more accessible**

American University Physics Colloquium, Oct 2021

A Learner-Centered "real world" UX/UI Accessibility Project

Female (90%); Asian (60%); 18-25 years old (90%); < 1 year academic UX/UI experience (69%); no professional UX/UI experience (70%)

Greater **ability to implement accessible design into their process.**

Improved **Understanding of accessibility UX/UI laws & guidelines**

New York University, Spring 2021 Semester

★ Key 2021 Accomplishments

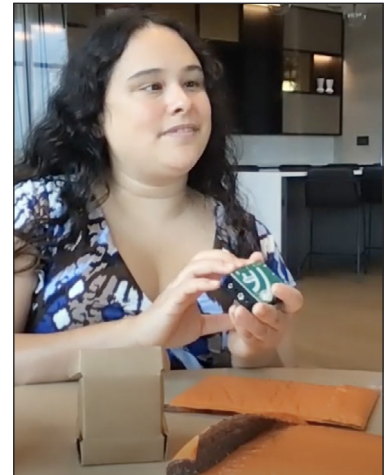
- ES:CSP infrastructure developed to collaborate with NASA SMEs, Soundscapes SMEs, accessibility partners, educators, developers, & citizen science community
- Increased Accessibility Awareness/Knowledge in future STEM workforce; Collaborated with NYU as a “Real World Client” so students could support the development of an accessible citizen science user interface (UX/UI)
- Accessible Citizen Science Kit prototype
- SME-supported ES:CSP Science Investigation Plan
- Data analysis tools made public to ensure accessibility capabilities: Collaborated with Rainforest Connection to integrate analysis systems with their API and make the APIs public so that an accessible layer can be designed in 2022 that will work with already existing audio database and analysis tools
- Iterative Design and Assessment Framework lead to deeper understanding of accessibility challenges that must be addressed to make UX/UI effective AND accessible.



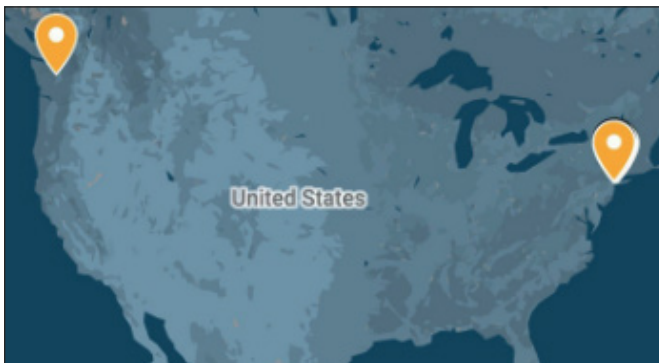
The inexpensive AudioMoth science data recorder made accessible by adding “bump dots” which are used in the BLV community to provide tactile cues.



Grasshopper sitting on a blade of grass against the background of the sun. It is expected that soundscape changes that occur during eclipses will be primarily demonstrated by insect species.



BLV Consultant conducting accessibility review of ES:CSP Citizen Science Kit prototype. Utilizing an iterative design process that considers accessibility from the start is crucial in ensuring that the kits are accessible and engaging.



Reach map. From ES:CSP Evaluator, not from live map

EC:CSP Video Link: <https://bit.ly/3GviSR5>

🧩 Key Partners

- GBH National Center for Accessible Media (NCAM)
- Regine Gilbert of New York University (NYU)
- National Federation of the Blind (NFB)

EARTH SCIENCE

Science Activation

GLOBE Mission EARTH (GME)



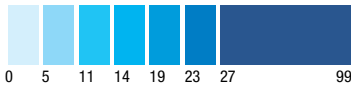
PI: Dr. Kevin Czajkowski

INSTITUTION: University of Toledo, OH

<https://www.globe.gov/web/mission-earth>

AUDIENCE AGE

All Ages



LEARNING CONTEXTS



DIGITAL LEARNING



NEIGHBORHOOD/ COMMUNITY



INFORMAL/ OUT OF SCHOOL



HOME/FAMILY



CITIZEN SCIENCE

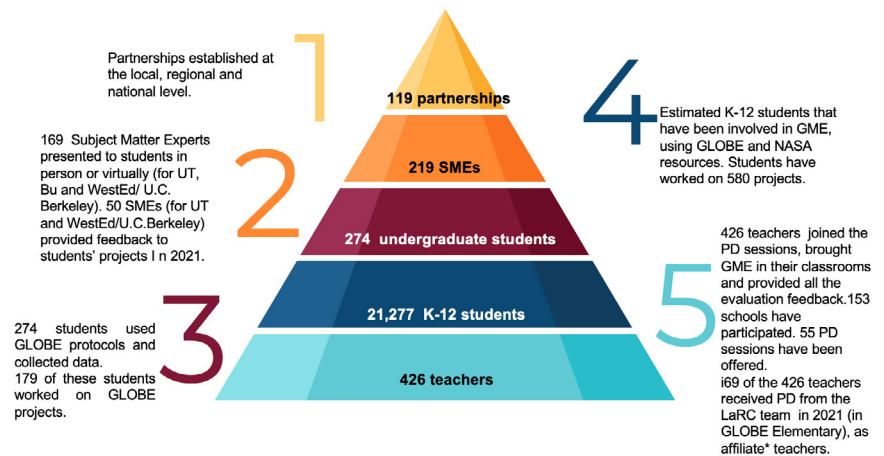


FORMAL EDUCATION



Fusing GLOBE with NASA assets to build systematic innovation in STEM

GLOBE Mission EARTH is a collaborative of multiple institutions across the United States formed to increase involvement in the GLOBE Program (www.globe.gov) and to incorporate NASA assets into student learning. Our focus is on disadvantaged student populations of all ages. Partners include: **NASA Langley Research Center** (LaRC), Hampton, VA; **Boston University** (BU), Boston, MA; **Tennessee State University** (TSU), Nashville, TN; **Palmyra Cove Research Facility**, Palmyra, NJ; and **WestEd/University of California at Berkeley** (UCB), Berkeley, CA. GLOBE Mission EARTH is funded by NASA Cooperative Agreement Notice (CAN) #: NNX16AC54A.



*Note: The affiliate teachers do not provide all the evaluation feedback

“ AUDIENCE QUOTE: “This project meets my needs by [helping me with] “data collection, sharing data with other places, understanding that kids, people all over the world, are doing similar science.”

—Marcy Burns, 5/6th Grade Teacher, Norwalk, Ohio

★ Key 2021 Accomplishments

- Over 4,100 K–12 Students involved; 70 Student Research Projects completed
- 99 Undergraduate Students involved
- 62 Teachers attended UT/BU/WestEd Professional Development (PD)
- 69 Teachers attended NASA LaRC PD in Elementary GLOBE
- 21 Subject Matter Experts (SMEs) connected to classrooms
- Multiple Virtual Science Symposia, Online Trainings and Events

Project Video:
https://youtu.be/iwAaqV6_xII



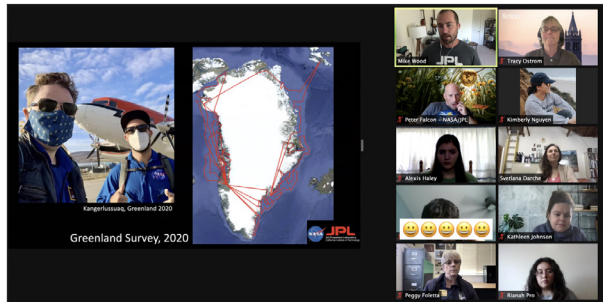
TerraRover Training for Teachers Summer 2021



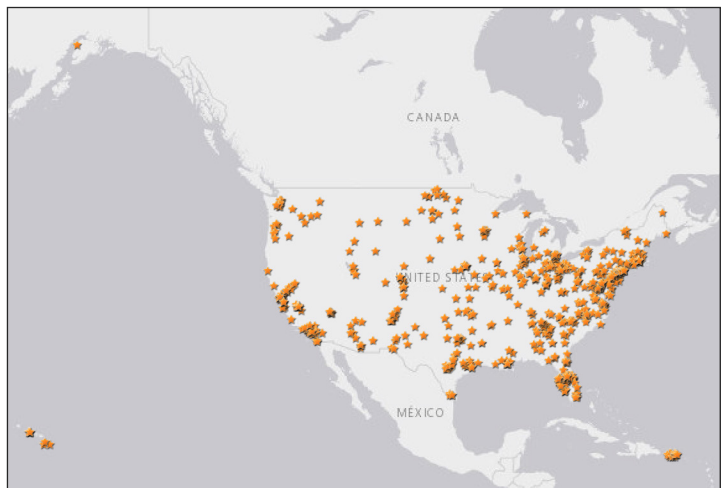
Students collecting hydrology data



GLOBE Youth Geoscientists Interns, UC Berkeley



Virtual Science Symposium



Reach map 2020/2021

EARTH SCIENCE

Science Activation

Learning Ecosystems Northeast

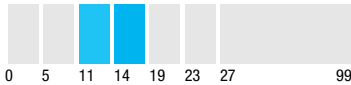


PI: Leigh Peake
INSTITUTION: Gulf of Maine Research Institute

<http://www.learningecosystemsnortheast.org>

AUDIENCE AGE

11-18



LEARNING CONTEXTS



DIGITAL LEARNING



NEIGHBORHOOD/COMMUNITY



INFORMAL/OUT OF SCHOOL



HOME/FAMILY

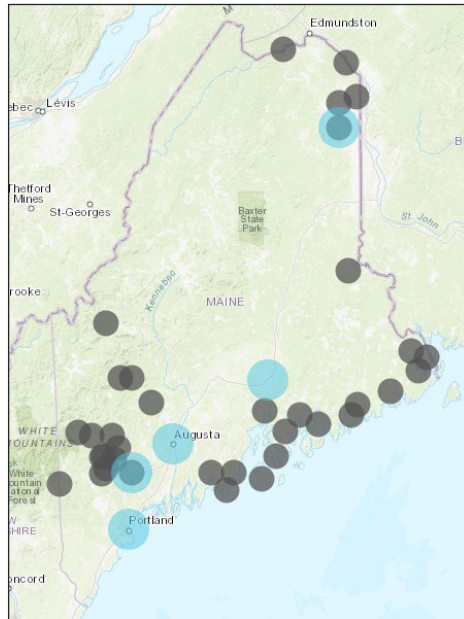


CITIZEN SCIENCE



FORMAL EDUCATION

Learning Ecosystems Northeast (previously Real World, Real Science) is creating Connected Learning Ecosystems across Maine and the Northeast focused on supporting informal and formal educators to create linked NASA-powered explorations of local climate change impacts and thereby lift youth STEM interest and agency.



8 Partner Organizations

12 Science Centers

6 Learning Ecosystems in Maine

100+ Maine Educators

50+ Youth with 4H

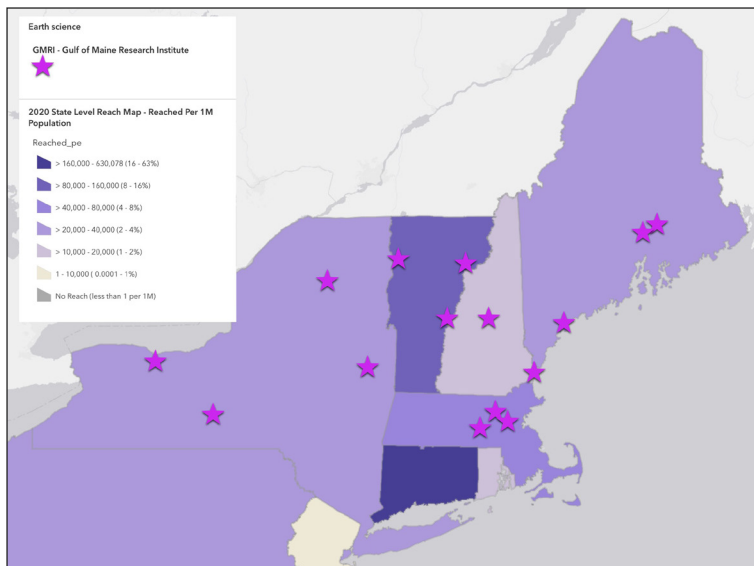
4466 Youth with GMRI

“ AUDIENCE QUOTE: “My head is so full right now! SO GLAD WE EXPANDED TO INFORMAL EDUCATORS. I will connect with Laura on revamped Project Wild and with Rebecca on Weatherblur. We’ll be investigating Blue Hill Peninsula for invasive species, water quality, and climate change.”

—Nell Hermann, Blue Hill Consolidated School

★ Key 2021 Accomplishments

- Launched 6 Connected Learning Ecosystems in rural Maine. 4 evolved from prior network of Teacher Communities. 2 added anew, including 1 serving Tribal communities.
- Data-rich climate learning experiences offered by GMRI, Maine 4H, Maine State Library
- GMRI, Wabanaki Youth in Science, and Maine Indian Education are developing model for data-rich ecosystem investigations that start from Indigenous cultural knowledge.
- GMRI and Gateway Community Services are developing data-rich climate learning experiences for their Color of Climate youth, extending that group from high school to middle school, and planning CLE launch for immigrant/refugee communities of Portland and Lewiston for early 2022.
- GMRI and Maine State Library are planning for Summer 2022 Summer Reading theme of Oceans!
- LabVenture reopened for in-person student visits with full schedule for the 2021–2022 school year.



Reach map

Project Video: bit.ly/3pRv5JU

⚙️ Key Partners

- Education Development Center, Inc.
- Gateway Community Services
- Maine State Library
- Sciencenter
- Shelburne Farms
- Stanford University Graduate School of Education
- University of Maine Cooperative Extension
- Wabanaki Youth in Science



Project partners investigate invasive knotweed



In/Out-of-school educators brainstorm connected climate learning experiences



LabVenture reopens after 18 months!

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA Community College Network



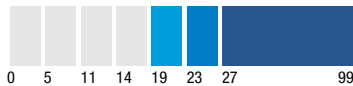
PI: Dr. Simon Steel

INSTITUTION: SETI Institute

<https://nccn.seti.org/>

AUDIENCE AGE

19+



LEARNING CONTEXTS


**FORMAL
EDUCATION**

The SETI Institute's NASA Community College Network (NCCN) is a major initiative to bring NASA Subject Matter Experts, research findings, and STEM resources to the nation's community college system.



24 Colleges in 15 States

AR, CA, FL, HI, IA, KS, KY, MD, MI,
MN, NC, NE, NV, NY, TX

Including 8 Hispanic Serving Institutions



SMEs from 3 NASA Centers + STScI, SAO, SERVI, NRAO, McDonald Obs., SWRI and more...

SME expertise in exoplanets, computational astrophysics, cosmology, lunar and planetary, black holes, star formation, galaxy evolution, ISM, minor bodies and NEOs, data visualization and astrobiology.



