A Resource Round-Up of 2018

The Year in Informal STEM Education

caise | center for advancement of informal science education

About CAISE

The Center for Advancement of Informal Science Education (CAISE) works to build and advance the informal STEM education (ISE) field by providing infrastructure, resources, and connectivity for educators, researchers, evaluators, and other interested stakeholders. We seek to characterize, highlight, and connect quality, evidence-based work on informal STEM learning. CAISE works closely with the Advancing Informal STEM Learning (AISL) program within the National Science Foundation (NSF).

Through **InformalScience.org**, we provide access to an ever-growing repository of more than 8,000 resources, including project descriptions, research literature, evaluation reports, and other documentation. In 2018, CAISE added 283 resources. CAISE also hosts the NSF AISL Principal Investigator meetings and convenes task forces and workshops that facilitate discussion and identify needs and opportunities for informal STEM learning researchers and practitioners. We are one of several NSF-funded resource centers that support NSF-funded professionals working in either formal or informal STEM education; others include the following:

Center for Innovative Research in CyberLearning (CIRCL, circlcenter.org)
Supports NSF's Cyberlearning program.

Community for Advancing Discovery Research in Education (CADRE, cadrek12.org)
Supports NSF's Discovery Research preK-12 (DRK-12) program.

CS for All Teachers (csforallteachers.org)
Supports all teachers interested in teaching computer science to preK through high school students.

EvaluATE (www.evalu-ate.org)
Supports NSF's Advanced Technological Education (ATE) program.

Math and Science Partnership Network (MSPnet, hub.mspnet.org)
Supports NSF's Math and Science Partnership and STEM+C programs.

STEM Learning and Research Center (STELAR, stelar.edc.org)
Supports NSF's Innovative Technology Experiences for Students and Teachers (ITEST) program.

Introduction

The *Year in ISE* is a slidedoc designed to track and characterize field growth, change and impact, important publications, and current topics in ISE in 2018. Use it to inform new strategies, find potential collaborators for your projects, and support proposal development.

Scope

This slidedoc highlights a selection of developments and resources in 2018 that were notable and potentially useful for the informal STEM education field. It is not intended to be comprehensive or exhaustive, nor to provide endorsement. To manage the scope and length, we have focused on meta analyses, consensus reports, compendia, and publications that we hope will have *general relevance* for ISE design, research, and practice.

Process

To generate content, we reached out to professional associations, institutions, and leaders within networks who were willing to submit their nominations for what was important in their ISE sector. We are grateful for their input. Please note that many resources could be categorized into multiple fields, particularly those pertaining to youth. Be sure to check out multiple sections!

We welcome your feedback on what you found useful, how we might improve this resource, and what should be included in 2019! Email caise@informalscience.org.

Types of Resources Included

Select Publications

Research, reports, meta analyses, consensus reports, and compendia.

By the Numbers

Data, trends, and geographic locations.

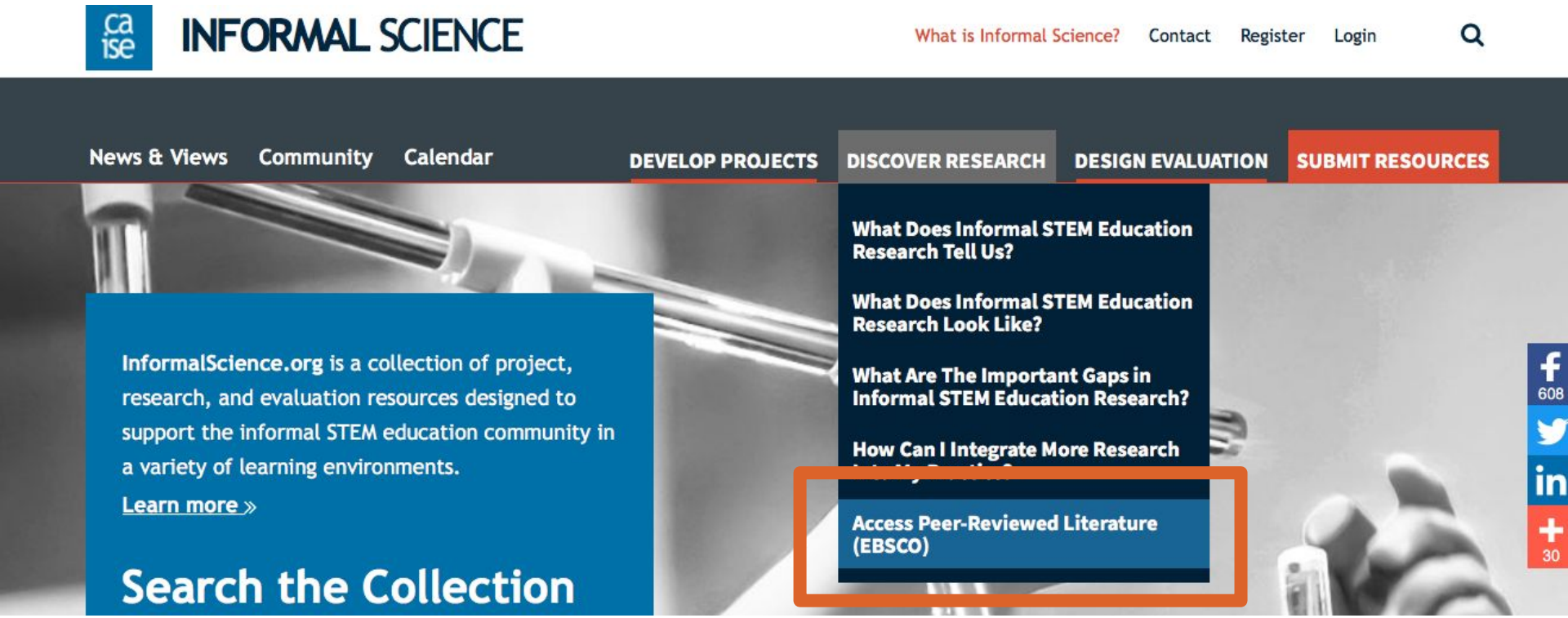
Other Resources and Notable Moments

Practitioner resources, conferences, and events.

Accessing Peer-Reviewed Literature on EBSCO

Some of the resources included in the 2018 *Year in ISE* are behind paywalls. Members of InformalScience.org have access to the full text of more than 2,000 peer-reviewed journals through EBSCO's Education Source database. This includes titles such as *Science Communication*, *Curator: The Museum Journal*, *Science Education*, *Cultural Studies of Science Education*, and *Science Scope*.

If you come across a resource here to which you'd like access, **search our database first.** Make sure you're logged into InformalScience.org, then navigate to "Discover Research" and click **"Access Peer-Reviewed Literature."**



Sectors and Categories

1. Citizen Science
2. Cyberlearning and Gaming
3. Living Collections
4. Making and Tinkering
5. Media
6. Public Libraries
7. Public Science Events
8. Science Centers and Museums
9. Science Communication
10. Youth and Afterschool
11. Other Notable Publications and Moments

New this year: Science Communication

As part of our current NSF AISL award (no. DRL-1612739), CAISE is charged with exploring opportunities for synergy among those who conduct and/or study informal STEM learning and science communication and public engagement activities. The science communication items included in the 2018 *Year in ISE* are those we identified as most accessible and relevant to the ISE field.

Citizen Science

Also includes Public Participation in Scientific Research (PPSR)

Back to the list of sectors

Citizen Science

By the Numbers

More than 3,000 projects and events are registered on **SciStarter**, a global repository of citizen science projects, people, tools, and events. The top 18 projects of 2018 that the collective community shared and participated in were:

- GLOBE Observer: Clouds
- Ant Picnic
- Stream Selfie
- Project Squirrel
- CoCoRaHS: Rain, Hail, Snow Network
- Globe at Night
- Stall Catchers, by EyesOnALZ
- ISeeChange
- The MuttMix Project
- iNaturalist
- SquirrelMapper
- Nature's Notebook
- Play to Cure: Genes in Space
- Phylo
- Mars Mappers
- LingoBoingo
- Bugs In Our Backyard
- The Great Backyard Bird Count

Citizen Science

Select Publications

A Citation Study of Citizen Science Projects in Space Science and Astronomy
Sten Odenwald in *Citizen Science: Theory and Practice*
A citation study of 143 publications in refereed journals resulting from 23 citizen science projects in space science and astronomy.

A Framework for Articulating and Measuring Individual Learning Outcomes from Participation in Citizen Science
Tina Phillips, Norman Porticella, Mark Constas, & Rick Bonney in *Citizen Science: Theory and Practice*
A study that provides empirical data to understand how intended learning outcomes first described by the informal science education field have been employed and measured within the citizen science field.

A Science Products Inventory for Citizen-Science Planning and Evaluation
Andrea Wiggins, Rick Bonney, Gretchen LeBuhn, Julia Parrish, & Jake Weltzin in *BioScience*
A research paper that describes the development of a science products inventory tool that can be used to evaluate outcomes and products of citizen science projects.

Bridging the Nature Gap: Can Citizen Science Reverse the Extinction of Experience?
Stephanie Schuttler, Amanda Sorensen, Rebecca Jordan, Caren Cooper, & Assaf Shwartz in *Frontiers in Ecology and the Environment*
A literature review that finds that citizen science fosters cognitive and emotional aspects of experiences in nature and proposes that nature-based citizen science can potentially mitigate what researchers call “the extinction of experience.”

Citizen Science

Select Publications

Citizen Science: Innovation in Open Science, Society and Policy
Susanne Hecker, Muki Haklay, Anne Bowser, Zen Makuch, Johannes Vogel & Aletta Bonn
An edited volume that developed out of the first international citizen science conference of the European Citizen Science Association (ECSA) in 2016 in Berlin, Germany. This book brings together the diverse perspectives of 121 authors and provides case studies, theoretical perspectives, and concrete examples of research in action.

Citizen Science Maker Summit Report: Learning Outcomes and Next Steps
Erica Prange, Micah Lande, & Darlene Cavalier
A report on the 2017 Arizona State University and SciStarter Citizen Science Maker Summit, whose purpose was to catalyze and strengthen collaborations between the communities.

Getting it Right or Being Top Rank: Games in Citizen Science
Marisa Ponti, Thomas Hillman, Christopher Kullenberg, & Dick Kasperowski
A virtual ethnographic study of the public forums of two online citizen science projects, Foldit and Galaxy Zoo, the aim of which was to provide a nuanced view of how participants topicalize and respond to tensions between gaming and science.