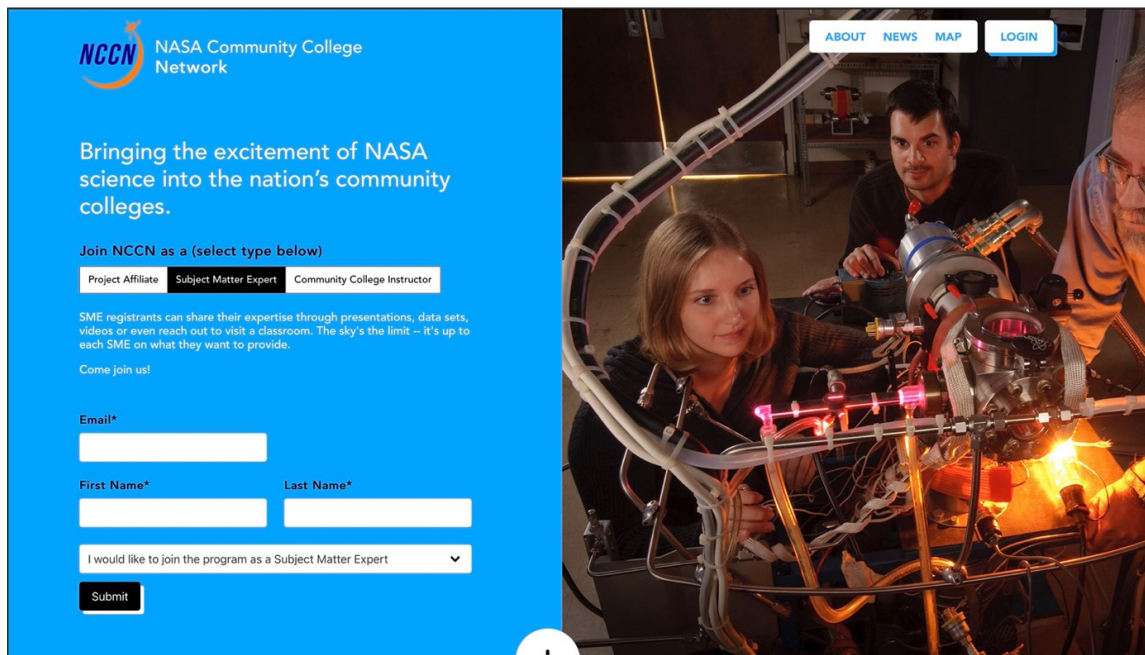
AUDIENCE QUOTES:

"Everything is in one place. So easy to find information."

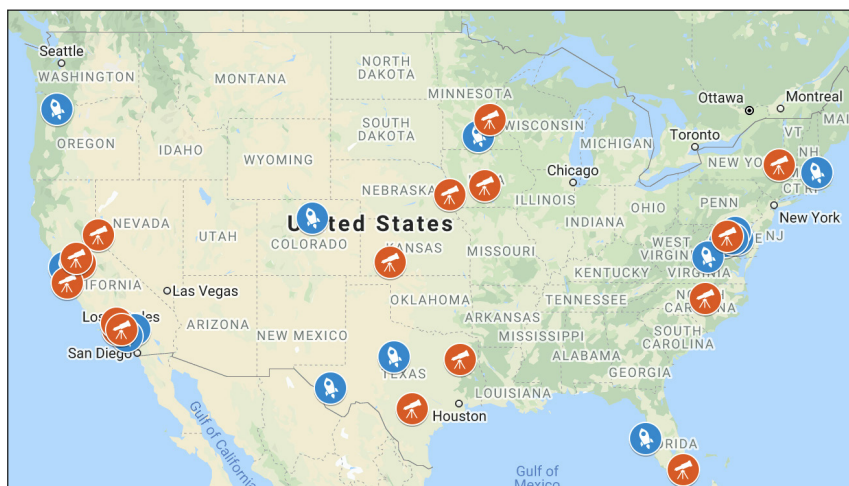
"What a wonderful resource!"

★ Key 2021 Accomplishments

- Successfully filled Pilot Year cohorts: 30 NASA Subject Matter Experts (SME) and 25 Community College Instructors (CCI)
- Guidance from Advisory Board consisting of 8 experienced SMEs and CCIs
- Creation of searchable database with 50 curated audience-specific resources
- Presentation of professional development webinars for both SMEs and CCIs
- WestEd held usability interviews with CCIs, conducted PD webinar evaluation surveys, and contributed to development of database.
- NCCN website includes recruitment tools, participant services, resource database, professional development and collaboration opportunities.



The image shows a screenshot of the NASA Community College Network (NCCN) website registration form on the left and a photograph of three people working with a complex piece of scientific equipment on the right. The website has a blue header with the NCCN logo and navigation links for 'ABOUT', 'NEWS', 'MAP', and 'LOGIN'. The main text reads 'Bringing the excitement of NASA science into the nation's community colleges.' Below this is a registration form with a dropdown menu to select a role: 'Project Affiliate', 'Subject Matter Expert', or 'Community College Instructor'. The 'Subject Matter Expert' option is selected. The form includes fields for 'Email*', 'First Name*', and 'Last Name*', and a dropdown menu for 'I would like to join the program as a Subject Matter Expert'. A 'Submit' button is at the bottom. The photograph shows a woman in the foreground looking at a piece of equipment with various tubes and lights, with two men looking on in a laboratory setting.



Subject Matter Experts
(also: Bonn, Germany, Madrid, Spain)

Community College Instructors
(also: Kahului, HI)

EARTH SCIENCE

Science Activation

NASA Earth Science Education Collaborative (NESEC)

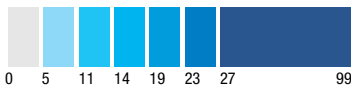
PI: Theresa Schwerin

INSTITUTION: Institute for Global Environmental Strategies

<https://nsec.strategies.org>

AUDIENCE AGE

5+



LEARNING CONTEXTS

DIGITAL
LEARNINGNEIGHBORHOOD/
COMMUNITYINFORMAL/
OUT OF SCHOOL

HOME/FAMILY

CITIZEN
SCIENCEFORMAL
EDUCATION

Short Description: Enable broad participation in authentic NASA Earth STEM experiences for lifelong learners through three interconnected areas: Citizen Science (GLOBE Observers); Science Investigations with NASA; Strategic Partnerships and Collaborations.

NESEC contributes to SciAct's vision: By 2026 to increase learners' active participation in the advancement of knowledge.

Citizen
Science
Contributions

62K+ volunteer hours
212K+ GLOBE observers registered
744K+ observations (clouds, trees, land cover, mosquito habitats)
790K+ satellite images matched to cloud observations
1.56M+ photos submitted

Science
Research and
Investigations

20 peer-reviewed papers
1,300+ student research projects, by 6,400+ learners
650+ Girl Scout Troops plus 4,350 individual scouts
12 GLOBE Goes to Camp pilot sites with 2K+ campers
790K+ satellite images matched to cloud observations
1.56M+ photos submitted

SMEs

>130 SMEs have participated in NESEC activities, ranging from partners to ad hoc engagement

“**AUDIENCE QUOTE:** “This fall, I’ll be joining Colgate University. I’m going to be a minor in environmental studies because of my exposure through the GLOBE Trees program.”

—Macdonald Chirara, high school student,
South Africa, 2021 NASA CitSciCon

★ Key 2021 Accomplishments

- **Participation in all 50 states**, with 1,000+ U.S. students participating in research projects
- **Social media** reached 6.85M+
- **Six new peer-reviewed papers** including three with student citizen scientists
- **GLOBE Observer updates** include **major improvements to Mosquito Habitat Mapper** tool, and **new capabilities in early 2022** that will enable requests for GLOBE data collection in designated areas
- **Collaborations resulted in new resources and opportunities to support STEM Learning** (e.g., SEES Earth System Explorers virtual internship; GLOBE Mission Earth Pacing Guides; eClips Spotlight Video Challenge: Cloud Detectives; Shaw University pilot citizen science course for undergraduates; ISEF Earth System Science Award; SciStarter/Girl Scouts Think Like a Citizen Scientist Journey)
- **Two international data challenges** increased GLOBE data density: Trees and Mosquito Habitats/Land Cover.

⚙️ Key Partners

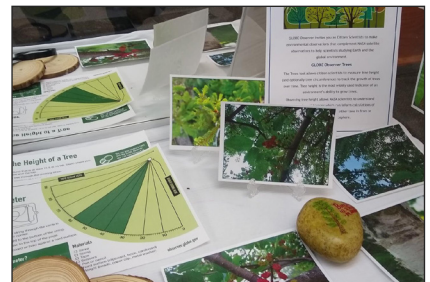
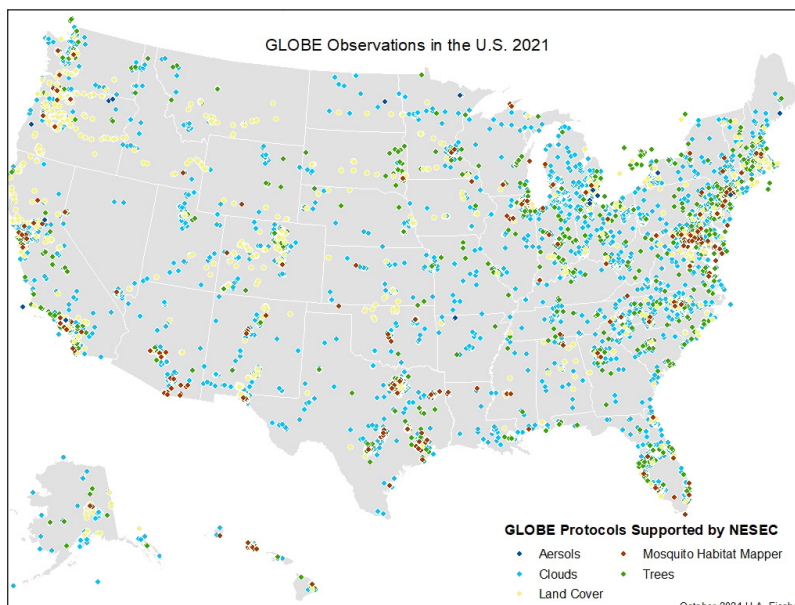
- NASA GSFC
- NASA Langley
- NASA JPL
- Oregon State University
- SciStarter



GLOBE Goes to Camp



A citizen scientist, Macdonald Chirara, presents at 2021 NASA CitSciCon



LaSalle Public Library GLOBE Trees display

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA eClips 4D



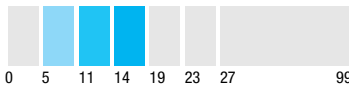
PI: Shelley Spears

INSTITUTION: National Institute of Aerospace (NIA)

<https://science.nasa.gov/science-activation-team/eclips>

AUDIENCE AGE

5-18



LEARNING CONTEXTS



DIGITAL LEARNING



NEIGHBORHOOD/ COMMUNITY



INFORMAL/ OUT OF SCHOOL



HOME/FAMILY



CITIZEN SCIENCE



FORMAL EDUCATION

NASA eClips increases STEM literacy through the lens of NASA by bringing together engaging standards-based videos and resources with educational best practices for the national K–12 formal and nonformal educational communities. NASA eClips introduces learners to STEM concepts and provides educators with engaging resources and tools to support teaching and learning.



NASA eClips website and YouTube— Nearly 13.7 million lifetime views!

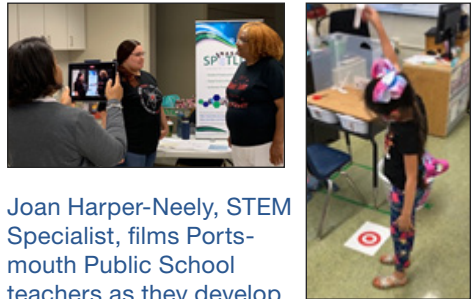


Accessibility and Equitable Opportunities

“I feel extremely valued for my input and suggestions. As a special education teacher, I am able to offer a unique view on the videos/educational programs and how all students can access these. I am able to offer techniques on how to adapt materials so that all students can be involved to an appropriate level. Special education teachers are often overlooked as being knowledgeable or having significant input, so I feel honored that my feedback is valued and well-received.”

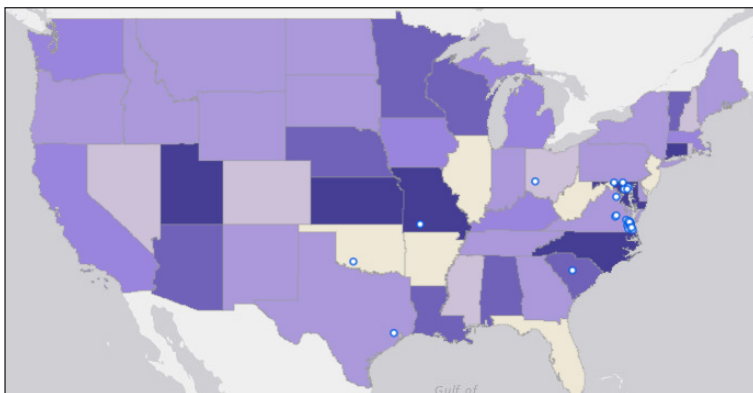
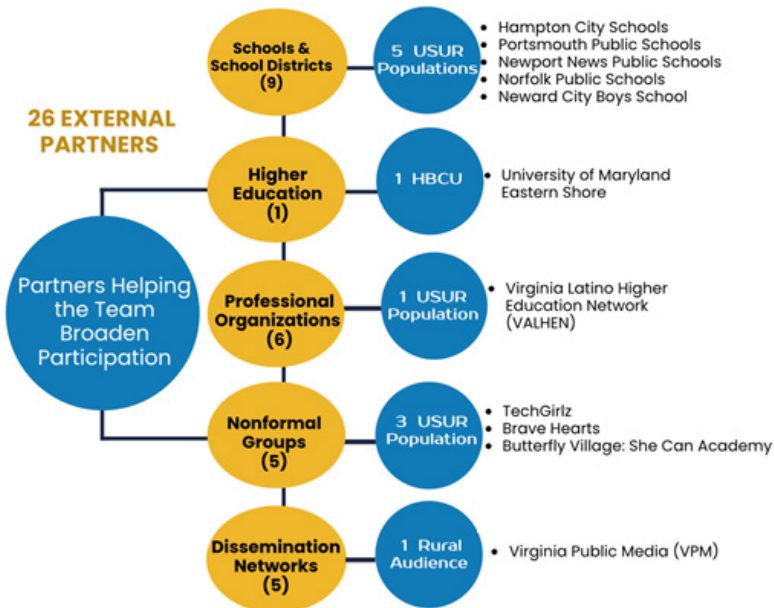
★ Key 2021 Accomplishments

An inclusive model increases collaboration and incorporates educators and learners in the intentional design of videos and resources.



Joan Harper-Neely, STEM Specialist, films Portsmouth Public School teachers as they develop a Spotlight video confronting the misconception that “Mars is red because it is hot.”

Integrated collaborations led to co-development of Spotlight Challenges with SciAct Partners.



Reach map

A diverse group of educators on the NASA eClips Advisory Boards enables the team to:

- develop Spanish resources;
- interact with a more diverse learner audience;
- increase product accessibility; and
- increase national reach.



HELIOPHYSICS

Science Activation

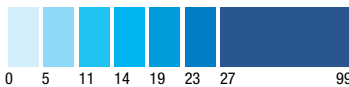
NASA Heliophysics Education Activation Team (HEAT)

PI: Dr. Antti Aleksi Pulkkinen

INSTITUTION: NASA Goddard
Space Flight Center

<https://science.nasa.gov/science-activation-team/nasa-heliophysics-education-activation-team>

AUDIENCE AGE

All Ages

LEARNING CONTEXTS


**DIGITAL
LEARNING**

**NEIGHBORHOOD/
COMMUNITY**

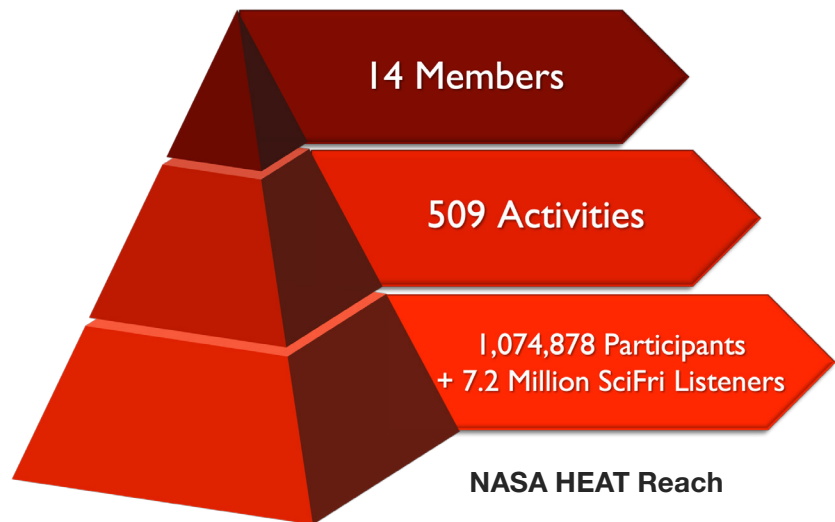
**INFORMAL/
OUT OF SCHOOL**

HOME/FAMILY

**CITIZEN
SCIENCE**

**FORMAL
EDUCATION**

NASA Heliophysics Education Activation Team (NASA HEAT) develops engaging educational programs about heliophysics in-person and virtually. From running successful, nationwide educational programming, such as handling NASA eclipse coordination, to smaller, community-centric projects, NASA HEAT's varied members provide innovative, engaging programs to reach the nation.



“Thank you so much for the wonderful space science activity kits. They are very thoughtful and well made. Our families are going to be super engaged, curious, and excited to learn together. The imagine alien life and aurora bracelet are two of my favorites, and the planisphere, what a bonus!”

—Summer Programming Coordinator
(on Aurora Packets sent out by UAF)

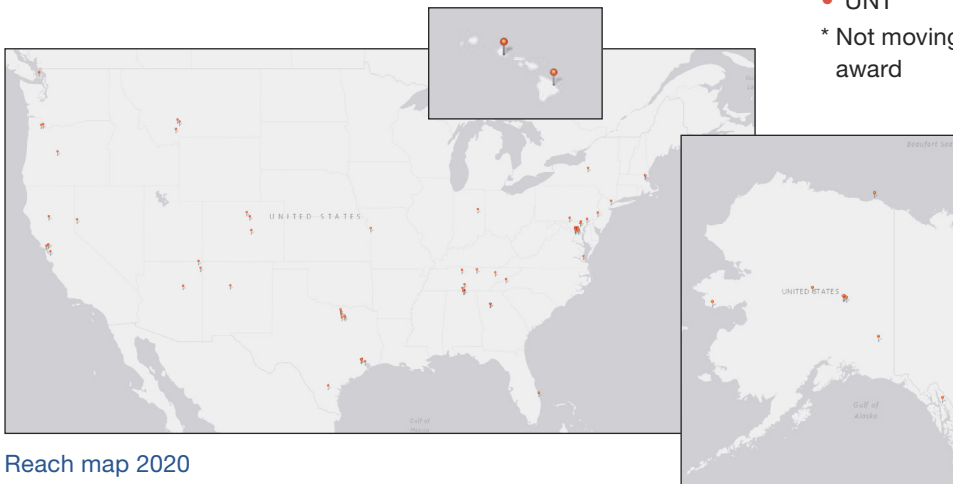
★ Key 2021 Accomplishments

- NASA HEAT began developing the Heliophysics Education Framework (HEF), which will be a resource for educators, parents, and other audiences to facilitate teaching fundamental heliophysics concepts at multiple levels, via NASA assets. These assets will be aligned with national education standards, which will be the foundation for the database.
- NASA HEAT began coordination for the 2023 and 2024 eclipses, including graphic and website development, organizational planning, and collaborations with the American Astronomical Society (AAS). They also assisted with coordinating the June 10, 2021 Annular Solar Eclipse, which included a webpage and fact sheet in Spanish and English and a live stream, viewed by over 600,000 people.

⚙️ Key Partners and Programs

- AAPT
- ARISA Lab*
- Aurorasaurus*
- IEI
- ISTE*
- MSGC
- NASA FSN / AU*
- STEAM Innovation Lab*
- SWLH
- Space Math
- NASA MSFC
- NSHP*
- Radio JOVE*
- Rice University*
- Science Friday*
- UAF
- UNT*

* Not moving forward with ROSES 2021 award



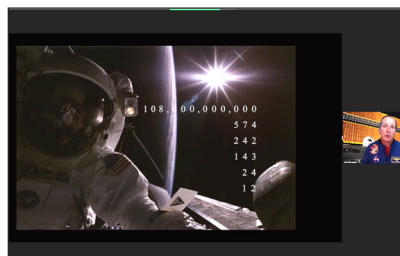
Reach map 2020



1 Min. Video



An example of AAPT’s Digi Kits, a hands-on, inquiry-driven activity that aligns with Science Education Framework and NGSS Standards. Note: Coronal Mass Ejections (CME)



On September 23, 2021, Dr. John Herrington shared with 450 viewers the Apollo program statistics before fascinating them with his personal journeys.



Student drawing of the Aurora–Sun connection and showing their Aurora bracelet that they made to better understand the colors of the aurora and how they correspond to the different gases.

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA Infiniscope

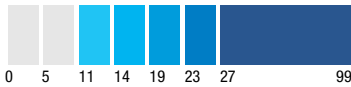


PI: Dr. Ariel Anbar
INSTITUTION: Arizona State University

<https://infiniscope.org>

AUDIENCE AGE

11+



LEARNING CONTEXTS

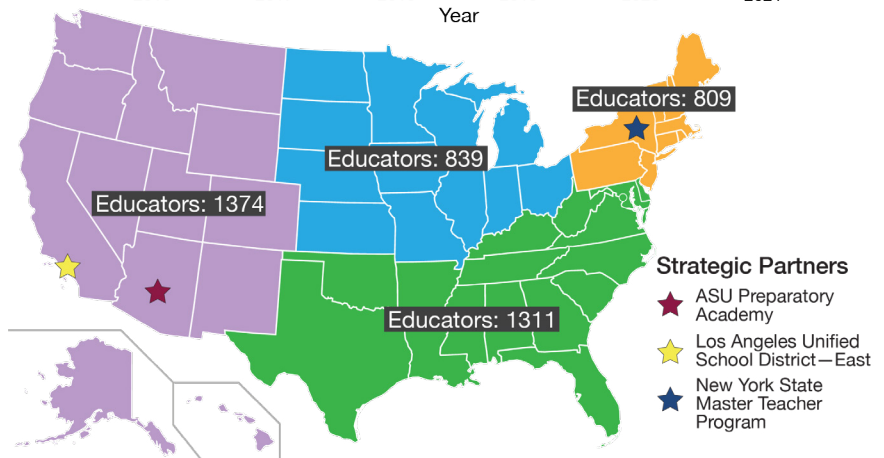
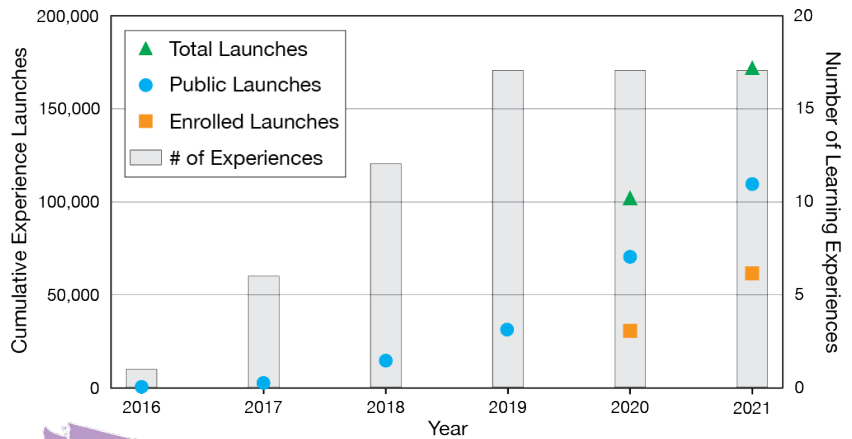


DIGITAL LEARNING



FORMAL EDUCATION

Infiniscope creates NGSS-aligned, interactive, digital learning experiences featuring authentic NASA science, data, and subject matter experts for learners of all ages and cultivates a community of practice that empowers educators in the Earth and Space Science community.



AUDIENCE QUOTE: “I am so happy to have found a place where I can connect directly with other educators and exchange ideas and inspiration using tools that will engage learners, wherever we educate.”

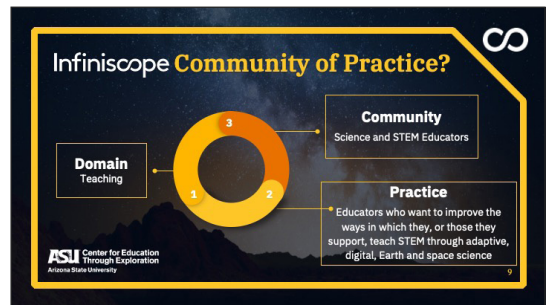
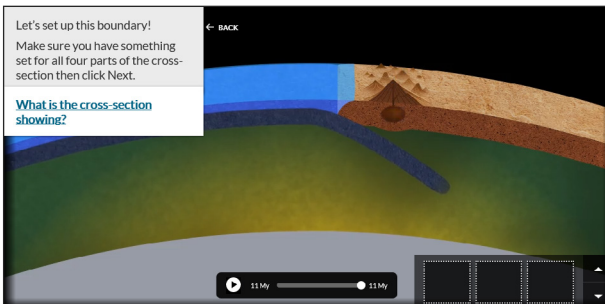
“I feel that the learning experiences I find in Infiniscope are so valuable. They are holistic, creative, and well designed. My students enjoyed participating in the activities.”

★ Key 2021 Accomplishments

- Infiniscope usage nearly doubled from 2020
- Transition to new technology base
- Developed a framework to guide CA digital curriculum program
- Production of 2 new experiences (Fate of the Plates and Tilt our World)
- Developed Tour It tool for easy creation of Virtual Tours

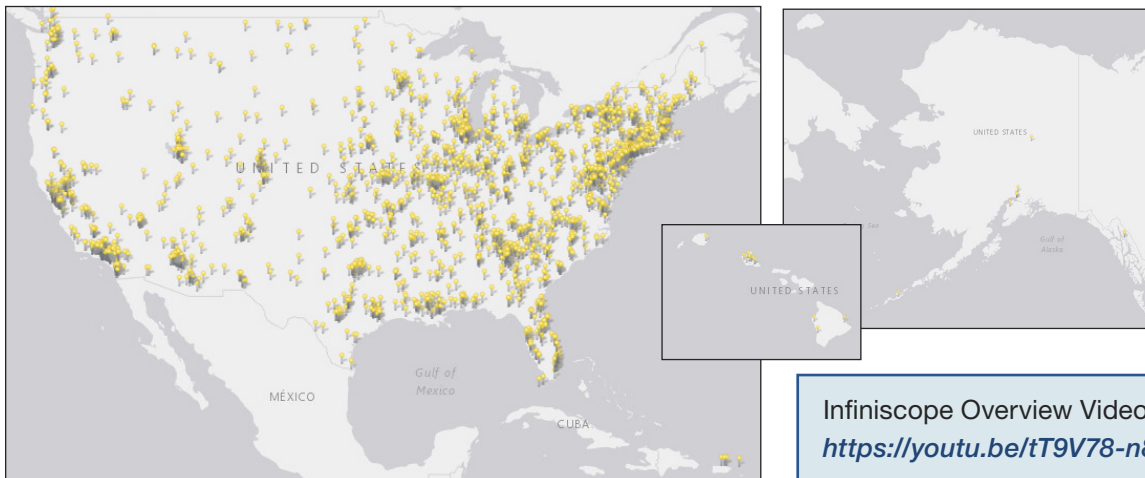
⚙️ Key Partners

- CMU - Open Learning Initiative
- Los Angeles USD - East
- NYS Master Teachers
- ASU Preparatory
- Chief Science Officers Program
- American Geophysical Union
- ASU Teachers College



Experiences: (Top) Screenshot from Fate of our Plates, a lesson designed to discover mechanics of plate tectonics. (Bottom) Screenshot from teacher produced virtual tour created during summer workshop using Tour It tool.

Community: (Top) Students collaboratively learning about Mars using Red Rocks and Insight lessons. (Bottom) The Infiniscope teaching network is a community empowered to connect, collaborate, and create learning experiences for their learners.



Infiniscope reach map

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA SMD Community of Practice for Education (SCoPE)



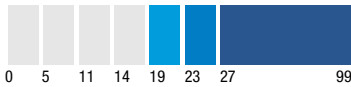
PI: Dr. Meenakshi Wadhwa

INSTITUTION: Arizona State University

<https://scope.asu.edu>

AUDIENCE AGE

19+

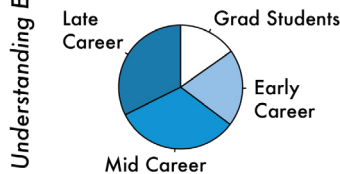


The SCoPE project facilitates connections between NASA experts/early career scientists and Science Activation teams with emphasis on training, seed-grant support, and broadening participation across all demographics.

Collaborations with **18** SciAct Teams



Understanding External SMEs
246 Survey Responses from Subject Matter Experts



“ AUDIENCE QUOTE: “It is very important that young children (K–12) see people who look like them in fields that they might aspire to. In some cases, seeing someone do a job that they know nothing about is tremendously impactful. This is 100% my biggest and most important reason for doing outreach events.”

—SME Survey Participant

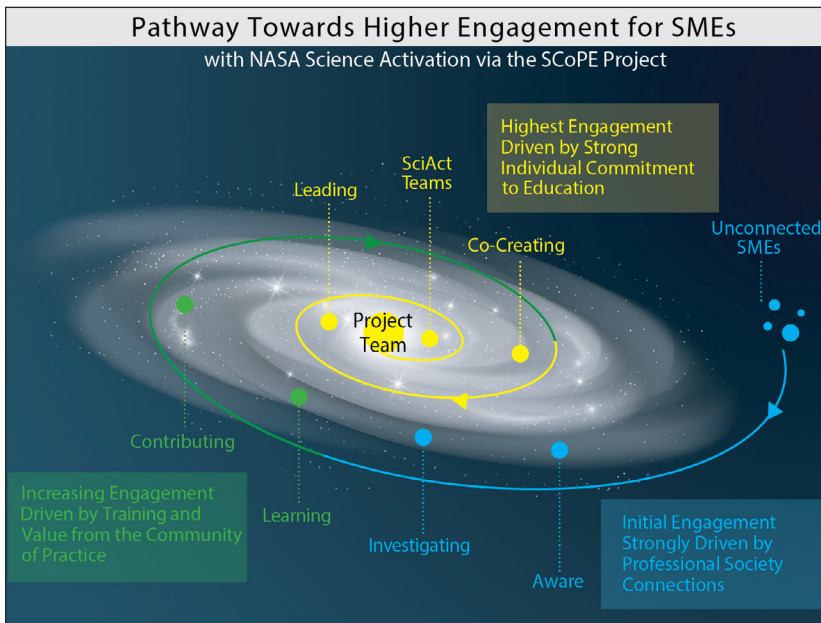
★ Key 2021 Accomplishments

- Needs assessment survey responses received from 246 NASA experts or early career scientists
- 105 NASA experts or early career scientists opted to learn more
- Established project infrastructure to support activities
- Planned conference activities for AGU 2021 and AAS 2022

⚙️ Key Partner

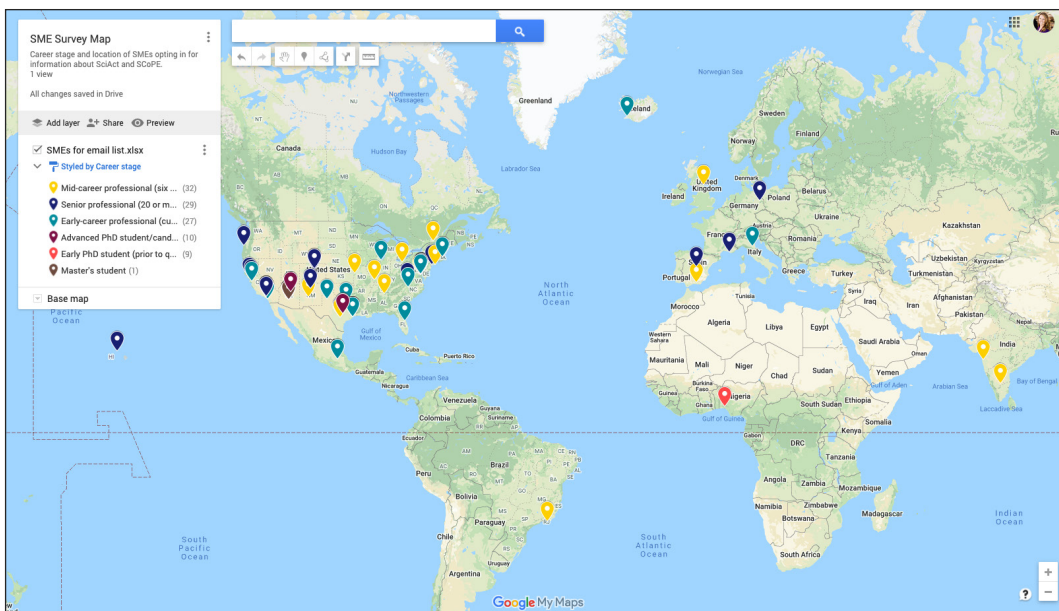
- American Geophysical Union (AGU)

A representation of the anticipated pathways for newly engaged SMEs.