Citizen Science

Select Publications

Innovation in Citizen Science – Perspectives on Science-Policy Advances

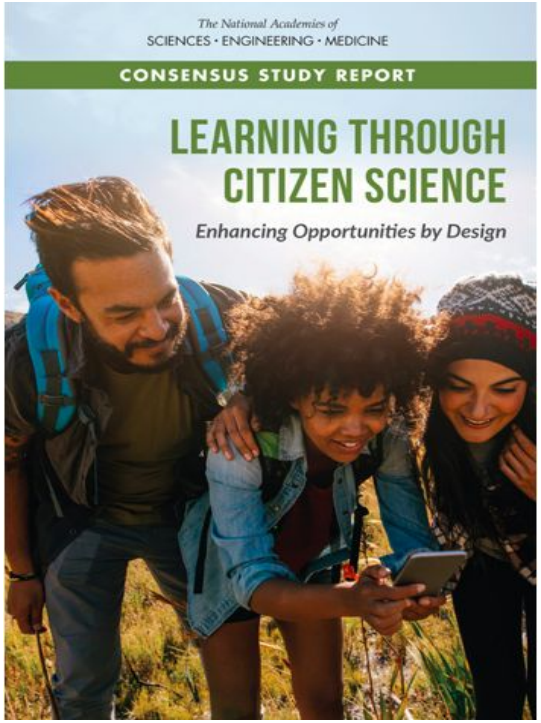
Susanne Hecker, Rick Bonney, Muki Haklay, Franz Hölker, Heribert Hofer, Claudia Goebel, Margaret Gold, Zen Makuch, Marisa Ponti, Anett Richter, Lucy Robinson, Jose Rubio Iglesias, Roger Owen, Taru Peltola, Andrea Sforzi, Jennifer Shirk, Johannes Vogel, Katrin Vohland, Thorsten Witt, & Aletta Bonn in *Citizen Science: Theory and Practice*

This paper synthesizes results of discussions at the Citizen Science: Innovation in Open Science, Society and Policy conference in 2016 in Berlin, Germany, and distills major points of the discourse into key recommendations.

Learning Through Citizen Science: Enhancing Opportunities by Design

National Academies of Sciences, Engineering, and Medicine

A consensus report which affirms that citizen science projects can help participants learn scientific practices and content and includes examples, recommendations, and a proposed research agenda.



Citizen Science

Other Resources & Notable Moments

***Connected Science Learning*, Issue 6**

National Science Teachers Association & Association of Science-Technology Centers

A special issue dedicated to K-12 citizen science experiences that successfully connect formal and informal education.

Forest Service Citizen Science Project Planning Guide

United States Department of Agriculture

Provides practical guidance on whether and how to design, implement and manage a citizen science project.

The Crowd & The Cloud

Camellia Sanford, Fatima Carson, Saul Rockman, & Julia Li

This multimedia project included a broadcast television series, an interactive website, and a social media strategy. The summative evaluation report here documents large-scale changes in the public's awareness and perceptions of citizen science.

Cyberlearning and Gaming

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Cyberlearning and Gaming

Select Publications

Broadening Youth Participation in Computer Science & Engineering
Judi Fusco & Patricia Schank
A primer from the Center for Innovative Research in CyberLearning (CIRCL) that reviews practices from selected work that has helped broaden youth participation in computer science and engineering.

Digital Play for Global Citizens
Jordan Shapiro
A report from the Joan Ganz Cooney Center that leads educators, youth development leaders, and parents through a vast landscape of digital resources—some of which may already be familiar tools—and suggests innovative ways to nurture young learners to become macro-minded citizens.

Game-Based Health Education: The Case of Hexacago Health Academy
Megan Macklin, Patrick Jagoda, Ian Jones, & Melissa Gilliam in *Journal of STEM Outreach*
Describes a summer program with a strong youth-initiated mentoring component, where game-based learning provides health education and stimulates interest in careers in medicine among adolescents from underrepresented minority populations.

Cyberlearning and Gaming

Select Publications

Getting it Right or Being Top Rank: Games in Citizen Science

Marisa Ponti, Thomas Hillman, Christopher Kullenberg, & Dick Kasperowski

A virtual ethnographic study of the public forums of two online citizen science projects, Foldit and Galaxy Zoo, the aim of which was to provide a nuanced view of how participants topicalize and respond to tensions between gaming and science.

Social Media Based STEM Enrichment Curriculum Positively Impacts Rural Adolescent Health Measures

Ann Chester, Sara Hanks, Summer Kuhn, Floyd Jones, Travis White, Misty Harris, Bethany Hornbeck, Sherron McKendall, Mary McMillion, Cathy Morton, Mallory Slusser, & R. Kyle Saunders in *Journal of STEM Outreach*

A rural high school STEM outreach program used a social media curriculum focused on healthy lifestyles and measured the impact on the health of 134 adolescents from 26 counties in West Virginia.

Cyberlearning and Gaming

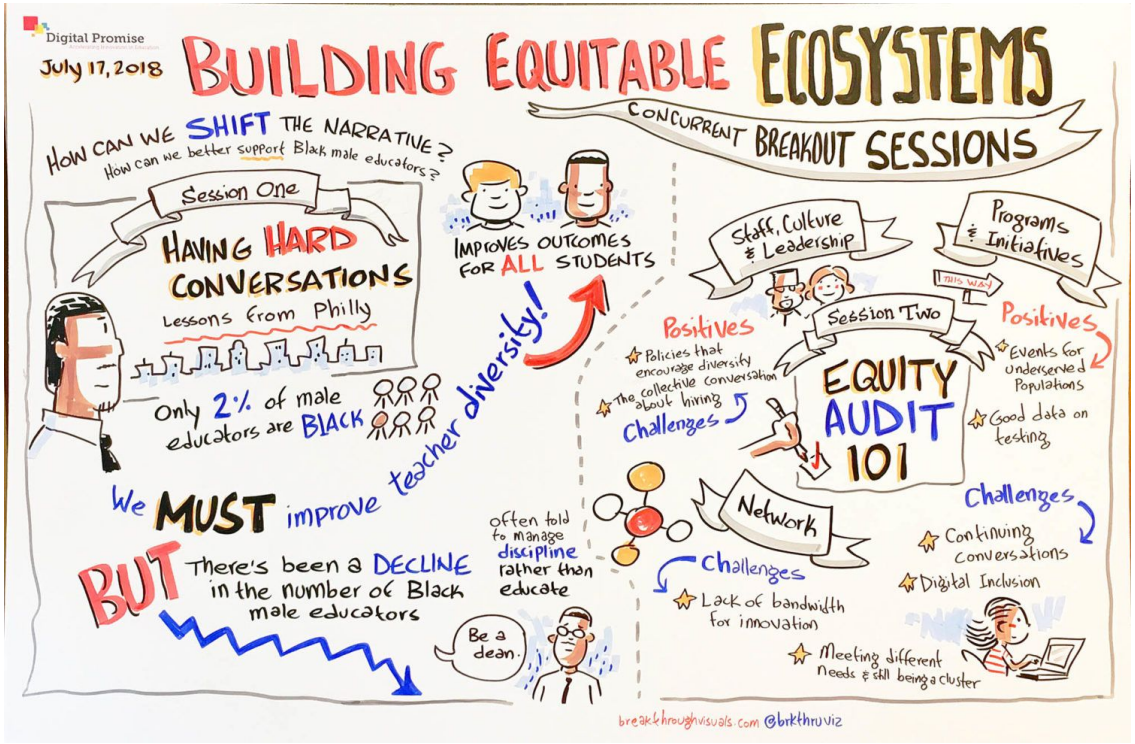
Other Resources & Notable Moments

[Digital Observation Technology Skills: Incorporating Modern Digital Technology Into Outdoor Experiential Education]
R. Justin Hougham, Marc Nutter, & Caitlin Graham
Presents a framework for integrating modern, mobile technology into outdoor, experiential science education.

Conferences & Meetings

[Designing 2030: Designing the Future of Teaching and Learning] (May 2018 in Oakland, CA)
The Concord Consortium

[2018 Education Innovation Clusters Convening: Looking to the Future] (July 16-18 in Philadelphia, PA)
Digital Promise



Living Collections

Zoos, aquariums, botanical gardens, parks, and nature centers

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Living Collections

By the Numbers

There are **233 accredited zoos and aquariums in the United States,** according to the Association of Zoos and Aquariums (AZA). Their latest annual member survey revealed:

- 50 million children visit AZA-accredited facilities with their families annually
- 12 million student learners visit AZA-accredited facilities on field trips annually
- AZA-accredited institutions trained 400,000 teachers in informal science education methods over the last decade

ASSOCIATION OF ZOOS & AQUARIUMS

Living Collections

Select Publications

Developing Empathy in Aquarium and Zoo Visitors
Elly Schofield & Kathayoon Khalil
Describes a multi-institution partnership aimed at creating a collective understanding of the best practices for building and measuring empathy at zoos and aquariums.

Empathy for Animals: A Review of the Existing Literature
Ashley Young, Kathayoon Khalil, & Jim Wharton in *Curator*
This paper reviews existing literature on empathy in relation to and with non-human animals, offers a definition of empathy as it applies to all species, and discusses key components of empathy development, including barriers and promoters.

Instrument Development and Validation for Conservation Learning: A Tool for More Rigorous Research and Evaluation
Fran Mast, Lei Zhao, & Lindsay Maldonado in *Curator*
An overview of Shedd Aquarium's work to validate an instrument that reliably and accurately measures aspects of conservation learning in the context of zoo experiences.

Penguin Promises: Encouraging Aquarium Visitors To Take Conservation Action
Judy Mann-Lang, Roy Ballantyne, & Jan Packer in *Environmental Education Research*
This study investigates the impact of an innovative conservation action campaign implemented at uShaka Sea World in Durban, South Africa.

Living Collections

Select Publications

Pre-College Urban Ecology Research Mentoring: Promoting Broader Participation in the Field of Ecology for an Urban Future

Jason Aloisio, Brian Johnson, James Lewis, J. Alan Clark, Jason Munshi-South Su-Jen Roberts, Deborah Wasserman, Joseph Heimlich, & Karen Tingley in *Journal of Urban Ecology*

This paper makes the case that pre-college urban ecology research mentoring provides a place-based, authentic research experience that strengthens science identity and intent to pursue ecology-related majors among underrepresented racial minorities.

The Role of Post-Visit Action Resources in Facilitating Meaningful Free-Choice Learning After a Zoo Visit

Jill Bueddefeld & Christine Van Winkle in *Environmental Education Research*

This research explores the role of post-visit action resources in facilitating long-term learning for individual environmental actions after a zoo visit.

Visitors' Values and Environmental Learning Outcomes at Wildlife Attractions: Implications For Interpretive Practice

Roy Ballantyne, Karen Hughes, Julie Lee, Jan Packer, & Joanne Sneddon in *Tourism Management*

This paper develops an understanding of zoo and aquarium visitors' personal values and the impact of their values on their reflective engagement, learning, and self-reported changes in post-visit behavior.

Zoo Exhibit Experiences and Visitors' Affective Reactions: A Preliminary Study

Jerry Luebke in *Curator*

This study explores the types of personal experiences that were related to zoo visitors' empathic and affective reactions at an animal exhibit.

Making and Tinkering

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Making and Tinkering

By the Numbers

- **Making Spaces** is a partnership between Google, Maker Ed, and the Children's Museum of Pittsburgh, working to sustainably integrate making into schools across the United States through a regional hub model. **In 2018, Making Spaces expanded to 21 hubs!**

- The Maker Promise, an initiative from Maker Ed and Digital Promise, asks U.S. school and district leaders to sign a concrete commitment to dedicate a space for making, designate a champion for making, and display what students make in K-12 schools.

- As documented in the report **Fulfilling the Maker Promise: Year Two**, the number of **Maker Promise schools grew to 1,849 with more than 1,908 Maker Champions in 2018.**

Making and Tinkering

Select Publications

Accessible Making: Designing Makerspaces for Accessibility
Katherine Steele, Maya Cakmak, & Brianna Blaser in *International Journal of Designs for Learning*
This brief examines a three-step process used to make a university-based makerspace more accessible and welcoming to individuals with disabilities, including a tour, design activity, and brainstorming session.