The center of the diagram (yellow) depicts the most active members, including the project team, SciAct teams, and highly engaged SME leaders. On the periphery (blue) are SMEs with no knowledge of or connection to the SciAct.

SCoPE project activities are intended to bring SMEs along a pathway from unconnected to aware of SCoPE opportunities, to investigating those opportunities, to learning how to engage in education, to contributing to the SciAct in a small way, to co-creating education products with a SciAct team, and, for a small number, to leading in the community. It is expected that some SMEs will also exit the community over time, but this diagram is intended to show only the incoming pathway.



Reach map – SME Survey Opt-in. See [live map](#)

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

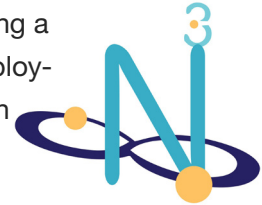
NASA's Neurodiversity Network



PI: Prof. Lynn Cominsky
INSTITUTION: Sonoma State University

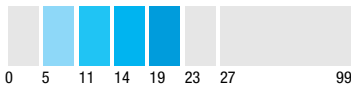
<https://science.nasa.gov/science-activation-team/nasa-neurodiversity-network>

NASA's Neurodiversity Network (N3) is providing a pathway to NASA participation and STEM employment for neurodiverse learners, with a focus on those on the autism spectrum.



AUDIENCE AGE

5-22



LEARNING CONTEXTS



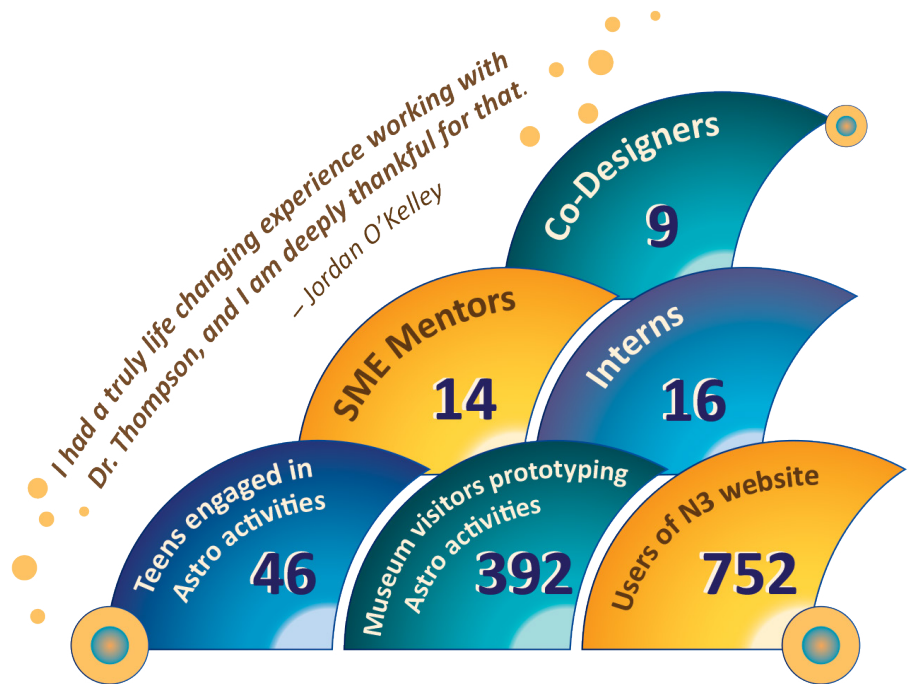
DIGITAL LEARNING



INFORMAL/ OUT OF SCHOOL

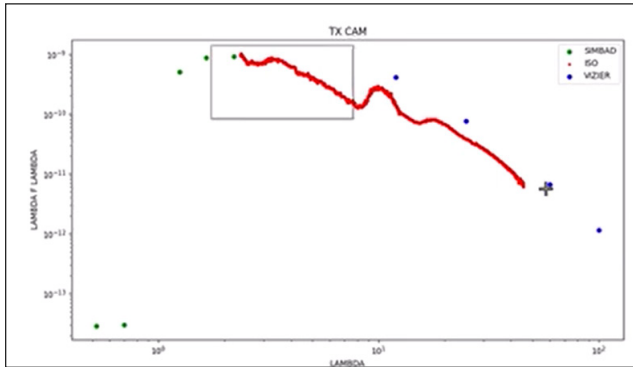
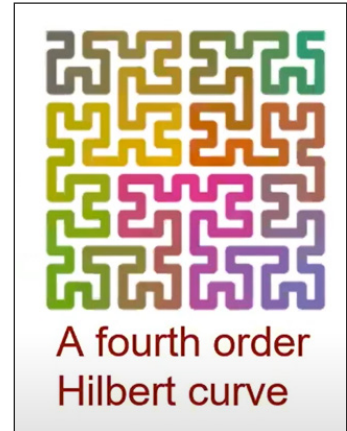


FORMAL EDUCATION



★ Key 2021 Accomplishments

- Piloted remote astronomy activities at four autism-focused high schools, then revised using co-design process
- Sixteen summer interns were supported by 14 SME mentors, engaging in research projects in Astronomy, Earth Science, Heliophysics, Mathematics, and Rocketry/Payloads.
- Prototype museum activities tested
- Mentor training in best practices for working with autistic learners

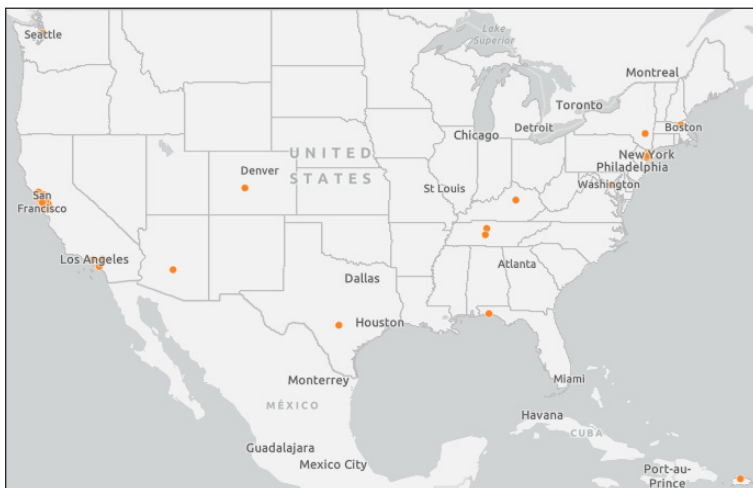


Olivia Wheeler wrote python code to gather data from different telescopes for multi-wavelength analysis. SME: Prof. Angela Speck

Trevor Hoffman is devising a method to use space-filling Hilbert curves to extend the Kolmogorov-Smirnov test to more than one dimension. SME: Dr. J. Garrett Jernigan



Benjamin Snyder built the Rising Data rocket and payload. SME: Tony Alcocer and Kevin John



Reach map

On the Hunt for White-light Flares
Kian Miranda-Rodriguez, Juan C. Martinez Oliveros

Abstract
Solar flares are explosive phenomena in the Sun. White-light flares are a category of such events, seen in the white-light continuum. In this work we present the results of the analysis of 455 solar flares in our catalog (<https://doi.org/10.3847/1538-4357/ab9c1e>). We found 109 amount white-light flares in the sample. 33 of those flares show a coronal component.

What are white light flares
White light flares are explosive releases of magnetic energy in the corona of the sun. Flares are particle accelerators, and their process starts with magnetic energy, and that leads to direct heating but could also have a significant fraction of that energy that moves at the speed of light into non-thermal particles which soon turns into direct heating.

Scientific questions and motivation
Understanding the conceptual idea of the how flares and white-light flares are generated. How hard X-ray and white-light emissions relate? Are all flares white-light flares? Do all flares have a white-light coronal counterpart?

Some results
The bar chart below shows how many flares in the original catalog are white-light flares and how many of those present a coronal counterpart.

From these results it is clear that only 1% of all flares are white-light flares and only a fraction of those present coronal features.

The radial distribution of flares demonstrate that most of flares are located close to the limb. We believe that this is because the signal to noise ratio of the flare kernels is better at larger longitudes.

Conclusions
→ Not all flares are white-light flares. Only 102 flares in the 455 flare sample show a white-light component.
→ From those only a fraction (33) present a coronal component.
→ The flares happen very quickly in less than a few minutes which makes it easier to miss at first.
→ The flares appear as a quick flash of light and then it would disappear.
→ The sizes are usually different whether they are big or small.
→ They show up on the coronal mass recordings and the standard recordings.

Kian Miranda-Rodriguez studied over 450 flares and found 109 white light flares. SME: Dr. Juan Carlos Oliveros Martinez

🧩 Key Partners

- EDC
- NYSCI
- WestEd

Project Video: <http://n3.sonoma.edu/video>

ASTROPHYSICS

Science Activation

NASA's Universe of Learning

PI: Dr. Denise Smith

PI INSTITUTION: Space Telescope Science Institute

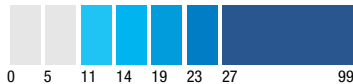
CO-I INSTITUTIONS: Caltech/IPAC, Center for Astrophysics (Harvard & Smithsonian), NASA JPL

<https://www.universe-of-learning.org>

NASA's Universe of Learning is a unique partnership providing direct access to intriguing discoveries, scientific data, and experts that span the full range of NASA's astrophysics missions. We combine these assets with best practices in learning to create resources ranging from captivating videos that motivate science learning to activities exploring telescope data that strengthen science identity. We partner with organizations nationwide to incorporate resources into community programs and professional learning experiences. Subject matter experts ensure the scientific integrity of our work, provide a human connection to science through presentations and interviews, help organizations develop exhibits and science programming, and more.

AUDIENCE AGE

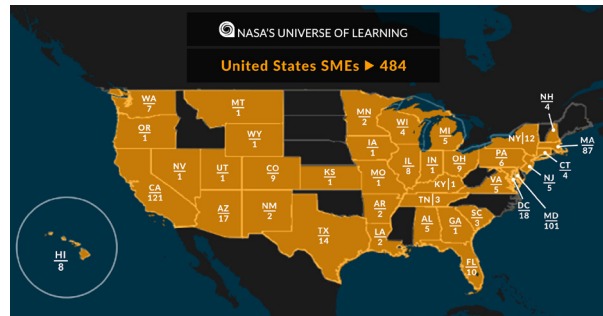
11+



LEARNING CONTEXTS

DIGITAL
LEARNINGNEIGHBORHOOD/
COMMUNITYINFORMAL/
OUT OF SCHOOL

HOME/FAMILY

CITIZEN
SCIENCE

644 subject matter experts in the Database (484 US-based in 38 states from 250 institutes, 53 missions represented)



291 SME requests in Year 6 (140 for the Webb Community Events)

20 NASA's Universe of Learning Projects
Examples of Nation-wide Reach for Year 6

- 395 ViewSpace venues
- 367 Educators attending Science Briefings
- 84 GSAWN webinar participants
- 47 Informal Learning Network sites
- 716 Cities with MicroObservatory users
- 2586 National Science Olympiad participants in 14 events
- 375 submissions for Astrophoto Challenges (spans multiple projects)



“**AUDIENCE QUOTE:** “Our [Girls STEAM Ahead with NASA] participants (girls aged 13–14) responded very well to the pixels to image activity and processing images with MicroObservatory. I think these activities helped them see and appreciate the connection between STEM disciplines and humanities disciplines and that they can be creative and interpretive with STEM learning.”

★ Selected Key 2021 Accomplishments

Programmatic

- Increased the rigor of our work by creating logic models for each project that were aligned to the SciAct mid-level objectives and used to inform project planning
- Established and formalized three infrastructure projects to provide key assets across the program: NASA Datasets, AstroPix, and Multimedia
- Developed final three content themes: Structure & Composition of the Universe, Extreme Physics & Phenomena, Cosmic Mysteries

SME Engagement

- Supported filling hundreds of SME requests, including the Webb Community Events (see front page), using the SME database that includes 644 SMEs

NASA Assets in STEM Learning

- Partnered with NASA and the Webb mission to increase reach and impact of nation-wide Webb Community Events held in conjunction with Webb launch
- Shared the science of the universe with educators through professional development experiences in Science Briefings and the Informal Learning Network’s Cosmic Conversations, and released the

JWST Teachable Moment with JWST-related learning activities

Broadening Participation

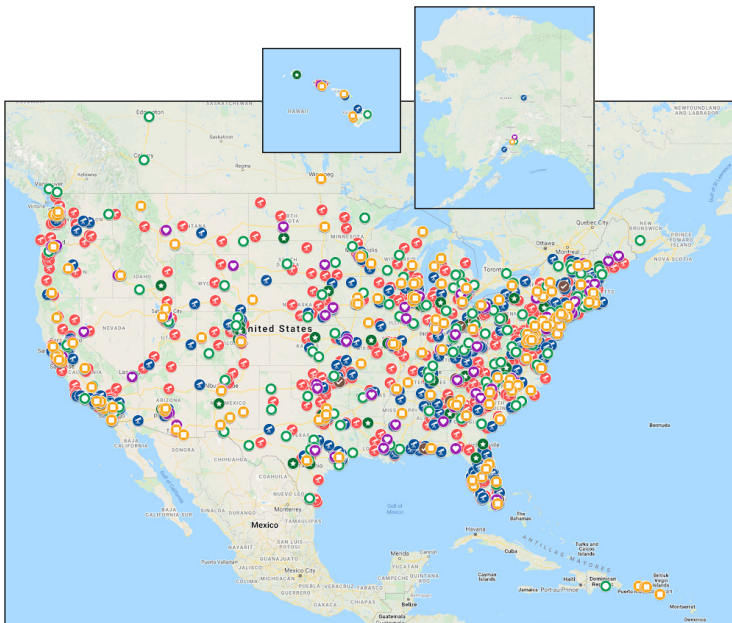
- Established Diversity Liaison role and a DEIA Working Group to support team in connecting and collaborating with underserved communities
- Increased attention to diverse audiences with release of sonifications of six astronomy objects, two cultural connection-focused ViewSpace videos, and selection of 10 new teams from underserved areas for the 2021–2022 Arizona Science Olympiad

🧩 Key Partners

- Association of Science-Technology Centers
- National Girls Collaborative Project
- National Science Olympiad
- Smithsonian Affiliations
- SAO Science Education Department

Project Video:

<https://youtu.be/12i9tOBSDq8>



- 🌱 Girls STEAM Ahead with NASA
- 👤 Informal Learning Network Participants
- 🔴 MicroObservatory
- 🏆 National Science Olympiad State Winners
- 🗨️ Science Briefings
- 🌍 ViewSpace
- 🚀 NASA Astrophoto Challenge



Orion’s Fire ViewSpace video about the cultural connection to Maya, with a mira en español option.