Equity and the Maker Movement: Integrating Children's Communities and Social Networks into Making
Edna Tan, Angela Calabrese Barton, & Katie Schenkel in *Science and Children*
This article reports that explicitly recruiting children's rich funds of knowledge, anchored in children's existing social networks, supported children in sustained, consequential making.

Equity in STEM-rich Making: Pedagogies and Designs
Jean Ryoo & Angela Calabrese Barton in *Equity & Excellence in Education*
This short article frames current equity issues in the Maker Movement and describes four articles that examine how complex power dynamics shape youths' making experiences. Carefully designed, equity-oriented pedagogical and design approaches can support youth in challenging sociohistorical narratives and complex power dynamics around making.

Legitimate Peripheral Participation in a Makerspace for Emancipated Emerging Adults
Rachel Bonnette & Kevin Crowley in *Emerging Adulthood*
Following emancipation from foster care, youth often transition into adulthood without the support of family or school. This study analyzes the diverse relationships of three young adults with a maker community of practice, as they live in a transitional housing facility and engage with its on-site makerspace and affiliated museum.

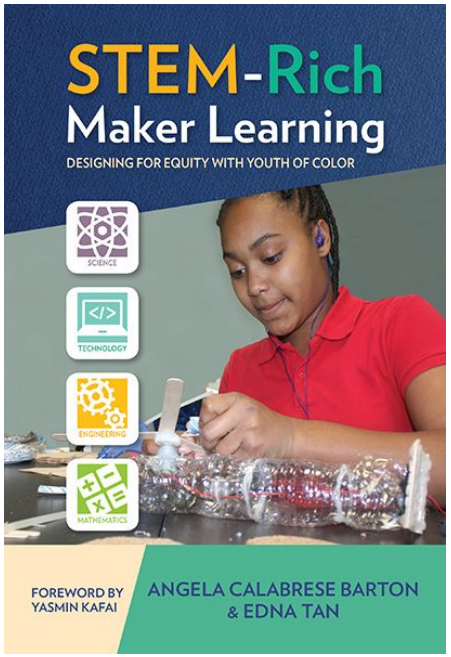
Making and Tinkering

Select Publications

Maker Grows Up: Committing to Sustainable Programs Nationwide
Grace Lynch in *School Library Journal*
As making and tinkering become more mainstream in schools and libraries, educators are thinking more critically about the factors that determine meaningful making experiences.

Making Deeper Learners: A Tinkering Learning Dimensions Framework
Bronwyn Bevan, Jean Ryoo, Aaron Vanderwerff, Mike Petrich, & Karen Wilkinson in *Connected Science Learning*
Educators from the Exploratorium's Tinkering Studio and the Lighthouse Community Public Schools explored how out-of-school making and tinkering programs could support learning that flows into the school day.

Reframing "Failure" in Making: The Value of Play, Social Relationships, and Ownership
Jean Ryoo & Linda Kekelis in *Journal of Youth Development*
Explores the characteristics that make individuals more likely to persist through failure during maker activities.



STEM-Rich Maker Learning: Designing for Equity with Youth of Color
Angela Calabrese Barton & Edna Tan
This book features longitudinal ethnographic data and examples that show how youth of color from low-income backgrounds innovate and make usable artifacts to improve their lives and their communities.

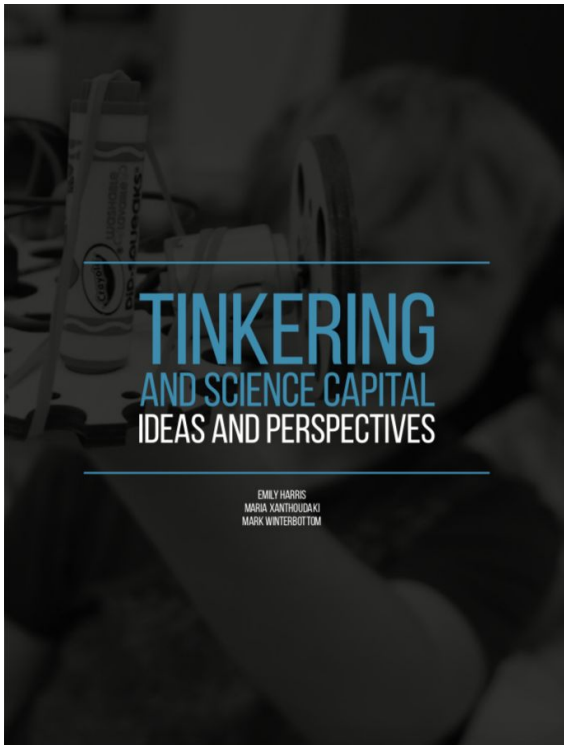
Making and Tinkering

Select Publications

[The Design of Early Childhood Makerspaces to Support Positive Technological Development: Two Case Studies]
Marina Umaschi Bers, Amanda Strawhacker, & Miki Vizner in *Library Hi Tech*
This paper describes design principles for successful makerspaces and integrates three approaches for designing learning environments: the makerspace movement, Reggio Emilia's Third Teacher approach, and the positive technological development framework.

[Tinkering and Science Capital: Ideas and Perspectives]
Emily Harris, Maria Xanthoudaki, & Mark Winterbottom
A reflection on the potential of tinkering for engagement in learning and STEM, through the lens of "science capital."

[Towards Critical Justice: Exploring Intersectionality in Community-Based STEM-Rich Making with Youth from Non-Dominant Communities]
Edna Tan & Angela Calabrese Barton in *Equity & Excellence in Education*
This study investigates STEM-rich making that utilized community ethnography as a pedagogy approach and supported youth to make a difference in their communities.



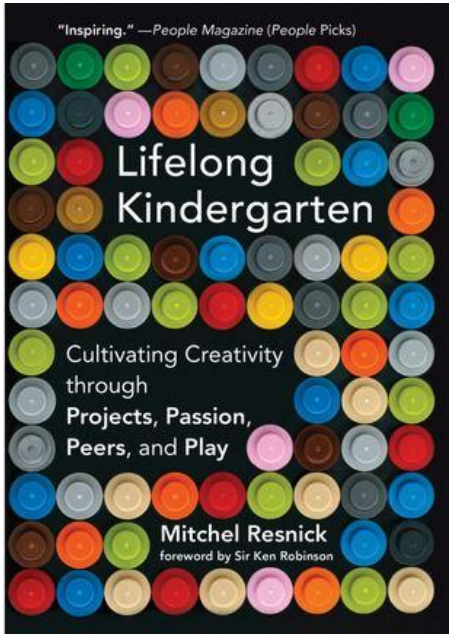
Making and Tinkering

Other Resources & Notable Moments

Assessing Learning in Maker Education
Stephanie Chang, Maker Ed
A look at how maker education is assessed—and how assessment is evolving to measure more than just content.

Celebrating Making and Tinkering for the National Week of Making
Melissa Ballard, CAISE
A blog round-up of 15 NSF AISL projects focused on making and tinkering.

***Connected Science Learning*, Issue 7**
National Science Teachers Association & Association of Science-Technology Centers
This issue focuses on STEM learning experiences through making. Read the introduction by editor Dennis Schatz.



Learners First: How Educators Hone Their Craft
Allyce Pinchback-Johnson, Root + All
Explores various settings (including informal learning spaces) that foster teacher professional learning.

Lifelong Kindergarten: Cultivating Creativity through Projects, Passion, Peers, and Play
Mitchel Resnick, MIT Media Lab
Drawing from more than 30 years of experiences at MIT's Media Lab, Resnick discusses new technologies and strategies for engaging young people in creative learning experiences.

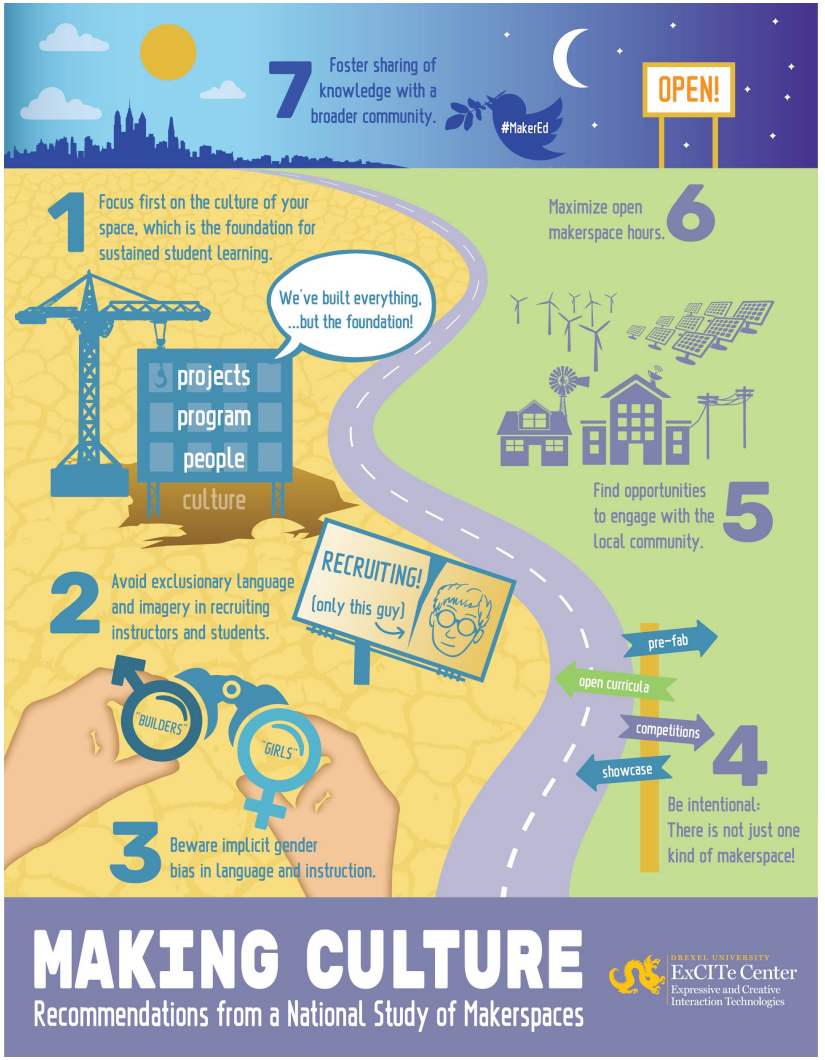
Making and Tinkering

Other Resources & Notable Moments

Makers, Crafters, Educators: Working for Cultural Change
Elizabeth Garber, Lisa Hochtritt, & Manisha Sharma (editors)
This edited collection addresses making and crafting in relation to community and schooling practices, culture, and place. It positions making as an agent of change in education.

Making Culture
Drexel University ExCITe Center
This book provides an in-depth examination of K-12 education makerspaces nationwide. It is a product of a year-long investigation visiting 30 makerspaces across 12 metropolitan regions.

More Tinkering: How Kids in the Tropics Learn by Making Stuff
Curt Gabrielson
This book features more than three dozen educational tinkering projects based on the author's years of working with kids in Timor-Leste.



Making and Tinkering

Other Resources & Notable Moments

Moving Beyond the 4 Myths of Maker Education
Jakki Spicer, Maker Ed
Clarifies how maker education fits into the learner-centered ecosystem and addresses myths that often show up in conversations about maker education.