375 learners processed image data of M87 in the Summer NASA’s Astrophoto Challenges.

ASTROPHYSICS

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA@ My Library



PI: Anne Holland

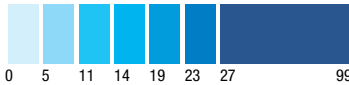
INSTITUTION: Space Science Institute

<https://science.nasa.gov/science-activation-team/nasa-at-my-library>

A National Earth and Space Science Initiative that connects NASA, public libraries, and their communities. NASA@ My Library 2.0 prepares library staff to facilitate programs related to high profile NASA events such as the James Webb launch and First Image, Earth Day, and the Collaborative Summer Learning Program Theme “Oceans of Possibilities.” Supports for library staff include training, virtual toolkits, patron badging, subject matter expert support, and resources from other SciAct programs.

AUDIENCE AGE

All Ages



LEARNING CONTEXTS



DIGITAL LEARNING



NEIGHBORHOOD/ COMMUNITY



INFORMAL/ OUT OF SCHOOL



HOME/FAMILY



CITIZEN SCIENCE



FORMAL EDUCATION



By the NUMBERS

- 60 Partner Libraries
- 8000+ Member CoP
- 5 University Partners
- 10 State Library Advisors
- 6 NASA@ My Library 1.0 Mentors



AUDIENCE QUOTE: “The take and make kits you sent to our library many months back were definitely a big hit. Our local boys and girls club had to be closed frequently last Spring so we provided the kits to children who came into our library. We were able to remain open but could not have classes or programs so the take and make kits were very popular. They helped us bridge the gap between being “kind of” open to now being fully open.”

—Carolyn Cook, Commerce Public Library

★ Key 2021 Accomplishments

- 60 Partner libraries recruited and onboarded
- Recruited and onboarded 6 mentors & 10 State Library advisors to advise on project activities and mentor new partner libraries
- 5 Universities onboarded to provide near-peer SMEs for Partner Libraries
- Initiated Beanstack patron reading / activities app for JWST Challenge
- JWST virtual toolkit and 4 STEAM Strategies videos produced for librarians
- 3 JWST webinars conducted for library staff
- American Library Association’s (ALA) ALA Connect platform networks libraries with mentors, experts, and team members
- Community Engagement Kit for librarians developed and released
- 2 live shows with AMNH (YouTube Videos: Oct. 13 & Oct. 14)
- External evaluator administered baseline library survey

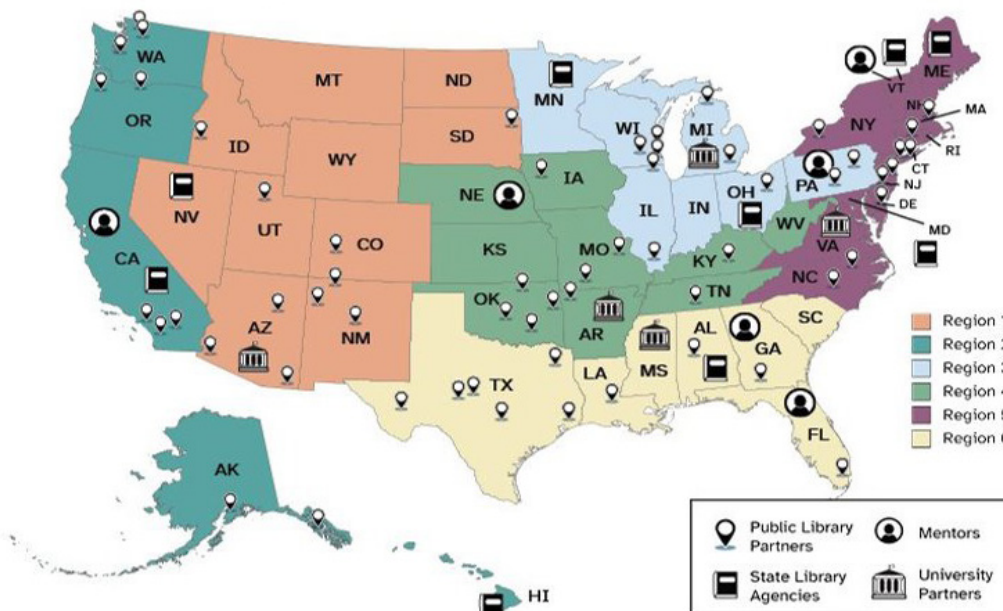


Yuma County Library flyer



AstroDay at the Prince Kuhio Mall sponsored by the Hawaii State Library. Participants received Mosquito Habitat Mapper Kits

Guide on the Side Training Video: <https://youtu.be/SJSsEI04Seo>



🧩 Key Partners

- ALA
- EDC
- LPI
- Partner and State Libraries
- Beanstack
- 5 Universities
- SciAct cross collaboration

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Native Earth | Native Sky



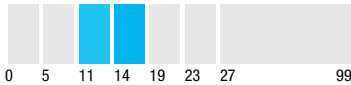
PI: Dr. Kat Gardner-Vandy

INSTITUTION: Oklahoma State University

<https://science.nasa.gov/science-activation-team/native-earth-native-sky>

AUDIENCE AGE

11-18



LEARNING CONTEXTS



**DIGITAL
LEARNING**



**FORMAL
EDUCATION**

Native Earth | Native Sky (NENS) co-creates culturally-relevant earth and sky STEM curriculum with three Native American Nations in Oklahoma. We interweave stories, language, and culture into formal classroom earth and space curriculum in an effort to increase Native American participation in STEM careers. Year 1 is focused on Choctaw Nation of Oklahoma.



- By the NUMBERS:**
- 1 University
 - 3 Nations
 - 12 Choctaw Board of Advisors
 - 1,000+ student/100 teacher potential reach in Choctaw Nation by 2023

““Together, we have formed an advisory board of Choctaw elders, first speakers, and CNO representatives from Advanced Technologies, Arts, Cultural Center, Education, Historic Preservation, and Language... A high level of respect was demonstrated throughout [the first meeting] — respect for stories, knowledge, high caliber programs already in place, for one another, and for process as well as awareness that some stories that are sacred in nature may not be shared. This was appreciated by all!”

—Audrey Jacob, Director of Art, Choctaw Nation of OK Cultural Center

★ Key 2021 Accomplishments

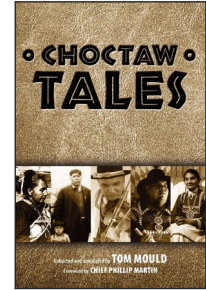
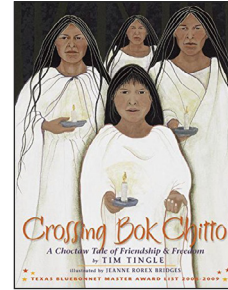
NENS focused on relationship building and story (data) collection with the Choctaw Nation in Year 1. Even though the pandemic delayed our IRB and prevented us from starting interviews with elders, we collected many stories from Choctaw adult and children’s literature to begin working on curriculum. We have built an example lesson from *Crossing Bok Chitto* by Tim Tingle. We held our first Board of Advisors meeting with Choctaw Nation and visited the new Cultural Center. We also continued relationship building with Chickasaw Nation and Cherokee Nation.

✚ Key Partners

- Choctaw Nation of OK
- Chickasaw Nation of OK
- Cherokee Nation of OK
- NASA Science Activation and SMD
- OSU Center for Sovereign Nations
- Boeing

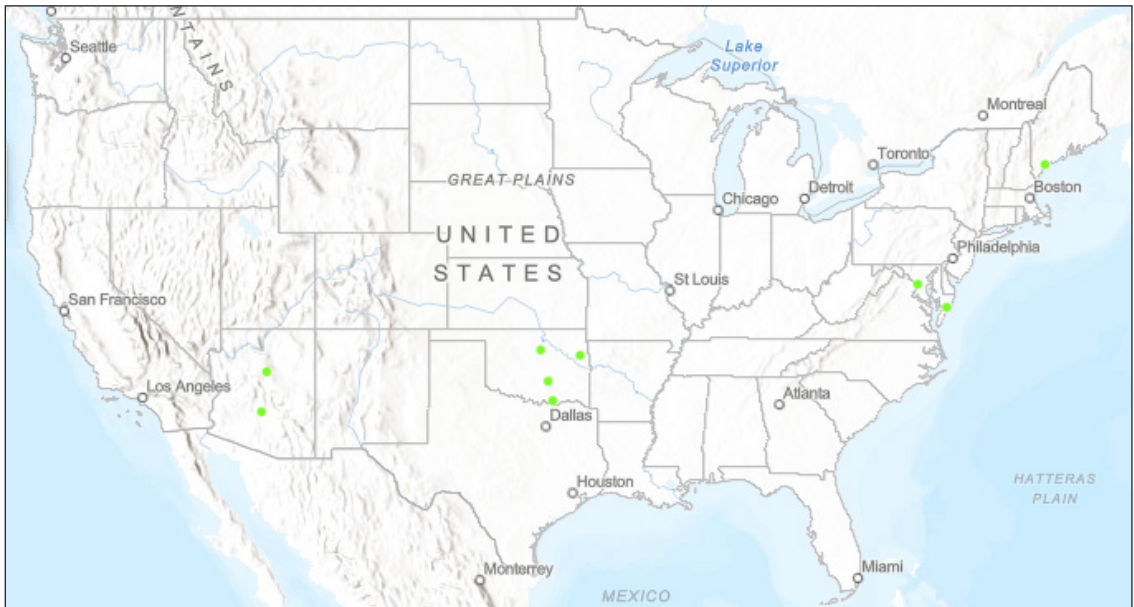


The NENS team visits the Choctaw Nation of OK Cultural Center to collect stories and build relationships.



Choctaw Nation of OK Cultural Center

Reach map



HELIOPHYSICS

Science Activation

Navigating the Path of Totality



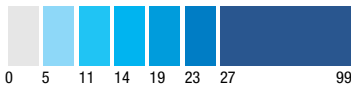
PI: Dr. Robert Semper

INSTITUTION: Exploratorium

<https://science.nasa.gov/science-activation-team/exploratorium>

AUDIENCE AGE

5+



LEARNING CONTEXTS



DIGITAL LEARNING



INFORMAL/ OUT OF SCHOOL



HOME/FAMILY

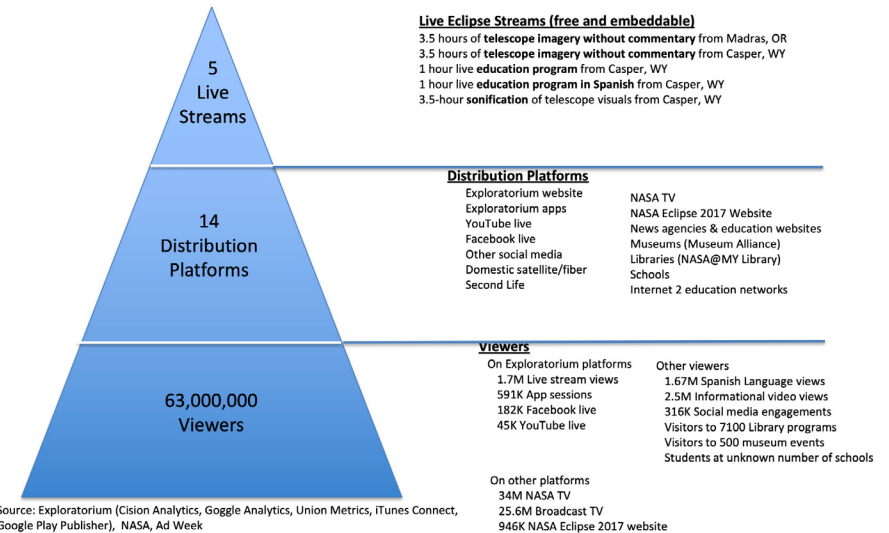


FORMAL EDUCATION

Navigating the Path of Totality supports a national public education program using the two upcoming solar eclipses, the annular eclipse in 2023 and the total eclipse in 2024, as platforms for developing continued public interest, engagement, and education focused on NASA Heliophysics and associated STEM content. This project provides ongoing opportunities to feature SMEs and NASA’s Heliophysics Observatory System of missions like MMS, Solar Orbiter, and Parker Solar Probe. A specific audience focus includes K–12 educators, Spanish language speakers and Native Americans, specifically Navajo.

2017 Eclipse Results

Livestream served as a base experience for people in many settings on and off the path

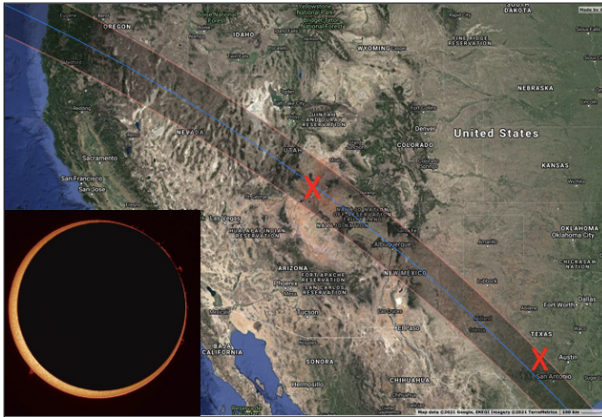


“ AUDIENCE QUOTE: “The Spanish feed was quite interesting and related the eclipse to the human experience and grounded it in some historical and local context.”

—2019 reviewer

★ Key 2021 Accomplishments

- Preliminary location scouting for production
- Review of previous eclipse productions and evaluations
- Initial development of “Road to the Eclipse” storyline
- Initial development of K–12 classroom activities
- Presentation of Latino audience engagement strategies to SciAct
- Partnerships established with Indigenous Education Institute, NASA HEAT SciAct project, and American Astronomical Society



Annular Eclipse, October 14, 2023, UT & TX



Total Eclipse, April 8, 2024, MX & TX



Reach map

★ Key Partners

- Indigenous Education Institute
- Edu, Inc.
- NASA SciAct HEAT
- Parker Solar Probe



ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Northwest Earth and Space Science Pathway



PI: Dr. Darci Snowden
INSTITUTION: Central Washington University

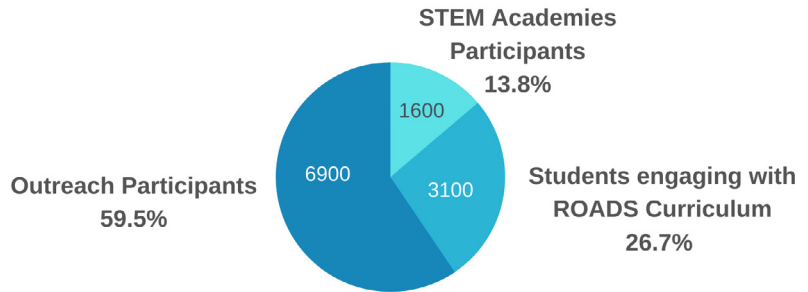
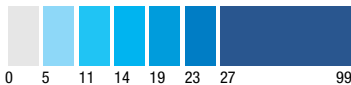
<https://science.nasa.gov/science-activation-team/nessp>

NESSP works to create a NASA presence in the Northwest United States and beyond with outreach activities, educator professional development, and student challenge activities based on NASA missions. We aim to reach underrepresented minorities, girls, and students in rural areas to increase STEM interest and self-efficacy.