Open Portfolio Project Research Brief Series (Phase 2)
Maker Ed
A set of 12 briefs looks into the motivations, implications, and practices necessary to situate open portfolios as a means of assessment in maker-centered learning environments.

Space to Learn: Ideas and Inspiration for Transforming Learning Spaces
Adam Reger, Root + All
Even the smallest tweaks to the design of a learning space can add up to a change that fosters active participation and gets students to take ownership of their learning. This booklet is a starting point for those interested in reimagining a learning space.

Summaries of the Making Connections Project and Play Tinker Make Activities
Lauren Causey and Keith Braafladt, Science Museum of Minnesota
This practitioner guide offers insight into engaging community organizations as equal partners and developing learning activities.

Conferences & Meetings

- NSF EAGER Maker Meeting (December 10-11 in Alexandria, VA)
- 4th Annual Maker Educator Convening (October 19-20 in San Jose, CA)

Media

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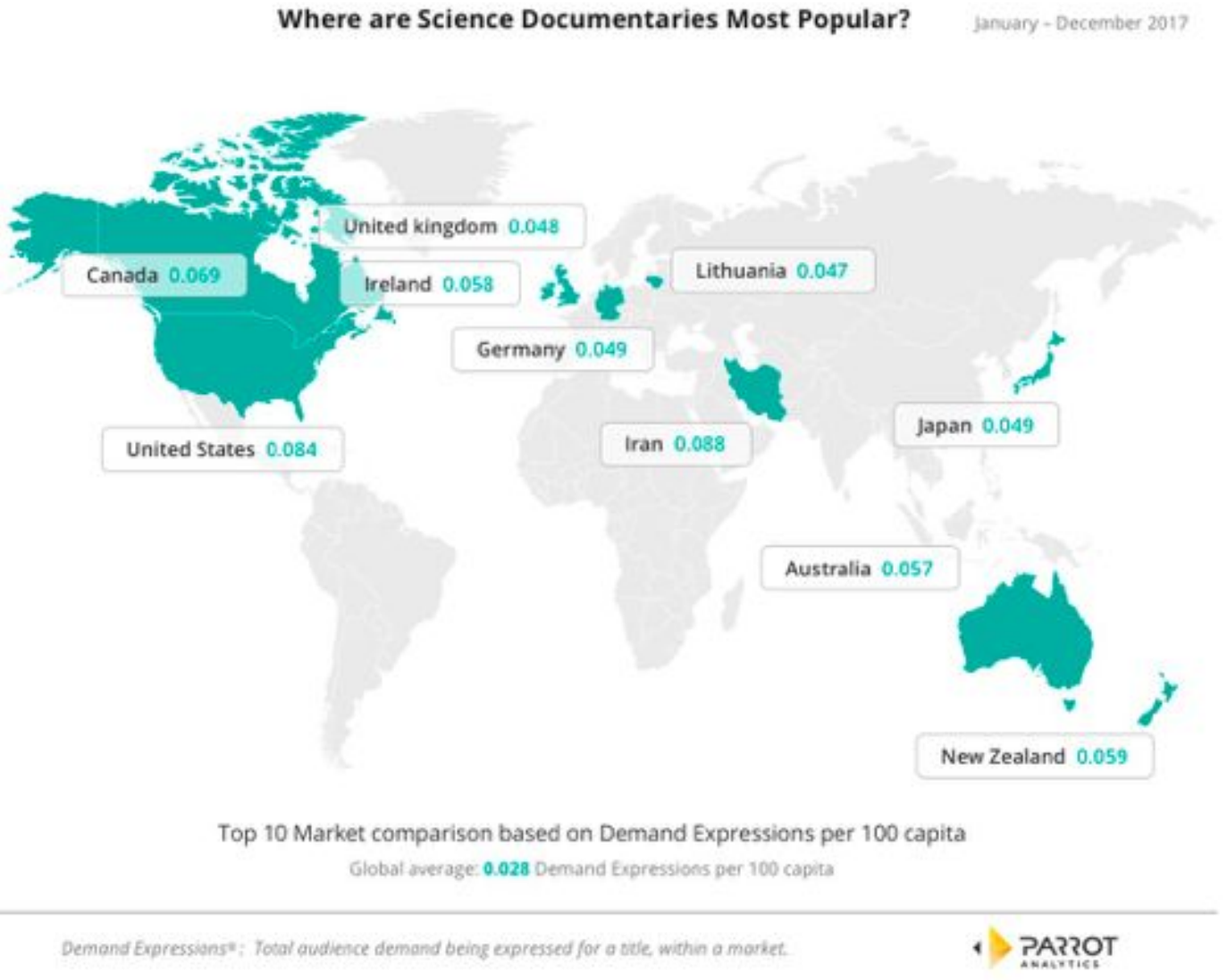
Media Projects

By the Numbers

[The Demand for Documentaries Across Online & Social Media Platforms: Recent Highlights]

DocumentaryBusiness.com

Highlights of Parrot Analytics' analysis of cross-platform demand for unscripted programs, focused on documentaries and the subgenres of science and nature.



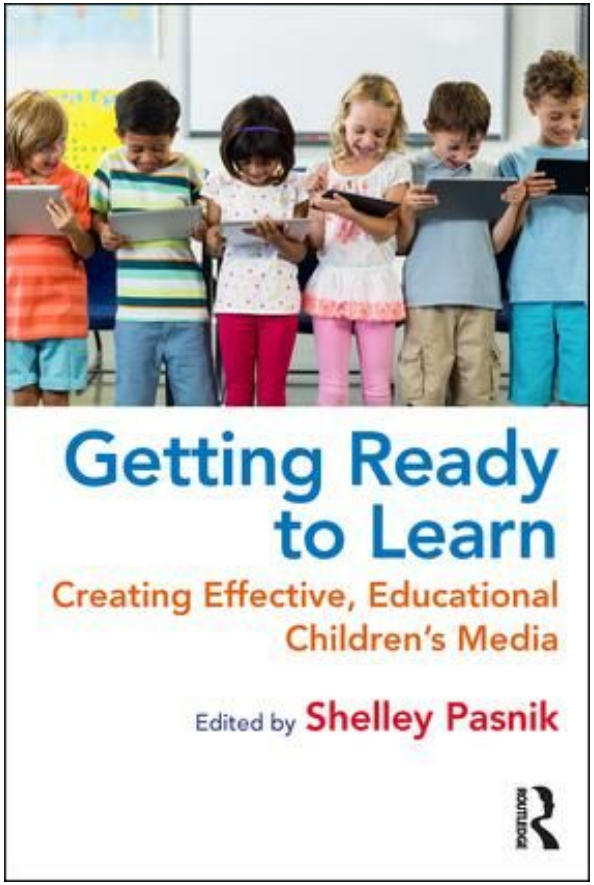
Media Projects

Select Publications

Cognitive Development in Digital Contexts
Fran Blumberg & Patricia Brooks (editors)
The impact of screen media on key aspects of children's and adolescents' cognitive development.

Expanding Latino Parents' Access to Child Development Research through the News Media
Alicia Torres, Selma Caal, Luz Guerra, & Angela Rojas
The Child Trends News Service promotes the adoption of research-based parenting practices by building awareness of and appreciation for actionable child development research. This brief describes best practices for communicating with and engaging Latino parents.

Getting Ready to Learn: Creating Effective, Educational Children's Media
Shelley Pasnik (editor)
How educational media have played and continue to play a role in meeting the learning needs of children, parents, and teachers.



Media Projects

Select Publications

Millenials Are the Most Science-Curious Generation in the U.S.

Sue Ellen McCann, Fred Jacobs, Jason Hollins, Asheley Landrum, & Dan Kahan

Millennials, born between 1981 and 1996, are projected to become the largest and most diverse adult generation in the United States soon and have radically changed media consumption habits. This is the first survey of Millennial science media habits, science curiosity, and cultural beliefs.

SciGirls Strategies Final Research Report, XSci, 2018

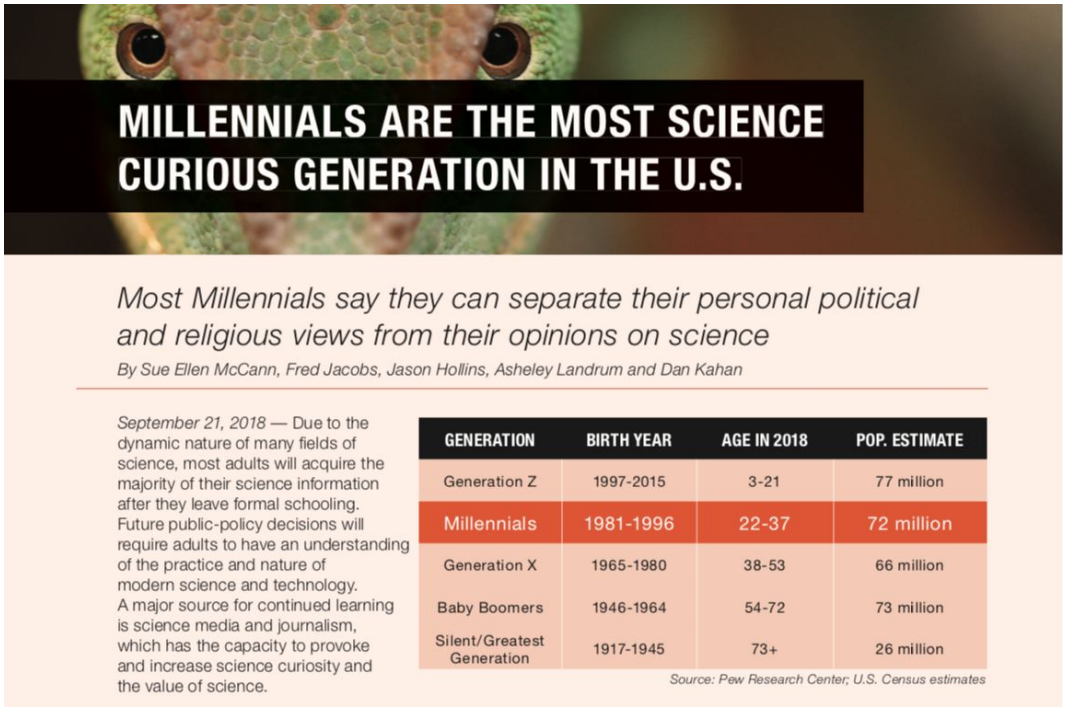
Experiential Science Education (XSci) Research Collaborative at the Center for STEM Learning, University of Colorado-Boulder

A final report from a 2018 study of SciGirls that investigated three research questions around girls' STEM identity development.

Social Media and Participatory Authorship in Giant Screen Films

Mary Nucci

Examines the role of social media in the development of giant screen films.



MILLENNIALS ARE THE MOST SCIENCE CURIOUS GENERATION IN THE U.S.

Most Millennials say they can separate their personal political and religious views from their opinions on science

By Sue Ellen McCann, Fred Jacobs, Jason Hollins, Asheley Landrum and Dan Kahan

September 21, 2018 — Due to the dynamic nature of many fields of science, most adults will acquire the majority of their science information after they leave formal schooling. Future public-policy decisions will require adults to have an understanding of the practice and nature of modern science and technology. A major source for continued learning is science media and journalism, which has the capacity to provoke and increase science curiosity and the value of science.