Total Students Reached: 11,600

AUDIENCE AGE

5+



LEARNING CONTEXTS



NEIGHBORHOOD/
COMMUNITY

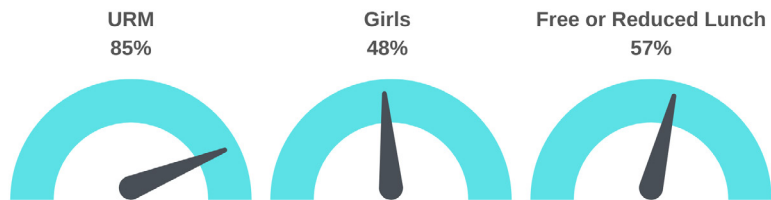


INFORMAL/
OUT OF SCHOOL



FORMAL
EDUCATION

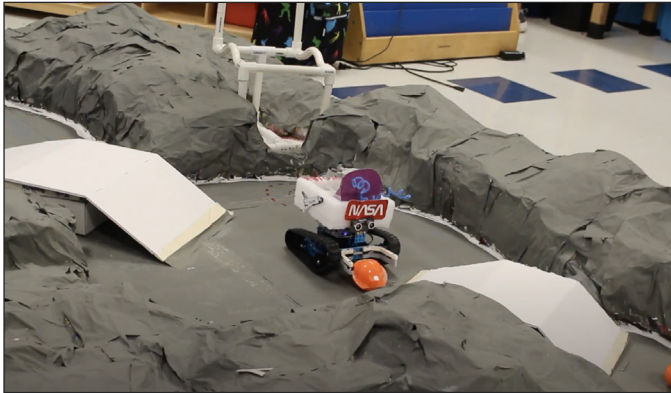
ROADS Curriculum Student Composition



“My students have always been really interested in space, and I’ve had very little for them to participate in that’s really a hands-on activity that is actually mimicking a real-life experience. . . . And with middle school kids, it’s got to be interesting or applicable or they’re going to not do it at all. So, I’m just really excited that it’s something that I think my kids will be really engaged in.”

★ Key 2021 Accomplishments

- Completion of ROADS on Asteroids
- Evaluation of the first ROADS Companion Course demonstrating impact on students and educators
- Launch of new Companion Course for ROADS on Icy Worlds
- Virtual Outreach and STEM Academies, with activities resuming in person this fall
- Culturally relevant curriculum implementation from UW Riverways
- Implemented five two-day educator professional development sessions with positive evaluation results
- Continued and new relationships with rural schools, and Native Communities including Quileute Tribal School, Blackfeet Nation, and Crow Tribe.



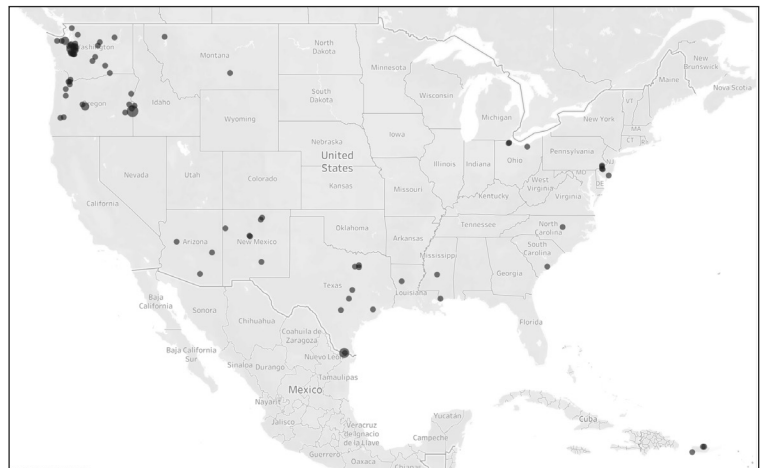
A rover completing its mission for a ROADS on Asteroids Team



A ROADS participant explaining programming lessons learned from the mission



Local news article from outreach in rural Idaho



Map of 2021 Educator Professional Development Workshop participants

⚙️ Key Partners

- Astromaterials
- Solar System Treks

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NISE Network SEISE



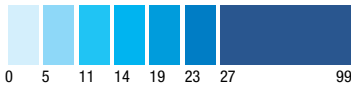
PI: Paul Martin

INSTITUTION: Arizona State University

<https://science.nasa.gov/science-activation-team/nise-network>

AUDIENCE AGE

All Ages



LEARNING CONTEXTS



INFORMAL/
OUT OF SCHOOL

The National Informal STEM Education Network (NISE Network) Space and Informal STEM Education (SEISE) project leverages a robust network of hundreds of museums across the United States to advance the NASA Science Mission Directorate vision for education by engaging public audiences nationwide in informal and lifelong learning related to fundamental STEM concepts. The Network utilizes NASA SMEs, SMD assets and data, and existing educational products and online portals to create compelling learning experiences that share the story, science, and adventure of NASA's scientific explorations of planet Earth, the solar system, and the universe beyond.



AUDIENCE QUOTE: *“The pandemic has broadened participation with our NISE kits. The NISE Network kits have allowed us to stay engaged with the public while providing hands-on science activities to the public during the pandemic.”*

—Dafne Garduno, Gateway Science Museum, Chico, CA

★ Key 2021 Accomplishments

- Supporting of 350 museum partners using the four Explore Science: Earth & Space Toolkits (2017–2020) and the Sun, Earth, Universe exhibition to reach their audiences with NASA SMD research, mission, and accomplishments
- Launching the new Earth & Space Project-Based Professional Learning Community to support 100 leveraging partner museums making Earth & Space science relevant and inclusive for their local communities across the U.S. through project-based professional development
- Completed 3 new guides & tools for museum partners: Working with STEM Experts; Earth and Space Learning Framework; Earth and Space Content Framework
- Coordinating museums' preparation and responses to important NASA missions events (Perseverance Rover landing and James Webb Space Telescope launch), celestial events (June Solar Eclipse), and celebrations (Earth Day) through new web resource collections, online workshops, and Explore Science: Earth & Space Toolkit suggestions



Gateway Science Museum's toolkit containers featuring NISE Network Earth & Space activities (Chico, CA)



Talk About Genius! Video Series from tag! Museum featuring NISE Network activities (St. Augustine, FL)

⚙️ Key Partners

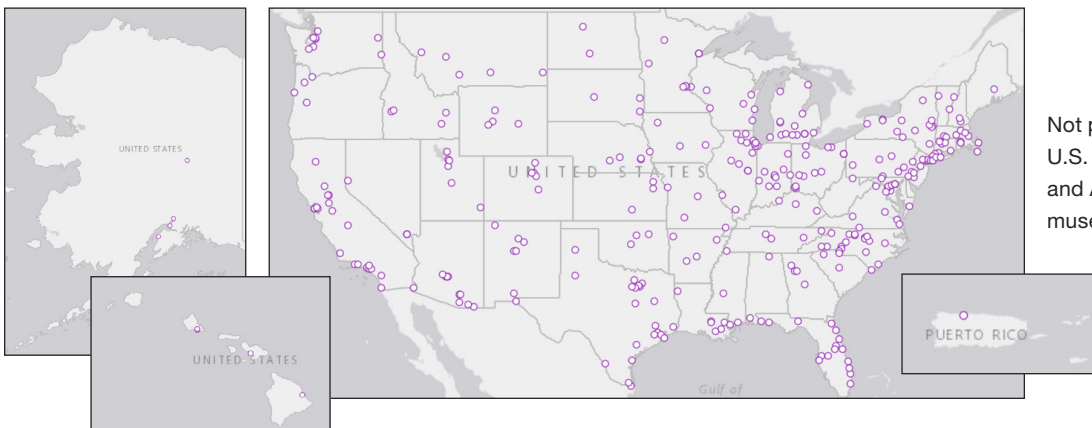
- NASA JPL (multiple groups)
- NASA's Universe of Learning (STScI)
- NASA Earth Science Education Collaborative (IGES)



STEM Saturday video from Children's Museum Oro Valley using a NISE Network activity (Oro Valley, AZ)



Jim Bell (ASU) presenting on the Preparing for NASA Perseverance's landing on Mars online workshop



Not pictured: Guam, U.S. Virgin Island, and American Samoa museum partners

PLANETARY SCIENCE

Science Activation

PLANETS (Planetary Learning that Advances the Nexus of Engineering, Technology, and Science)

PI: Joëlle Clark

INSTITUTION: Northern Arizona University

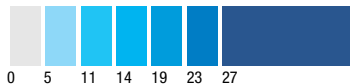
<https://planets-stem.org>

PLANETS is an out-of-school time (OST) program for educators and youth in grades 3–8 that provides STEM learning with NASA planetary science and engineering, particularly for underserved audiences using principles of diversity, equity, access, and inclusion. Our targeted groups of learners include indigenous, emergent multilingual and physical and/or sensory disabilities.



AUDIENCE AGE

5+



99

LEARNING CONTEXTS

INFORMAL/
OUT OF SCHOOL

HOME/FAMILY

4,240
youth651
educators317
familiesWeb Downloads
by the numbers

Remote Sensing

216

Water in Extreme
Environments

129

Space Hazards

146

720
combined hours from
co-design and DEIA
experts

“ AUDIENCE QUOTE: “The unit was an amazing opportunity, for not only the kids but for the program staff too! The quality of it was great and very well thought out and for the most part very detailed.”

—OST Educator

★ Key 2021 Accomplishments

- Welcomed new partners: WestEd, co-design consultants, and DEIA advisory board members
- Conducted a literature review and focus group interviews around effective practices for working with target audiences in OST environments
- Convened co-design and SME teams to identify barriers and solutions for optimizing PLANETS materials



Unit at a Glance

Use this resource to quickly check key learning objectives for this unit. *Includes Learning Progressions – Press image to see enlargements in a new window.*

Water in Extreme Environments - Unit at a Glance

How-To Videos for Educators

How to Build a Periscope

Additional Resources for Educators

- Unit At A Glance
- Learning Progressions
- Back Pocket Activity Essentials
- Tips for Interactivity
- Developing 21st Century Skills

[DOWNLOAD ADD'L](#)

Connect with NASA

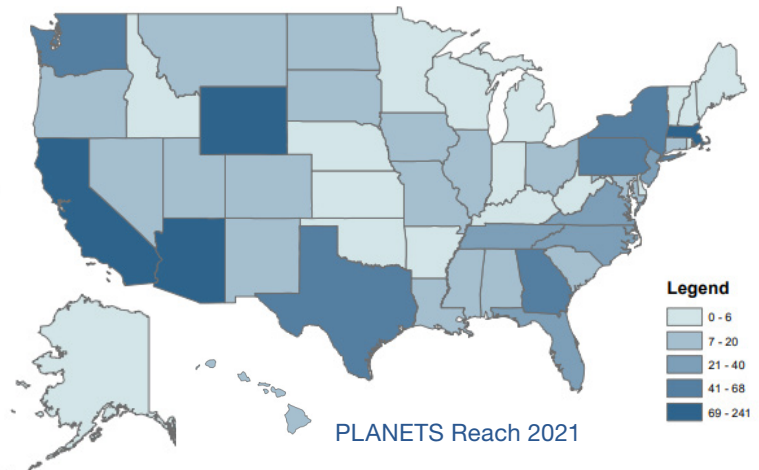
Products for all Units

- Science Educator Guide
- Engineering Educator Guide
- Educator Resources (videos, learning progressions, and more)

⚙️ Key Partners



Visit our site to learn more



PLANETARY SCIENCE

Science Activation

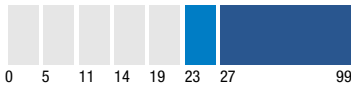
Planetary Resources and Content Heroes (ReaCH)

PI: Andy Shaner

INSTITUTION: Lunar and Planetary Institute

<https://www.lpi.usra.edu/planetary-reach/>

AUDIENCE AGE

23+

LEARNING CONTEXTS

NEIGHBORHOOD/
COMMUNITYINFORMAL/
OUT OF SCHOOL

HOME/FAMILY

Planetary ReaCH is developing a model for preparing planetary SMEs (content heroes) to better engage Black and Latinx audiences.

Planetary Assessment Groups/Missions

- Small Bodies Assessment Group (SBAG)
- Cross-AG Inclusion, Diversity, Equity, Accessibility committee
- Mercury Exploration Assessment Group (MExAG) outreach committee
- Lucy mission leadership/communications
- Outer Planet Assessment Group (OPAG)
- MAVEN science/engineering team

Conferences/Meetings

- 2021 Lunar and Planetary Science Conference
- 2021 AAS Division of Planetary Science Meeting (October)
- 2021 AGU Fall meeting (December)

ReaCH team members presented to multiple conferences, planetary exploration assessment groups, and missions to raise awareness of the project within the planetary science community

Needs Assessment Survey Question: What would allow or incentivize you to do more outreach?

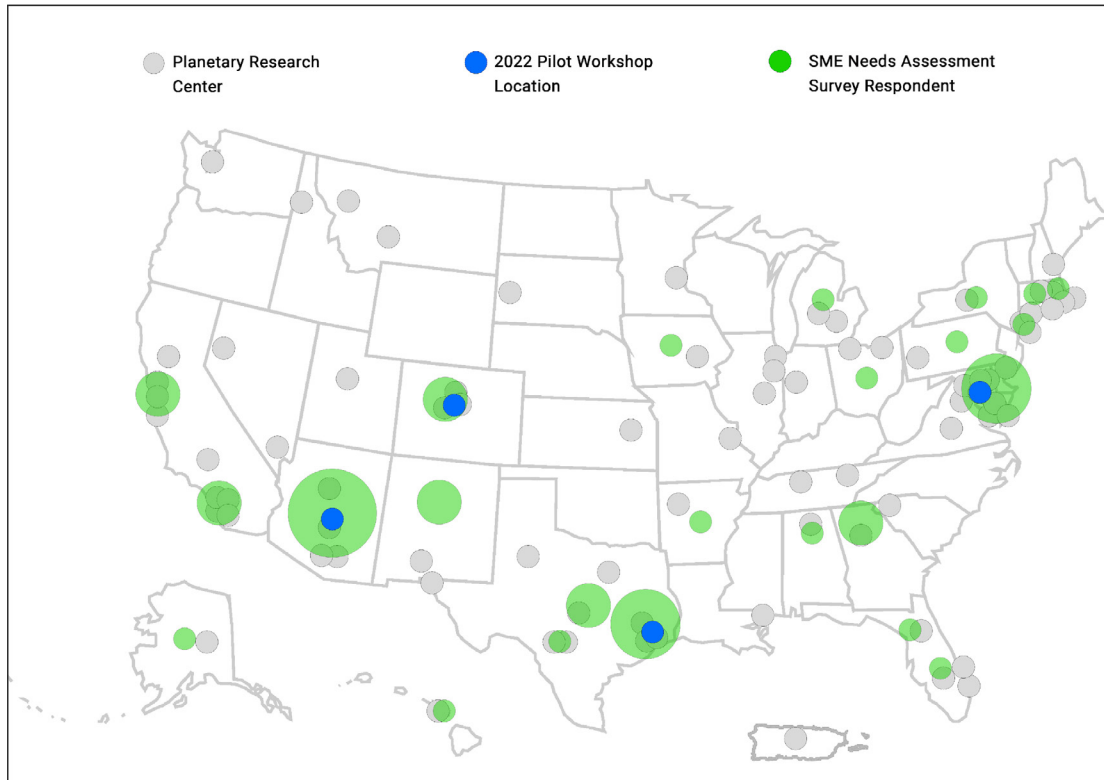
Planetary SME Response: Outreach opportunities SPECIFICALLY geared toward increasing DEIA in STEM.

★ Key 2021 Accomplishments

- SME needs-assessment survey developed and distributed in collaboration with SCoPE; 256 respondents, 100 planetary; (locations of planetary respondents in green on map below)
- Collaborating with PLANETS on a literature review; research on best practices for engaging Black/Latinx audiences and for professional development in engaging Black/Latinx audiences
- Identified four pilot workshop locations for 2022: Houston (LPI), Tempe (ASU), Boulder (UC/LASP), Baltimore (APL)
- Obtained feedback from Boys & Girls Clubs – Texas Alliance members to plan October 2021 trainings for BGC educators; these trainings will further inform the design of ReaCH SME workshops

✦ Key Partners

- NAU
- ASU
- APL
- UC/LASP
- BGC-TX Alliance



The Planetary ReaCH Logo: Our diverse team of scientists and educators worked with the LPI graphic designer to create the Planetary ReaCH logo. The resulting design reflects the team's desire to help planetary SMEs more effectively engage diverse audiences (particularly Black and Latinx communities) in planetary science and exploration.

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Smoky Mountains STEM Collaborative



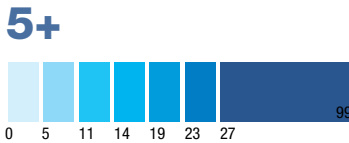
PI: Matthew Cass

INSTITUTION: Southwestern Community College

<https://science.nasa.gov/science-activation-team/smsc>

The Smoky Mountains STEM Collaborative is a STEM education ecosystem project serving learners in the southern Appalachians of western North Carolina. We work with an under-represented and diverse population, including enrolled members of the Eastern Band of the Cherokee Indian and many first generation college students. Our mission is to expand and engage the region in a cohesive, learner-centered STEM ecosystem that leverages Subject Matter Experts (SME's) and science centers to achieve NASA's mission to help learners of all ages "do" science in their own communities.

AUDIENCE AGE



LEARNING CONTEXTS

Five circular icons representing different learning contexts:

- NEIGHBORHOOD/COMMUNITY:** Icon of houses.
- INFORMAL/OUT OF SCHOOL:** Icon of people holding hands.
- HOME/FAMILY:** Icon of a house.
- CITIZEN SCIENCE:** Icon of a hand touching a smartphone screen.
- FORMAL EDUCATION:** Icon of a school building.

<p>10</p> <p>Public School Opportunities</p> <p>Six (6) additional events planned before program year end.</p> <ul style="list-style-type: none"> Classroom support After school fieldwork STEM-E Conference HS STEM Club 	<p>20</p> <p>Community Engagement Opportunities</p> <p>From the Perseverance Landing to Earth Day to the James Webb Launch - we kept our community informed this year.</p> <ul style="list-style-type: none"> Livestream of Perseverance Landing Earth Day WNC STEM Leaders Macon Library Program IOMN 	<p>5</p> <p>Professional Development Opportunities</p> <p>Including the launch of our NASA Teaching Ambassador program.</p> <ul style="list-style-type: none"> Math Circles NASA Ambassadors Train the Trainer @ American Camp Association Conference 	<p>7</p> <p>Community College Student Focused Opportunities</p> <p>Southwestern students used NASA data in the classroom to tackle real world problems</p> <ul style="list-style-type: none"> Internship at Appalachian State University 	<p>15</p> <p>Summer Programming Opportunities</p> <p>High school and middle school students were offered a variety of opportunities to engage with NASA content during the summer.</p> <ul style="list-style-type: none"> Astro Camp GLOBE Activities AREN Kite Activities Robotics Camp PARI Camp Boys & Girls Club
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“What we’ve learned is that a lot of [students] don’t feel incredibly confident when they get here about their abilities, but by the time they leave camp, they have a pretty firm belief that they can accomplish just about anything.”

—Amanda Hall, AstroCamp teacher

★ Key 2021 Accomplishments

- NASA Ambassador Program Kickoff - 6 Ambassadors in Year One
- Cross-Collaboration (AMNH, Infiniscope, GLOBE, Astro Camp)
- Out of this World Summer Programming
- Two Major NASA Livestream Events featuring SMEs (Perseverance, James Webb)



Rosman Location Global Nominee of the 2021 Space Apps Challenge
“SAR in the Cherokee Language”

(L to R) Andrew Frady, Alberto Cruz, Daniel Triplett

<https://2021.spaceappschallenge.org/challenges/statements/what-on-earth-is-synthetic-aperture-radar/teams/cass-crew/project>

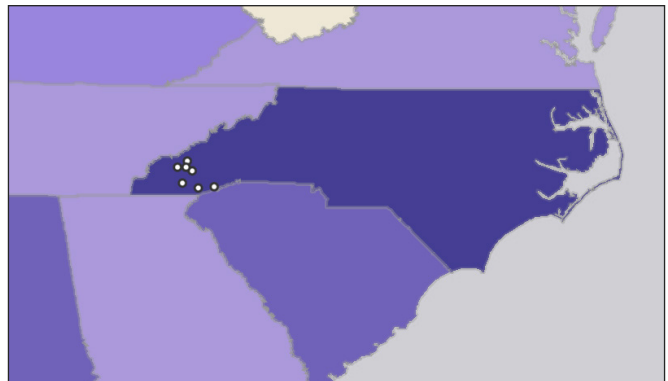
SMSC AstroCamp

- 40 Students
- 5 Teachers
- 2 High School interns
- 2 weeks of project-based learning
- 15 badges available to earn



🧩 Key Partners

- Pisgah Astronomical Research Institute
- Appalachian State University
- Fontana Regional Library
- 4 Public School Districts
- Western Regional Education Service Alliance
- Boys & Girls Club of the Plateau
- Western Carolina University



ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

STEM Ecosystems

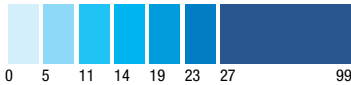


PI: Dr. Rae Ostman
INSTITUTION: Arizona State University

<https://science.nasa.gov/science-activation-team/stem-ecosystems>

AUDIENCE AGE

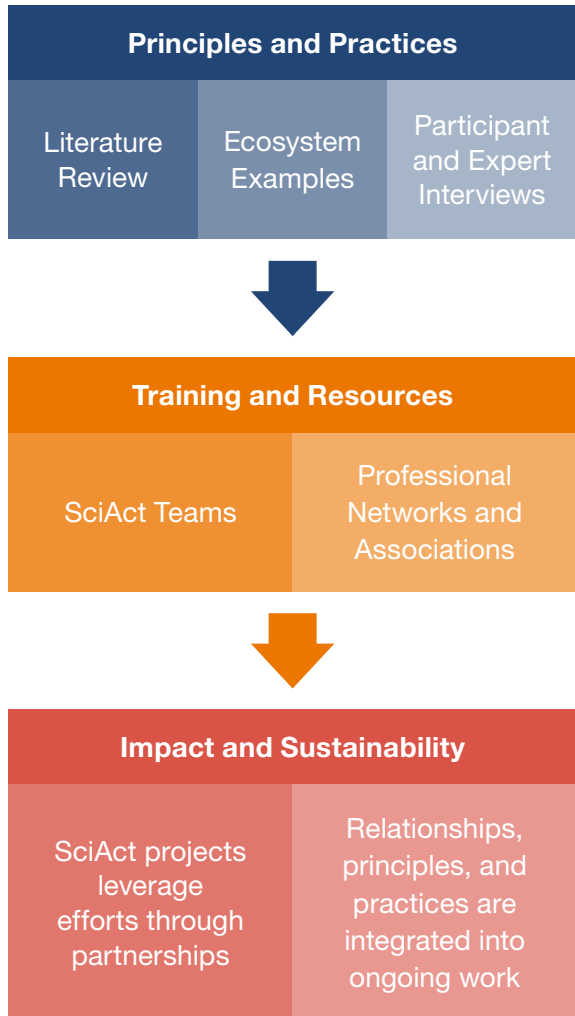
All Ages



LEARNING CONTEXTS

- DIGITAL LEARNING
- NEIGHBORHOOD/COMMUNITY
- INFORMAL/OUT OF SCHOOL
- HOME/FAMILY
- CITIZEN SCIENCE
- FORMAL EDUCATION

SciAct STEM Ecosystems works across the SciAct portfolio to strengthen collaborations and provide professional development and resources related to principles and practices of STEM learning ecosystems. The project is identifying strategies and approaches that SciAct teams and partners can use to broaden participation and connect learners with NASA SMEs and unique assets.



“PARTICIPANT QUOTE: *“The building of the ecosystem is really about building the connections [...] to reach these big goals that we have.”*

★ Key 2021 Accomplishments

Our Year 1 foundational work is organized into three inquiry cycles:

- definition and function of learning ecosystems;
- broadening participation and centering equity; and
- creating opportunities for authentic STEM engagement.

⚙️ Key Partners

- NASA Science Activation
- Arizona State University
- University of Alaska Fairbanks
- Southwestern Community College (NC)
- Museum of Science (Boston)
- STEM Ecosystems Network
- National Informal STEM Education Network

We are integrating information from published documents, case studies, and interviews with experts and ecosystem partners.



Annual meeting with project team and advisors (virtual)



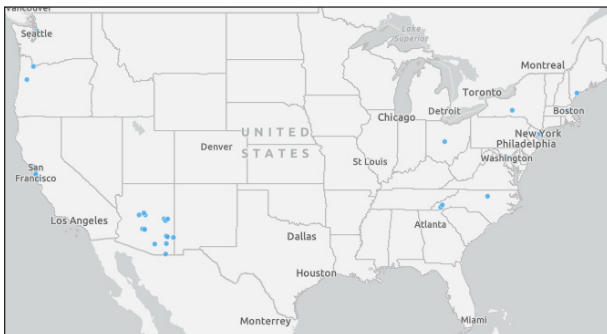
Learning from Kk'eyh (birch) summer camp program in Alaska



Earth Day celebration, North Carolina



Night sky and space science event, Arizona



Reach map

EARTH SCIENCE

Science Activation

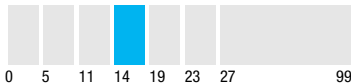
STEM Enhancement in Earth Science

PI: Margaret Baguio

INSTITUTION: UT Center for Space Research/NASA Texas Space Grant

<https://science.nasa.gov/science-activation-team/texas-space-grant-consortium>

AUDIENCE AGE

14–18

LEARNING CONTEXTS



DIGITAL
LEARNING



NEIGHBORHOOD/
COMMUNITY



INFORMAL/
OUT OF SCHOOL



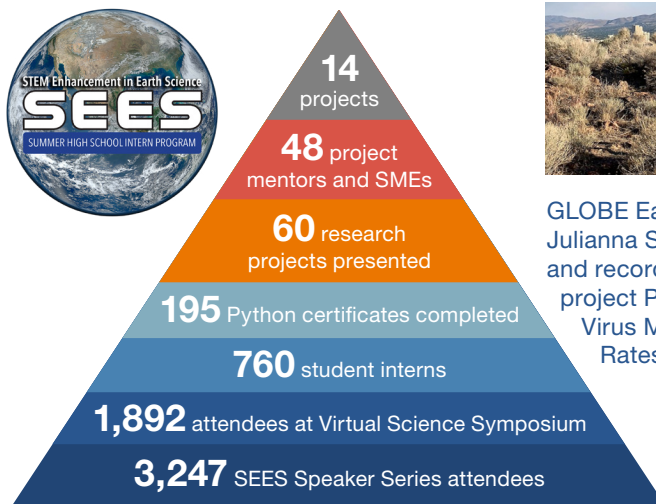
HOME/FAMILY



CITIZEN
SCIENCE

The STEM Enhancement in Earth Science (SEES) project addresses the national need to increase the number of high school students, particularly under-represented minorities and those from under-served areas, that will pursue STEM college degrees. In 2020–21, we partnered with institutions, organizations, and Science Activation partners to identify NASA missions, data from NASA’s fleet of earth observing satellites, mission planning, and Citizen Science projects as a catalyst for the virtual high school intern program.

The interns analyze and visualize data, learn about Careers from Subject Matter Experts, explore Career Choices from University experts, and conduct virtual tours of NASA facilities. Content knowledge, coupled with hands-on experiences, allows the intern to gain experience in authentic research through field investigation and data analysis.



GLOBE Earth explorer Julianna Schneider collecting and recording data for team project Predicting West Nile Virus Mosquito Positivity Rates and Abundance.



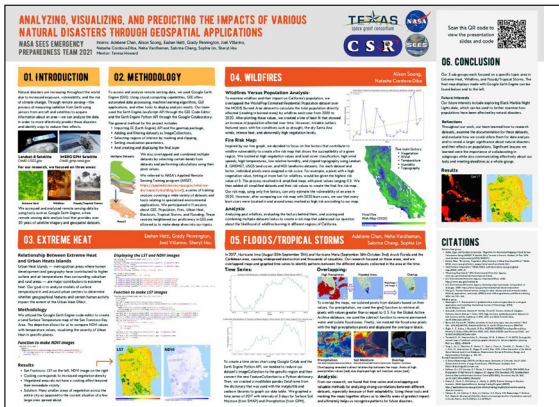
AUDIENCE QUOTE: “SEES provides the whole package: the ability to work through a real-life science/engineering problem with a team of like-minded individuals who each bring unique perspectives and abilities to bear. There is no coattail riding—everyone is expected to dig deep and to contribute. Students thrive in such an environment.”

★ Key 2021 Accomplishments

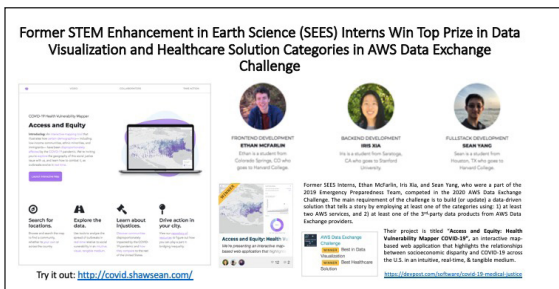
1130 applications/760 completed

- Selected 82 for traditional projects
- 117 for GLOBE Earth System Explorers
- 71 for Non-traditional Projects

- 210 contact hours per student
- Science Symposium with 1,892 livestream views since 8/4/21
- 20 AGU abstracts
- 270 students from 36 US States, 1 territory, and 3 international, 42% underrepresented, 25% underserved
- 60 Research projects presented
- 195 Python certificates completed
- 3,247 SEES Speaker Series attendees
- 27 AGU Posters/Abstracts submitted



SEES Emergency Preparedness poster, presented as 1 of 27 teams presenting at AGU Bright STaRS.



Former SEES Interns, Ethan McFarlin, Iris Xia, and Sean Yang, who were a part of the 2019 Emergency Preparedness Team, competed in the 2020 AWS Data Exchange Challenge. Their project is titled “Access and Equity: Health Vulnerability Mapper COVID-19”, an interactive map-based web application that highlights the relationships between socioeconomic disparity and COVID-19 across the U.S. in an intuitive, real-time, & tangible medium. Try it out: <http://covid.shawsean.com/>



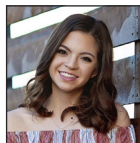
Watch the Value of Authentic Research During the NASA SEES Internship video on YouTube.



View the presentation slides & code from SEES Emergency Preparedness Team poster shown above.