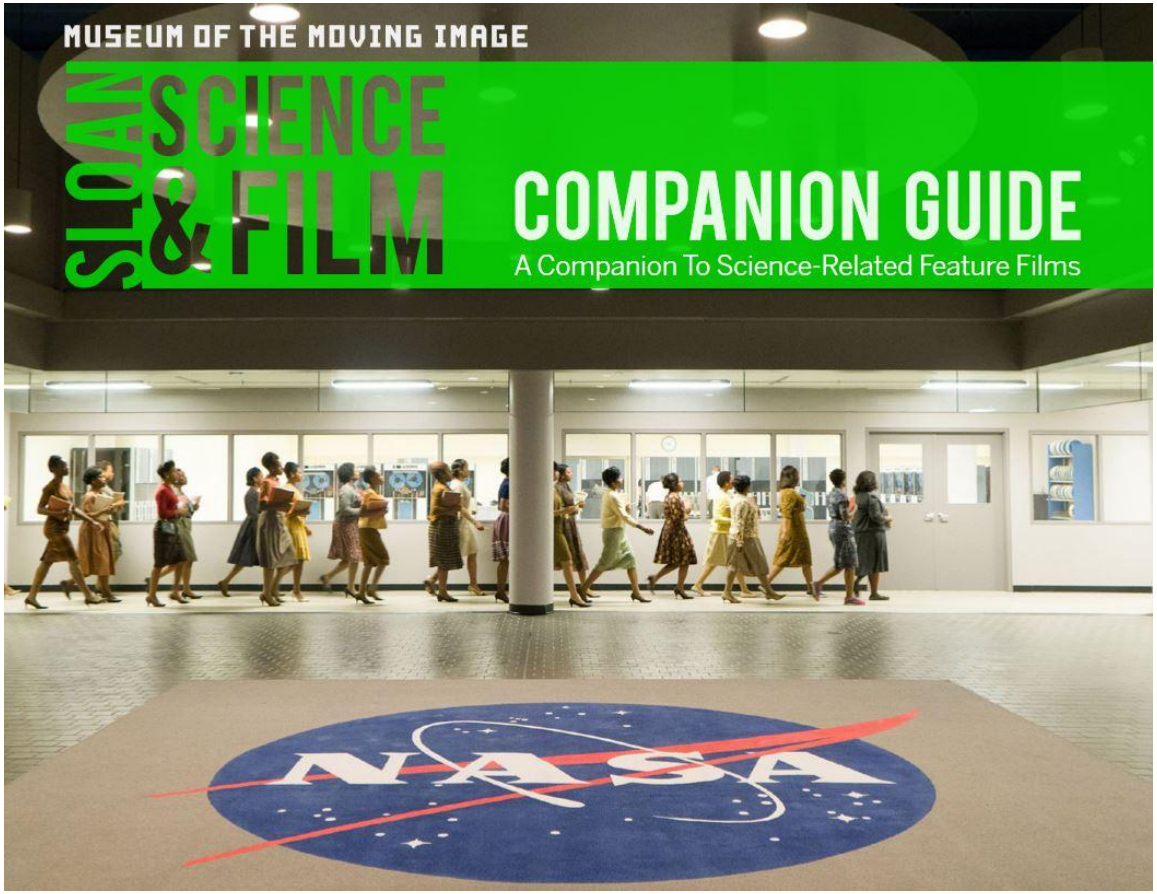
GENERATION	BIRTH YEAR	AGE IN 2018	POP. ESTIMATE
Generation Z	1997-2015	3-21	77 million
Millennials	1981-1996	22-37	72 million
Generation X	1965-1980	38-53	66 million
Baby Boomers	1946-1964	54-72	73 million
Silent/Greatest Generation	1917-1945	73+	26 million

Source: Pew Research Center; U.S. Census estimates

Media Projects

[A Guide to Short Science-Related Films for the Classroom]
Museum of the Moving Image
This educators' guide provides a teaching framework for 50 short, narrative (fiction) films, supported by the Alfred P. Sloan Foundation's nationwide film program. Each film integrates scientific or technological themes and is available to stream for free.

[A Companion To Science-Related Feature Films]
Museum of the Moving Image
This guide lists an additional 46 feature films with scientific or technological themes or characters.



Media Projects

Connecting Urban Families With Environmental Science
Marion Goldstein, Elizabeth Pierson, Jamie Kynn, & Lisa Famularo
This article in *Connected Science Learning* describes the development of the PLUM LANDING Explore Outdoors Toolkit, a set of public media resources designed to help informal educators and parents combine environmental education with outdoor recreation.

Conferences & Meetings

- **2018 Annual Media Impact Forum** (May 10 in Philadelphia, PA)
- **SMASH18** (Science Media Awards & Summit in the Hub, September 25-27 in Boston, MA)

Public Libraries

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Public Libraries

By the Numbers

Every year, the Institute of Museum and Library Services (IMLS) conducts the Public Libraries Survey. **Past surveys are available here.** Here are some highlights from the 2016 survey, the most recent one for which data are available:

- In 2016, there were more than 171 million registered users of public libraries, representing over half of the nearly 311 million Americans who lived within a public library service area.
- These users visited public libraries over 1.35 billion times in 2016.
- Public libraries offered half a million more programs in 2016 than in 2015, and 113 million people attended 5.2 million programs in 2016.
- Public libraries offered over 391 million e-books to their patrons.
- A report on the FY2017 findings will be published in 2019.

The 2018 International Space Station In-Flight Education Downlink event got 16,000 views from participating libraries.

Photo by the Space Science Institute's STAR Net initiative.

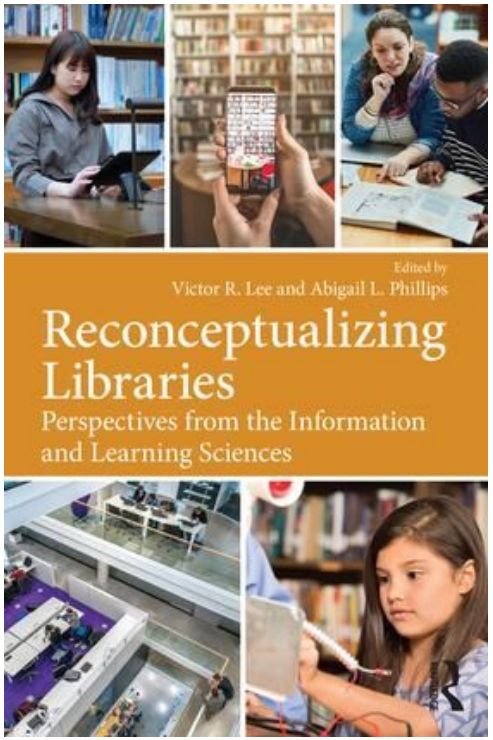
Public Libraries

Select Publications

Libraries, Broadband, and Digital Inclusion
Institute of Museum and Library Services
IMLS's largest grant program, Grants to States, funds over 1,500 projects each year that meet the purposes and priorities outlined in the Library Services and Technology Act. The program helps libraries assess connectivity needs, procure affordable broadband services, complete E-rate applications, train staff, and obtain technology.

Merry Work: Libraries and Citizen Science
Tiberius Ignat, Paul Ayris, Ignasi Labastida i Juan, Susan Reilly, Bertil Dorch, Thomas Kaarsted, & Anne Kathrine Overgaard
This article presents a snapshot of what libraries have so far achieved in citizen science and the challenges and opportunities that remain, with case studies from University College London, the University of Barcelona, the University of Southern Denmark, and Qatar National Library.

Reconceptualizing Libraries: Perspectives from the Information and Learning Sciences
Victor Lee & Abigail Phillips (editors)
This book brings together cases and models developed by experts in the information and learning sciences to identify the potential for libraries to adapt and transform in the wake of new technologies for connected learning and discovery.



Public Libraries

Other Resources & Notable Moments

Community Dialogues in Informal Science Institutions: Strategies to Work with Underserved Audiences, Activate New Partnerships, and Create a More Welcoming Institution

Anne Holland & Paul Dusenbery

Working closely with public libraries across the country, the STAR Library Network developed a Community Dialogue Framework to assist public libraries in reaching new patrons, becoming an even more welcoming venue, and building new partnerships.

Computational Thinking and Libraries

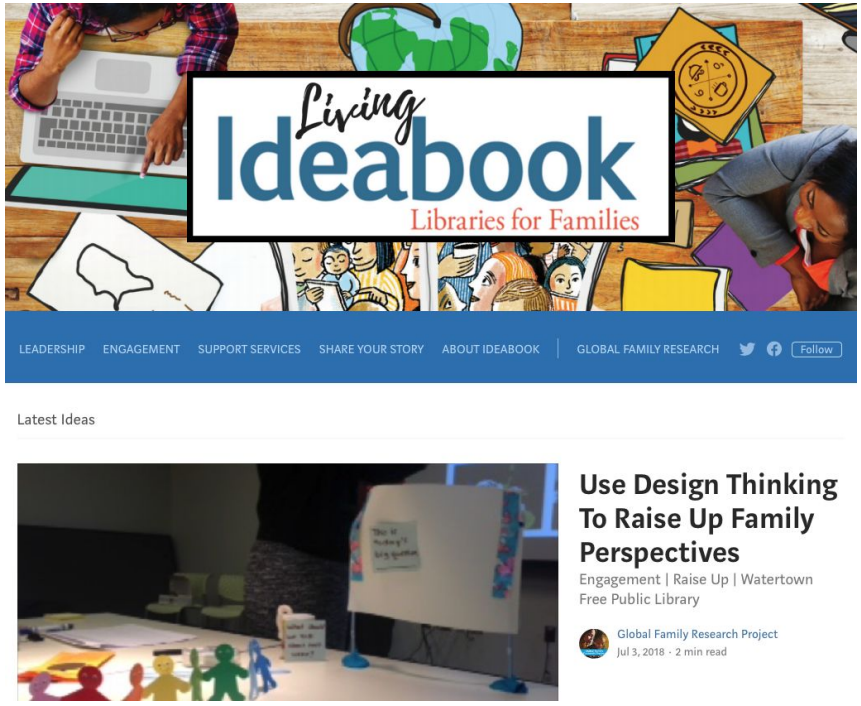
Young Adult Library Services Association

A set of videos highlighting the ways in which libraries are integrating computational thinking into the work they do with and for youth and communities.

Living IDEABOOK

Global Research Family Project

A digital extension of two previous publications—*IDEABOOK: Libraries for Families* and *Public Libraries: A Vital Space for Family Engagement*—intended to be used as a continuously evolving resource for anyone designing a family engagement system.



Public Libraries

Other Resources & Notable Moments

Libraries Ready to Code
American Library Association
The Ready to Code Collection provides resources and strategies for coding and computational thinking activities that are grounded in research, that align with library core values, and that support broadening participation. It was created in collaboration with staff from 30 libraries who curated resources, developed content, and piloted strategies in order to support others in becoming Ready to Code.

"Make Do Share" Guide to Sustainable STEM Programming
Kitsap Regional Library
This guide serves as a springboard for public libraries to either begin building sustainable STEM programs or to enhance existing efforts.

Making and Information Literacy
Heather Moorefield-Lang
This blog draws on theories and definitions of information literacy and making to surface implications for libraries with makerspaces.