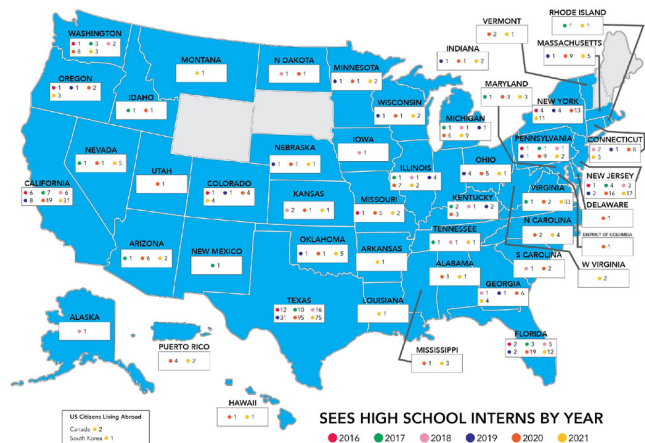


Anna MacLennan, a former STEM Enhancement in Earth Science Intern (SEES Class of 2019), was named one of The Mars Generation’s 24 Under 24 Leaders and Innovators in STEAM and Space Award Winners for 2020.



Former SEES Intern Lauren Rodriguez (utexas.edu): What made you decide to pursue an aerospace engineering degree?

“The summer before senior year in high school, I participated in the SEES high school internship program with the Texas Space Grant Consortium. I liked the challenge and the endless room for innovation. My team’s project focused on creating a concept design for a CubeSat and we were mentored by Professor Emeritus Dr. Wallace Fowler. Dr. Fowler did a great job of taking time each day to let us ask questions about careers and education, and in talking with him and my team, I found that an aerospace degree was likely my best fit major. By the end of that program, I had found enough specific interest in aerospace engineering and anything that flies that I couldn’t envision myself anywhere else.”



EARTH SCIENCE

Science Activation

Student Airborne Science Activation



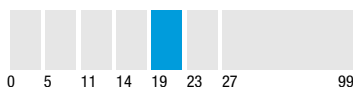
PI: Dr. Charles Gatebe

PM: Dr. Samiah Moustafa
(Interim: Kristina Pistone)

INSTITUTIONS: Coppin State University, Morgan State University, Hampton University, Howard University, University of Maryland Baltimore County, and the University of Maryland Eastern Shore & NASA Centers (ARC, GSFC, LaRC & WFF)

AUDIENCE AGE

19-22



LEARNING CONTEXTS



**DIGITAL
LEARNING**



**FORMAL
EDUCATION**

The Student Airborn Science Activation (SaSa) project aims to increase the number of STEM degrees from Minority Serving Institutions (MSIs) and prepare students to enter the STEM workforce. SaSa will engage students through NASA-related airborne campaigns, provide authentic engagement to students and raise the profile of MSIs geoscience departments relevant academic, research, and local communities.



QUOTABLE QUOTE: *“The sky’s no limit for NASA’s SaSa students!”*

★ Key 2021 Accomplishments

- Building authentic engagement among NASA Partners, MSIs and NASA HQ
- Creating student geoscience learning ecosystem (GLE) for student engagement with NASA scientists & engineers, academic advisors, peers, and the local communities
- Developing syllabus for Summer Internship Program
- Coordinating logistics for Summer Internship Program
- Confirming flight plans with partner P3 research aircraft and instruments
- Communicating about SaSa: Included in NASA presentation at the 2021 United Nations Climate Change Conference (COP26)

See our
promotional
video



🧩 Key Partners



THANK YOU

We hope you have enjoyed this brief snapshot of the Science Activation program and its 2021 Impacts. It is our hope to provide every student, educator, and lifelong learner the opportunity to not only experience the excitement of scientific discovery, but to become active participants in the advancement of knowledge well into the future. Keep up with our ongoing activities and explore Science Activation resources on our website. <https://science.nasa.gov/learners>



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DIRECTOR



Lin Chambers
DEPUTY DIRECTOR



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**SYSTEMS INTEGRATION AND
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Kim Holloway
PROJECT COORDINATOR

Science Division Leads



Dr. Egle Cekanaviciute
**BIOLOGICAL AND PHYSICAL SCIENCES
(ARC)**



Dr. Hashima Hasan
ASTROPHYSICS



Dr. Trena Ferrell
EARTH (GSFC)



Dr. Kelly Korreck
HELIOPHYSICS

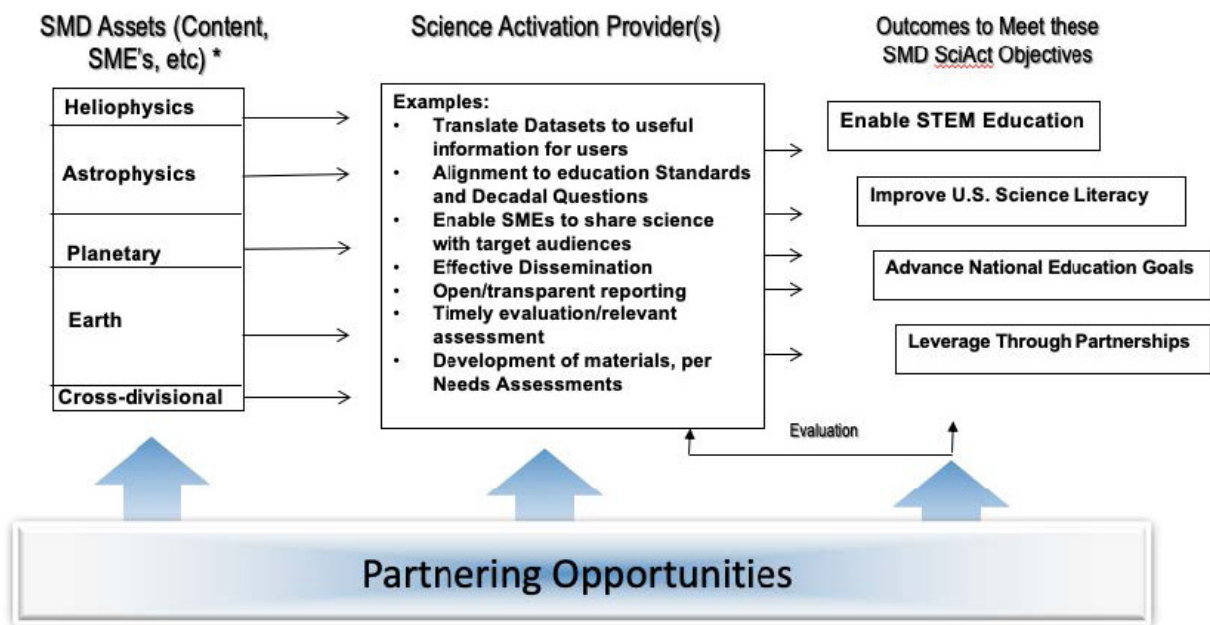


Dr. Michael Kelley
PLANETARY SCIENCES

APPENDIX

Science Activation Objectives/Mid-level Objectives

SMD Science Activation Model



SCIENCE ACTIVATION DESIRED OUTCOME/VISION STATEMENT:

To further enable **NASA science experts and content** into the learning environment more effectively and efficiently with learners of all ages.

OBJECTIVES:

Mid Level Objectives:

Enable STEM Education	Inspire participants' interest in STEM and the development of their identities as science learners.
	Provide opportunities for participants to engage with the disciplinary content related to NASA science and engineering .
	Increase number of and frequency with which NASA SMD assets are used by learners across the US.
Improve U.S. Scientific Literacy	Advance participants' understanding of the process of science using NASA SMD assets .
Advance National Education Goals	Increase participation in learner-centered experiences based on NASA SMD assets .
	Increase the diversity of participants reached by Science Activation through intentional, inclusive programming.
	Engage participants in learning experiences that promote development of skills for STEM careers.
Leverage Efforts through Partnerships	Leverage internal mechanisms to support sharing and learning across the Science Activation portfolio.
	Utilize external partners to leverage reach and effectiveness of the Science Activation portfolio.

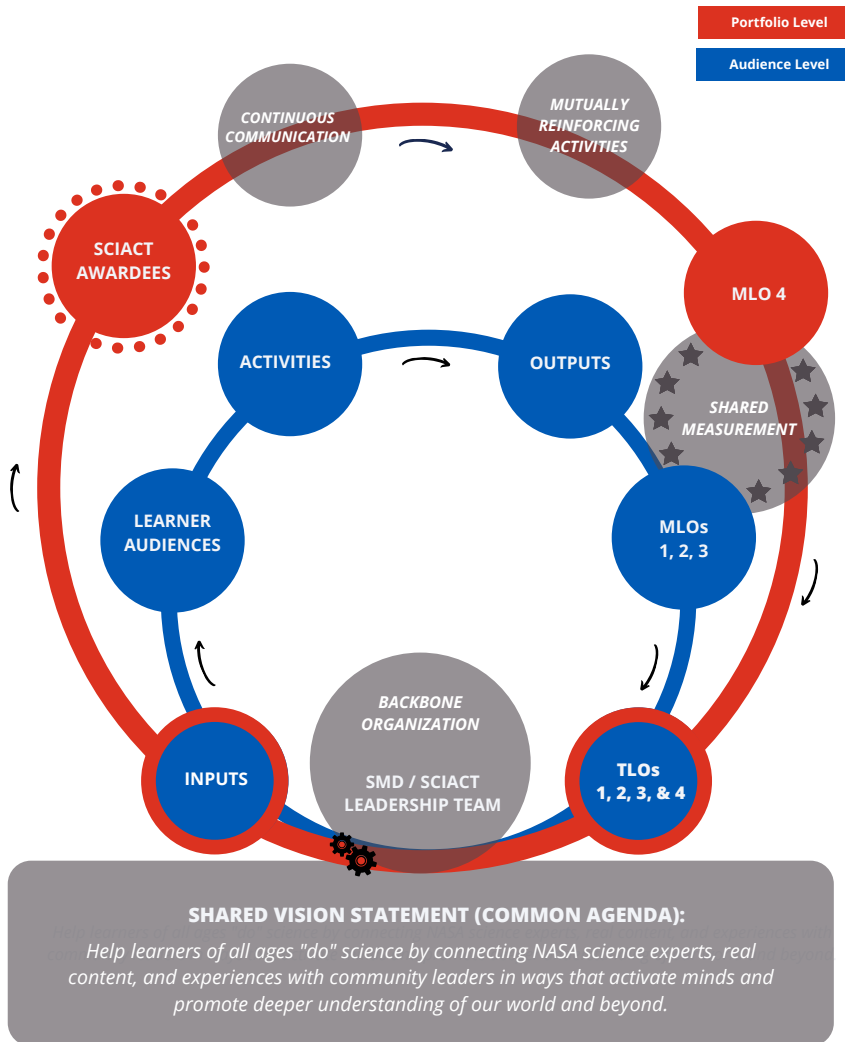
NASA SMD assets = science content and data, space and airborne platforms, and scientific and technical personnel.

Science Activation Logic Model

At the portfolio level, an integrated Logic Model has served learners effectively, especially during the pandemic, by allowing a nimble and adaptive approach to meeting the needs of our audiences.

NASA SCIENCE MISSION DIRECTORATE SCIENCE ACTIVATION PROGRAM, 2.0 LOGIC MODEL

A visual representation of program-wide SciAct 2.0 components, emphasizing relationships across activities and program alignment with the Collective Impact model



LOGIC MODEL LEGEND

Key terms, color codes, and texture patterns are defined and detailed below

COMPONENTS OF COLLECTIVE IMPACT

Translucent components highlight alignment between the Collective Impact model and SciAct components.

Common Agenda: A shared vision for change, one that includes a common understanding of the problem and a joint approach to solving it through agreed upon actions.

Shared Measurement System: Agreement on the ways successes will be measured and reported.

Mutually Reinforcing Activities: A diverse group of stakeholders working together by encouraging each participant to undertake the specific set of activities at which it excels in a way that supports and is coordinated with the actions of others.

Continuous Communication: Regular meetings to allow stakeholders to build experience with one another, and recognize and appreciate the common motivation behind their different efforts.

Backbone Support Organizations: Separate, dedicated staff to plan, manage, and support the initiative through ongoing facilitation, technology and communications support, data collection and reporting, and handling logistical and administrative details

Kania, John, and Mark Kramer. "Collective Impact." Stanford Social Innovation Review 9, no. 1 (Winter 2011): 36-41.

NEEDS-BASED INPUTS

- Science and Engineering Content/Data
- NASA Infrastructure Programs
- Participatory and Experiential Opportunities
- Subject Matter Experts (SMEs)

ACTIVITIES

- Outreach events/camps/workshops to engage audiences with science content and SMEs
- Audience engagement with lessons or activity based on NASA content
- Educator professional development (informal and K-12)
- Resource development (curriculum, videos, online platforms)
- Project evaluation
- Knowledge-sharing among awardees
- Action groups and communities of practice

OUTPUTS

- Audience Engagement with STEM experience
- Media products
- Lessons and curriculum
- Digital platforms to engage with data
- Citizen Science opportunities
- Increased dissemination opportunities
- Shared metrics and evaluation data



SCIAC AWARDEES INCLUDED IN

PORTFOLIO EVALUATION

CAN-15, with Extension

- AAA
- Arctic SIGNS
- AREN
- eClips
- Exploratorium
- GLOBE Mission Earth
- Infiniscope
- NAML
- NASA's Universe of Learning
- NESEC
- OpenSpace Project
- PLANETS
- RWRS -> Learning Ecosystems Northeast
- SEES
- SEISE-Net/NISENet
- Smoky Mountain STEM

ROSES-20

- CosmicDS
- ES:CSP
- N3
- Native Earth | Native Sky (NENS)
- NCCN
- Planetary Reach
- SaSa
- SciAct STEM Ecosystems
- SCoPE

ROSES-21

- CHALLENGER/LEARNER (2.0)
- Eclipse Ambassadors
- Eclipse Ballooning
- HEAT (2.0)
- ID Dark Sky
- NESSP (2.0)
- OCEANOS
- PLACES

MID-LEVEL OBJECTIVES

Used to guide Awardee-level programmatic and evaluation activities

- **1a.** Inspire participants' interest in STEM and the development of their identities as science learners.
- **1b.** Provide opportunities for participants to engage with the disciplinary content related to NASA science and engineering.
- **1c.** Increase number of and frequency with which NASA SMD assets are used by learners across the US.
- **2a.** Advance participants' understanding of the process of science using NASA SMD assets.
- **3a.** Increase participation in learner-centered experiences based on NASA SMD assets.
- **3b.** Increase the diversity of participants reached by Science Activation through intentional, inclusive programming.
- **3c.** Engage participants in learning experiences that promote development of skills for STEM careers.
- **4a.** Leverage internal mechanisms to support sharing and learning across the SciAct portfolio.
- **4b.** Utilize external partners to leverage reach and effectiveness of the SciAct portfolio.

GUIDING OBJECTIVES AND MEASURABLE CONSTRUCTS

TOP-LEVEL OBJECTIVES

Used to provide collective vision across SciAct

Enable STEM Education

Advance National Education Goals

Improve U.S. Scientific Literacy

Leverage Efforts Through Partnerships

CONSTRUCTS

Used to organize Portfolio-Level evaluation activities

- STEM interest
- STEM identity
- Interest in STEM-related careers
- Awareness of the range of SciAct activities, generally
- Awareness of SciAct activities as distinct or unique from other STEM offerings
- Knowledge of science process.
- Expression of science knowledge.
- Application of science process.
- Confidence using SMD Assets in scientific processes.
- Performance of STEM skills
- Confidence using STEM skills.
- Awareness of STEM skills use as they relate to a profession.
- Intent to apply STEM skills in a professional setting
- Awareness of SciAct Resources/ SMD Assets to inform practice
- Intent to use SciAct Resources/ SMD Assets in practice



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<http://www.nasa.gov/offices/ocs>

www.nasa.gov