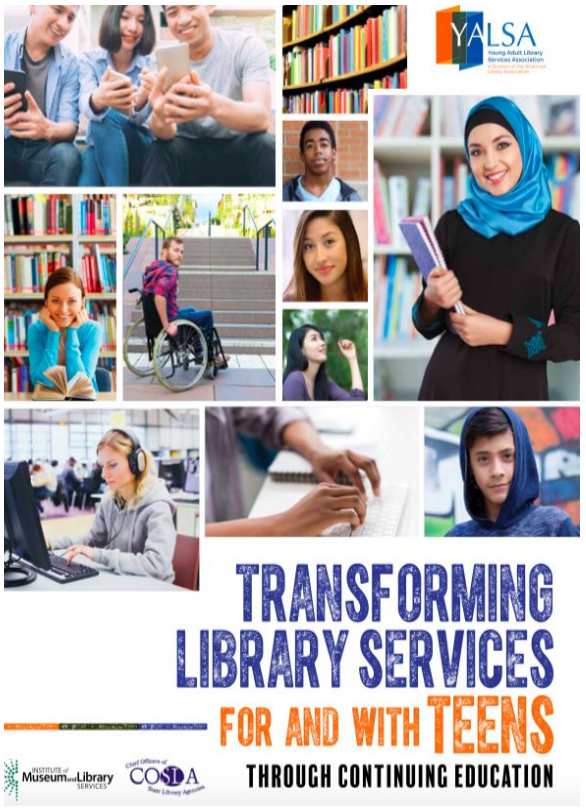
Public Libraries

Other Resources & Notable Moments

Transforming Teen Services For and With Teens Through Continuing Education

Young Adult Library Services Association

This report focuses on professional development for librarians to support a paradigm shift in teen programming where youth engagement, youth voices, and youth leadership are embedded throughout teen services.



STEM Activity Clearinghouse

Science-Technology Activities & Resources for Libraries (STAR Net)

In 2018, STAR Net added 193 new resources to this clearinghouse, including learning activities, connections to STEM information and materials, and ongoing webinars that connect librarians to STEM experiences, phenomena, and STEM-based professionals.

Thinking Sideways: Computational Thinking and Early Literacy

Public Library Association

This on-demand webinar explores components of computational thinking, what it looks like in early childhood, and how library staff can use developmentally appropriate activities to support whole-child development. Young children can become successful problem-solvers, creative thinkers, and lifelong learners at the library.

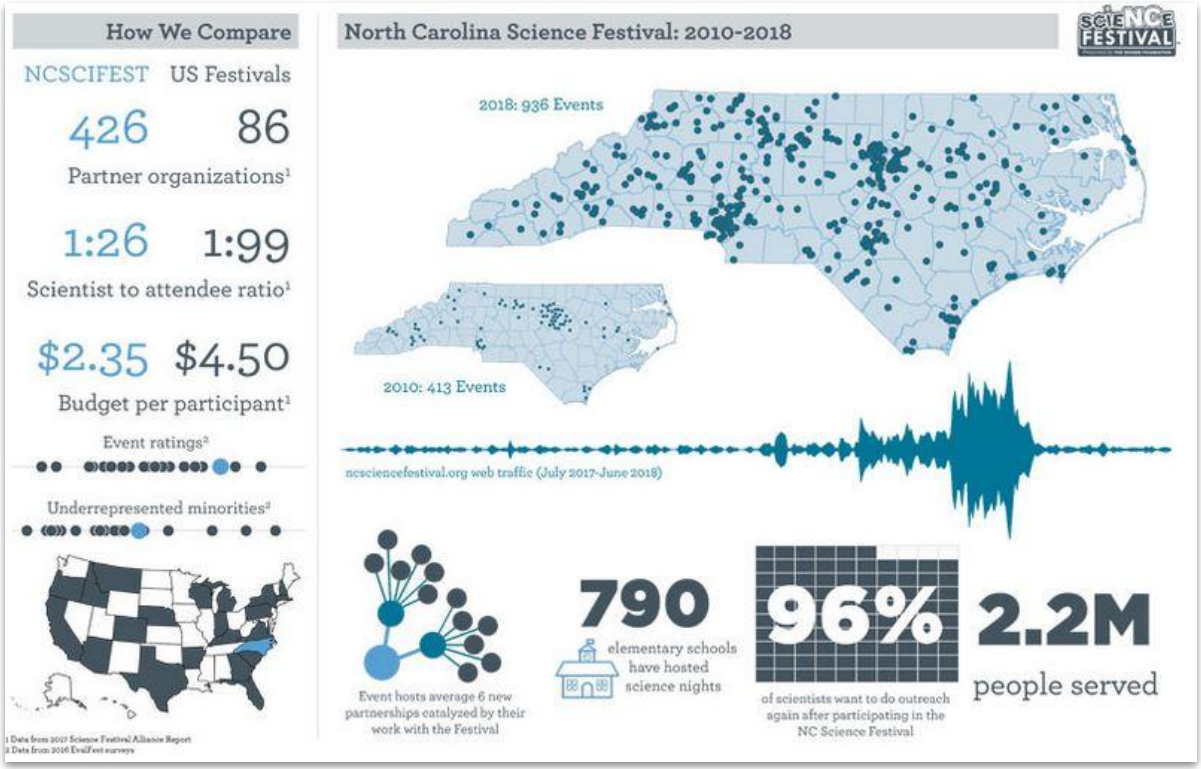
Public Science Events

Back to the list of sectors

Public Science Events

By the Numbers

- The Story Collider aired more than 100 stories on its podcast and hosted nearly 300 people in 59 shows across the United States, UK, Canada, New Zealand, and Germany.
- The North Carolina Science Festival created a “data placement” to tell the story of their festival, comparing their statistics with those of other science festivals around the country.



Public Science Events

Select Publications

Celebrating STEM in Rural Communities: A Model for an Inclusive Science and Engineering Festival

Maureen Munn, Joan Griswold, Helene Starks, Stephanie Fullerton, Conan Viernes, Thelma Sipe, Mike Brown, Craig Dwight, Randy Knuth, & Sheldon Levias in *Journal of STEM Outreach*

This article describes bringing science festivals to rural communities, where geographical isolation, socioeconomic disadvantages, and language barriers can reduce opportunities for residents to meet STEM professionals.

Debris, Diatoms, and Dolphins: Tracking Child Engagement at a Public Science Festival

Kaya Van Beynen & Theresa Burress in *International Journal of Science Education, Part B*

This study examines how elementary-aged children individually or collaboratively engaged with festival exhibits at a public science festival in St. Petersburg, Florida.

European Researchers' Night as a Learning Environment

Joseph Roche, Nicola Davis, Mark Chaikovsky, Shaun O'Boyle, & Cliona O'Farrelly in *International Journal of Interdisciplinary Educational Studies*

In 2015, 1.1 million European citizens and 18,000 researchers took part in events organized in more than 300 cities in Europe. This paper explores the types of learning that took place at European Researchers' Night in Ireland and makes recommendations on how learning might be better assessed.

Public Science Events

Select Publications

[Impacts of a Comprehensive Public Engagement Training and Support Program on Scientists' Outreach Attitudes and Practices]
Cathlyn Stylinski, Martin Storksdieck, Nicolette Canzoneri, Eve Klein, & Anna Johnson in *International Journal of Science Education, Part B*
Interviews with scientists who have participated in the Portal to the Public program indicate that the program helped them improve their engagement skills.

[Multi-Site Public Engagement with Science Synthetic Biology: Final Evaluation Report]
Camellia Sanford-Dolly & Claire Quimby
Summative evaluation report on programming promoting two-way dialogs with public audiences and professional scientists through public events and forums centered on the topic of synthetic biology.

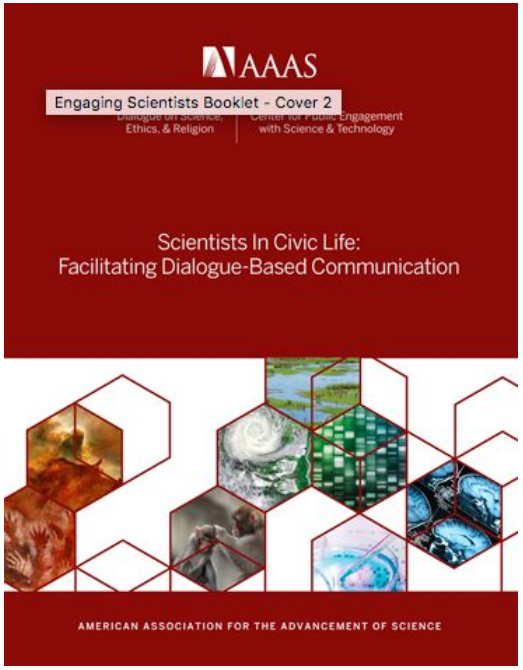
[The Public-Engaged Scientists: Motivations, Enablers and Barriers]
Simona Cerrato, Valentina Daelli, Helena Pertot, & Olga Puccioni in *Research for All*
Outcomes from focus groups with PhD students at the International School of Advanced Studies (SISSA) in Trieste, Italy, who are volunteering in the SISSA for Schools program.

Public Science Events

Other Resources & Notable Moments

(Escaping) the Paradox of Scientific Storytelling
Michael Dahlstrom & Dietram Scheufele in *PLoS Biology*
Scientists must compete with other storytellers, many of whom are not bound to scientific evidence. This presents a challenge: how can science preserve its credibility as a curator of knowledge while engaging audiences through a communication format that is agnostic to truth?

Scientists in Civic Life: Facilitating Dialogue-Based Communication
American Association for the Advancement of Science
A majority of Americans consider scientific knowledge essential, authoritative, and a source of hope, but they also take other factors into account during civic discussions, such as socioeconomic status, race, political identity, and religious beliefs.



Public Engagement with Science: A Guide to Creating Conversations among Publics and Scientists for Mutual Learning and Societal Decision-Making
Museum of Science, Boston
This guide is intended to help ISE organizations develop, implement, and evaluate activities and events that incorporate multidirectional dialogue and mutual learning through public engagement with science.

Science In Vivo
Science Festival Alliance
In early 2018, the Science Festival Alliance publicly launched this multi-year project focusing on science experiences that “go where the people are.”

Science Centers and Museums

Back to the list of sectors

Science Centers and Museums

By the Numbers

- The total **economic contribution of museums** in 2016 amounted to more than $50 billion in GDP, 726,200 jobs, and $12 billion in taxes to local, state, and federal governments, according to the American Alliance of Museums (AAM) report, Museums as Economic Engines: A National Report.

- **Children's museums** contribute $5.5 billion to the U.S. economy and 57,000 jobs directly, as well as another 24,000 jobs that are not in children's museums, as stated in Community Catalysts: Assessing the Economic Impact of Children's Museums.

- A survey conducted by AAM found that **97% of Americans believe that museums are educational assets for their communities**, 89% believe that museums contribute important economic benefits to their community, 96% would approve of elected officials who took legislative action to support museums, and 96% want federal funding for museums maintained or increased. Read more in Museums and Public Opinion: Exploring Four Key Questions About What Americans Think of Museums (pictured).

- AAM also released TrendsWatch 2018: The Scenario Edition, which imagines potential futures in order to help museums come up with creative solutions to central challenges.

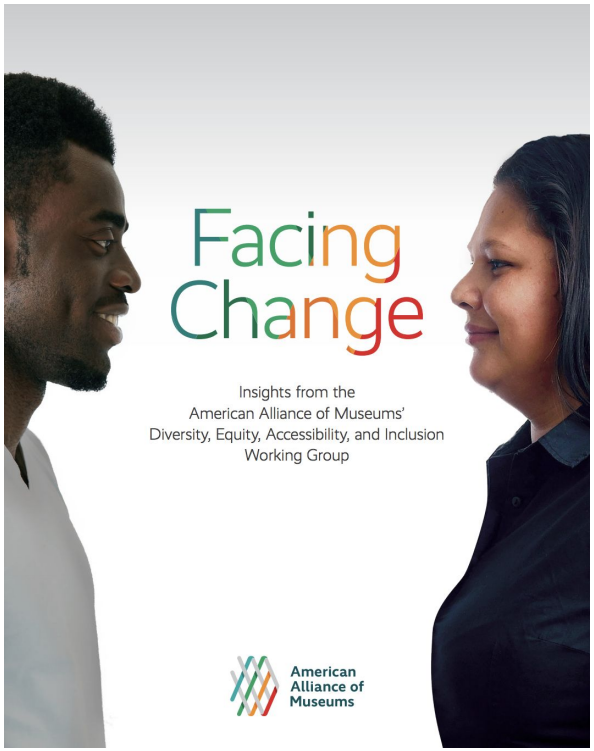
Science Centers and Museums

Select Publications

[Collaboration for Ongoing Visitor Experience Studies (COVES) First Aggregate Report]
Museum of Science, Boston
Results from a multi-institutional, collaborative visitor study covering 13,335 surveys gathered across 19 science centers.

[Facing Change: Insights from the American Alliance of Museums' Diversity, Equity, Accessibility, and Inclusion Working Group]
American Alliance of Museums
This report shares the working group's learnings, presented as five insights about the key components of effective museum diversity, equity, accessibility, and inclusion (DEAI) work.

[Intentional Practice for Museums: A Guide for Maximizing Impact]
Randi Korn
This book explains the idea of intentional practice and presents a Cycle of Intentional Practice that includes four quadrants with actions and corresponding questions situated around impact.



Science Centers and Museums

Select Publications

Learning from Museums (Second Edition)
John Falk & Lynn Dierking
This new edition investigates the extension of museums beyond their walls and the changing perceptions of the roles that museums increasingly play in the 21st century with respect to the publics they serve (and those they would like to serve).

Science Centers Inspire Lifelong Interest in Science
John Falk, Scott Pattison, & David Meier, The Institute for Learning Innovation
This study measured the current science interest of youths and adults and attempted to determine how different types of educational resources contributed to that interest.

Staff Matter: Gender Differences In Science, Technology, Engineering or Math (STEM) Career Interest Development in Adolescent Youth
Aaron Price, Faith Kares, Gloria Segovia, & Aerika Brittian Loyd
Explores the understudied role of program staff in an out-of-school time program at a large science museum, which may be especially relevant for supporting underrepresented minority youths' interest in STEM careers.

World Biotech Tour: Findings from an International Science Center and Museum Program
Association of Science-Technology Centers
Summative report that discusses successes and challenges, highlights lessons learned, and suggests recommendations to assist others in the field to develop or improve future programs, especially with an international network.

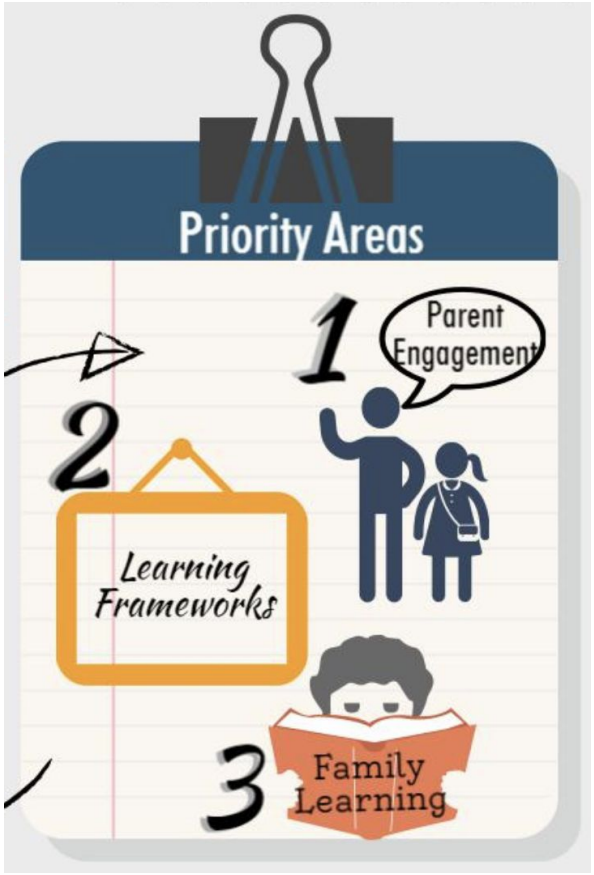
Science Centers and Museums

Select Publications

Families

Caregivers Understanding of Learning in Children's Museums
Children's Museum Research Network
This study revealed that most parents and caregivers observe their child(ren) learning during their visit to a children's museum and are able to identify different types of learning they observed.

Emergent Activity Frames in Facilitated Family Interactions at Math Exhibits
Smirla Ramos-Montañez, Scott Randol, Carla Herran, Scott Pattison, Andee Rubin, Todd Shagott, Elizabeth Andanen, & Marcie Benne
This study examined whether activity frames are a useful alternative to sociomathematical norms to help describe the behaviors of family members at interactive math exhibits.



Science Centers and Museums

Select Publications

School Partnerships

[An Examination of the Interactions Between Museum Educators and Students on a School Visit to Science Museum]

Neta Shaby, Orit Ben-Zvi Assaraf, Tali Tal

This study revealed that most interactions between museum educators and students on a school visit were technical explanations of how to operate the exhibits.

[Curation of Digital Museum Content: Teachers Discover, Create, and Share in the Smithsonian Learning Lab]

Smithsonian Learning Lab

Report on the creation of the Smithsonian Learning Lab, a platform for discovering resources and creating with teachers.

Science Centers and Museums

Other Resources & Notable Moments

Designing Our World
Oregon Museum of Science and Industry
Collection of educator resources for facilitating hands-on, real-world engineering activities that encourage youth, especially girls and those with diverse backgrounds, to pursue engineering-related careers and fill vital workforce gaps.

Let's Do Chemistry: A Framework and Strategies to Encourage Positive Attitudes Toward Learning Chemistry in Museums and Informal Settings
Rae Ostman, National Informal STEM Education Network
This guide describes some of the project's emerging research findings, explains how they are represented in the Let's Do Chemistry kit activities, and suggests ways that educators and chemists can apply the findings.

Responsive Museum Facilitation: A Video-Based Reflection Guide for Engaging with Families at Interactive Exhibits
Elizabeth Andanen, Andee Rubin, Scott Pattison, Ivel Gontan, & Crosby Bromley, Researching the Value of Educator Actions for Learning (REVEAL)
This is the fifth module in a video-based professional development program that builds on research to help facilitators of museum exhibits recognize expectations and shared understandings among family members.

Science Centers and Museums

Other Resources & Notable Moments

Science Centers Promote the Human Right to Science, Broaden Participation

Kathleen O'Neil, American Association for the Advancement of Science

This short article covers a live-streamed international conversation about the vital role of science centers and museums in promoting science.

Transforming Communities

Institute of Museum and Library Services

IMLS's strategic plan frames four key goals that will help the institute meet the essential information, education, research, economic, cultural, and civic needs of the American public over the next five years.

Science Communication

Back to the list of sectors

Science Communication

By the Numbers

- The **Climate Matters** program now supports more than 625 TV weathercasters across the United States in their efforts to help their viewers understand the impacts of climate change on their communities. The rate of on-air reporting about climate change by weathercasters has grown 17-fold since the program was launched six years ago. In 2017, we began building on this success with Climate Matters in the Newsroom, which provides local climate reporting resources to other local journalists.

Science Communication

Select Publications

Communication Ecologies: Analyzing Adoption of False Beliefs in an Information-Rich Environment
Nathan Walter, Sandra Ball-Rokeach, Yu Xu, & Garrett Broad in *Science Communication*
An article that offers a method to map and analyze communication ecologies—defined as the networks of communication connections on which individuals depend to construct knowledge and achieve goals—as social networks.

Climate Change, Cultural Cognition, and Media Effects: Worldviews Drive News Selectivity, Biased Processing, and Polarized Attitudes
Todd Newman, Erik Nisbet, & Matthew Nisbet in *Public Understanding of Science*
A study that demonstrates the substantial role of cultural cognition, in combination with news media choices, in contributing to opinion polarization on climate change and other politicized science topics.

Configuring Epistemic Authority: The Significance of Film Style in Documentaries about Science
Felicity Mellor in *Science In Context*
A study that examines two documentaries in order to consider how film style inflects science with different meanings. The analysis pays particular attention to the ways in which authority is assigned between film author, narrator, and depicted subjects and the degree to which different film styles promote epistemological certainty or hesitancy.

Science Communication

Select Publications

Diversifying Audiences and Producers of Public Involvement in Scientific Research: the AudioLab

Bella Starling & Jemma Tanswell in *Research Involvement and Engagement*

This study concludes that co-production of creative outputs by young people working with scientists and science communicators, and a 'reimagining' of the positive assets that diverse young adults bring to engagement with health research, promote greater diversity and inclusion among both the audiences and producers of public involvement in health research.

How Do Young Adults Engage with Science and Research on Social Media? Some Preliminary Findings and an Agenda for Future Research

Eszter Hargittai, Tobias Füchslin, & Mike S. Schäfer in *Social Media + Society*

A literature review of public engagement with science concludes that this area is ripe for research on social-media-based engagement in particular. In addition, a survey shows that young American adults are at least as likely to use social media for science and research as they are to use it to engage with other topics.

Reimagining Publics and (Non) Participation: Exploring Exclusion from Science Communication Through the Experiences of Low-Income, Minority Ethnic Groups

Emily Dawson in *Public Understanding of Science*

An article that explores science communication from the perspective of those most at risk of exclusion, drawing on ethnographic fieldwork.

Science Communication

Select Publications

Scientists in Civic Life: Facilitating Dialogue-Based Communication
American Association for the Advancement of Science
This paper outlines the social context for dialogue about science and technology, explains why an engagement approach that is centered on dialogue is particularly fruitful and important, and lists effective strategies for public science engagement.

The Different Audiences of Science Communication: A Segmentation Analysis of the Swiss Population's Perceptions of Science and Their Information and Media Use Patterns
Mike Schäfer, Tobias Füchslin, Julia Metag, Silje Kristiansen, & Adrian Rauchfleisch in *Public Understanding of Science*
A study that analyzes and assesses whether populations can be divided into segments with different perceptions and whether these segments exhibit specific patterns of media and information use.

The Science of Science Communication III: Inspiring Novel Collaborations and Building Capacity: Proceedings of a Colloquium
National Academy of Sciences
Published proceedings that summarize the presentations and discussions from a National Academies of Sciences, Engineering, and Medicine Colloquium convened in November 2017 (with videos).

When Facts Are Not Enough
Katharine Hayhoe in *Science*
This editorial argues that the best predictor of whether the public agrees with the reality of anthropogenic climate change is not how much scientific information there is, but rather where each person falls on the political spectrum.

Science Communication

Other Resources & Notable Moments

Broader Impacts

Portal to the Public Implementation Manual & Catalog of Professional Development Elements

Eve Klein

A practical guide for organizations planning to implement Portal to the Public in order to develop successful conversation-based public programs featuring scientists.

Science in the Public Eye: Leveraging Partnerships

Martha Merson

*iSWOOP (*Interpreters and Scientists Working on Our Parks) hosted a special symposia as part of the Society for Integrative and Comparative Biology annual meeting in January 2018. This blog provides access to the video recordings of the symposium presentations and their corresponding articles, which were published in the July 2018 issue of *Integrative and Comparative Biology*.

The Current State of Broader Impacts: Advancing Science and Benefiting Society

National Alliance for Broader Impacts

Participants in two 2017 NABI forums identified issues that inhibit innovative and successful outcomes and presented recommendations to address these barriers. This report summarizes those findings.

Science Communication

Other Resources & Notable Moments

Conferences & Meetings

- The 15th biennial **Public Communication of Science and Technology Conference** welcomed 350+ delegates from over 50 countries to Dunedin, New Zealand, April 3-6, 2018. Based on the theme "Science, Stories and Society," the program featured over 100 workshops, panel presentations, and roundtable discussions, some of which are archived here.
- The inaugural meeting of **#InclusiveSciComm: A Symposium on Advancing Inclusive Public Engagement with Science** was held at the University of Rhode Island in Kingston, September 28-29. The symposium addressed four themes that are central to advancing the national conversation on inclusive public engagement: frameworks, challenges, media, and strategies.
- **Support Systems for Scientists' Communication and Engagement Workshop Series**, convened by the Kavli, Rita Allen, Packard and Moore Foundations, explored how to make support for scientists' engagement and communication efforts more effective and sustainable.
    - **Workshop I: Communication Training** - Landscaping Overview of the North American Science Communication Training Community Report
    - **Workshop II: Scientific Societies** - For Better Public Engagement: What We Learned from Scientific Societies
    - **Workshop III: Academic Institutions** - Landscape Overview of University Systems and People Supporting Scientists in their Public Engagement Efforts
    - **Workshop IV: Science Engagement Facilitators** - Landscaping Overview of U.S. Facilitators of Scientists' Engagement Communities

Youth and Afterschool

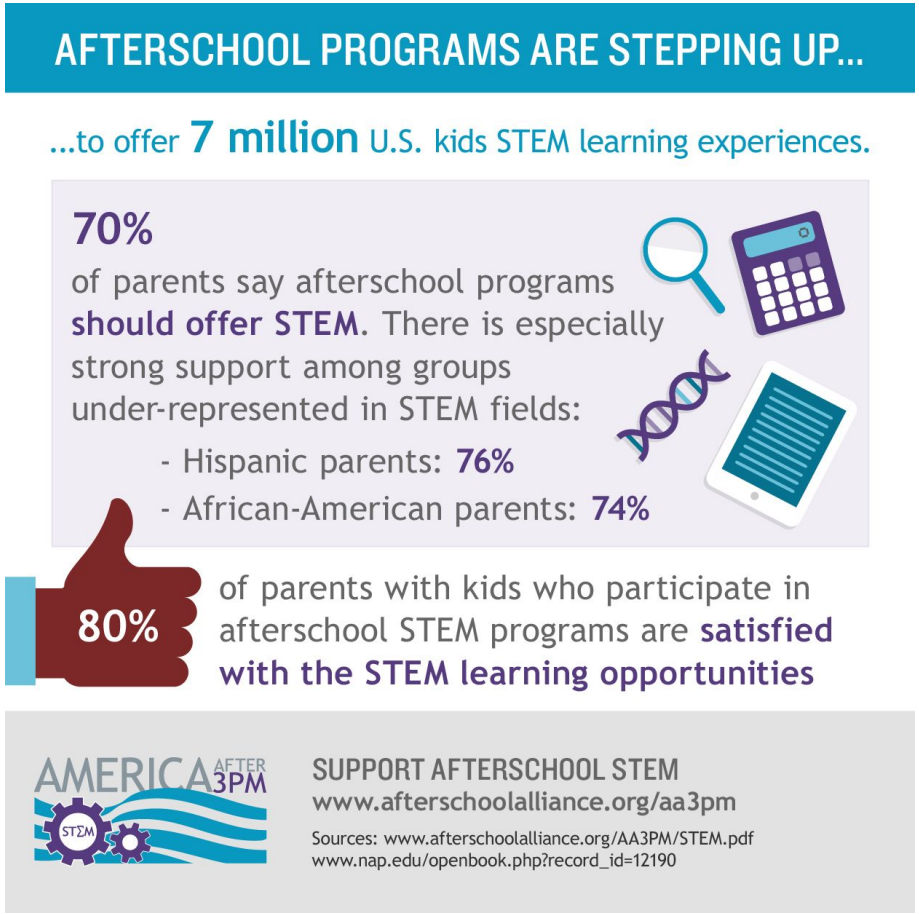
Back to the list of sectors

Youth and Afterschool

By the Numbers

- According to America After 3PM, a 2014 national household survey*, 10.2 million children regularly attend afterschool programs. The parents of almost 7 million kids say that their afterschool program offers STEM.
- In October 2018, the Afterschool Alliance's Lights on Afterschool reached new heights with 8,400+ events held across the United States. Of those celebrations, 600 events featured STEM, and 300 were a public library partnership.
- The STEM Learning Ecosystems community grew to 68, and now serves 33 million preK-12 children through cross-sector collaborations that include schools, out-of-school time programs, informal STEM institutions, higher education, and philanthropic and business partners.

** The next America After 3PM will be released in 2019.*



Youth and Afterschool

Select Publications

[Afterschool and Workforce: Opportunities for System-Level Alignment]

Carinne Deeds & Olivia Thomas, American Youth Policy Forum

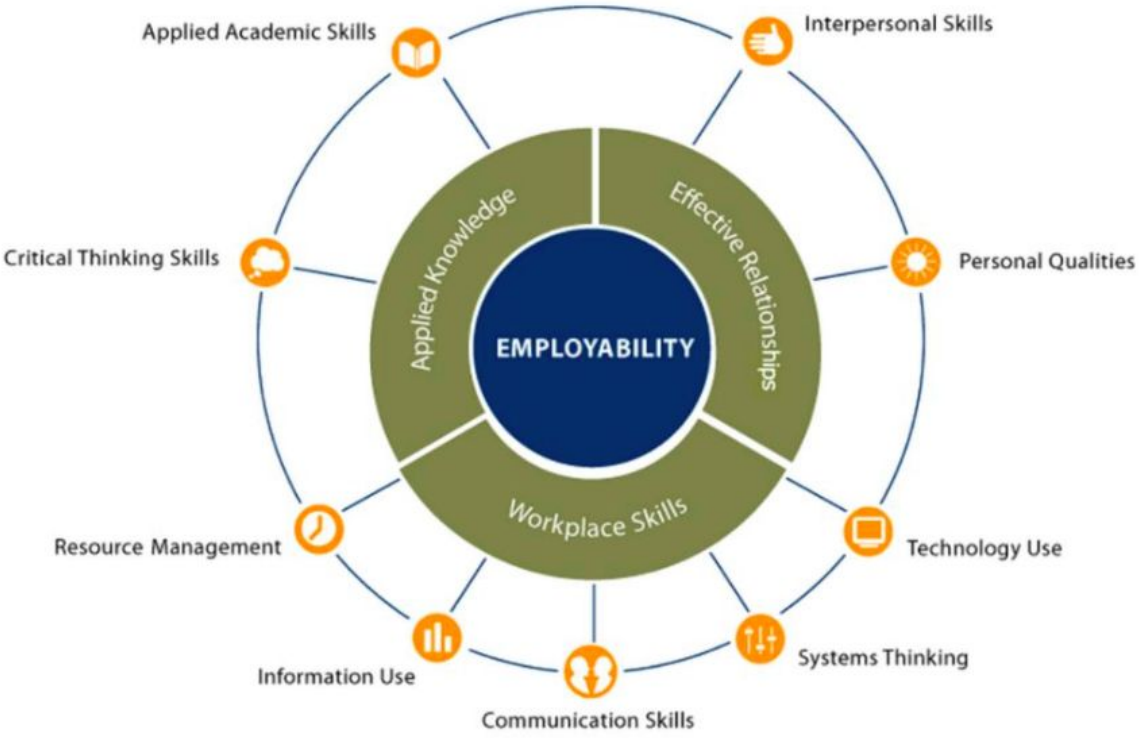
Explores the need for and benefits of better alignment across afterschool and workforce systems and the ways in which they can work together to better meet the needs of youth and the workforce.

[Black Girls Speak STEM: Counterstories of Informal and Formal Learning Experiences]

Natalie King & Rose Pringle in *Journal of Research in Science Teaching*

Presents the interpretations and perceptions of black girls who participated in a community-based informal STEM program. Using narrative inquiry, participants generated detailed accounts of their informal and formal STEM learning experiences.

Figure 1. Employability Skills Framework



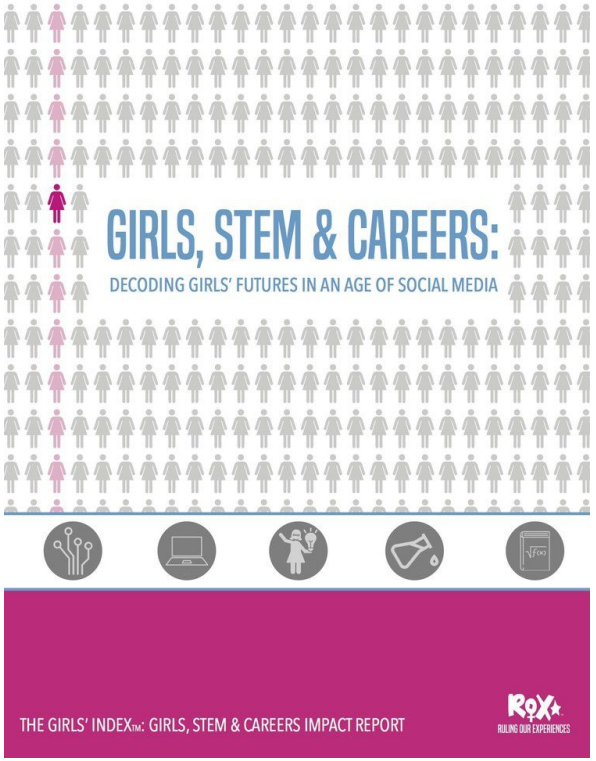
Youth and Afterschool

Select Publications

Developing A STEM Identity Among Young Women: A Social Identity Perspective
Ann Kim, Gale Sinatra, & Viviane Seyranian in *Review of Educational Research*
A review of empirical research on the experiences of female middle and high school students in STEM, exploring how aspects of the social environment influence STEM identity development.

Girls, STEM & Careers: Decoding Girls' Futures in an Age of Social Media
Ruling Our eXperiences
Provides a deeper understanding of behaviors, thoughts, and perceptions related to STEM based on a national sample of 10,000 girls in grades 5 to 12.

"He Saw I Had a Loving for It": Youth Interest Signaling as a Means of Generating Social Support in Technology Pathways
Dixie Ching, Rafi Santo, Kylie Peppler, & Christopher Hoadley, Hive Research Lab
Study of the ways that youth engage in "interest signaling," or communicating their needs in ways that motivate adults and peers to mobilize resources to support them.



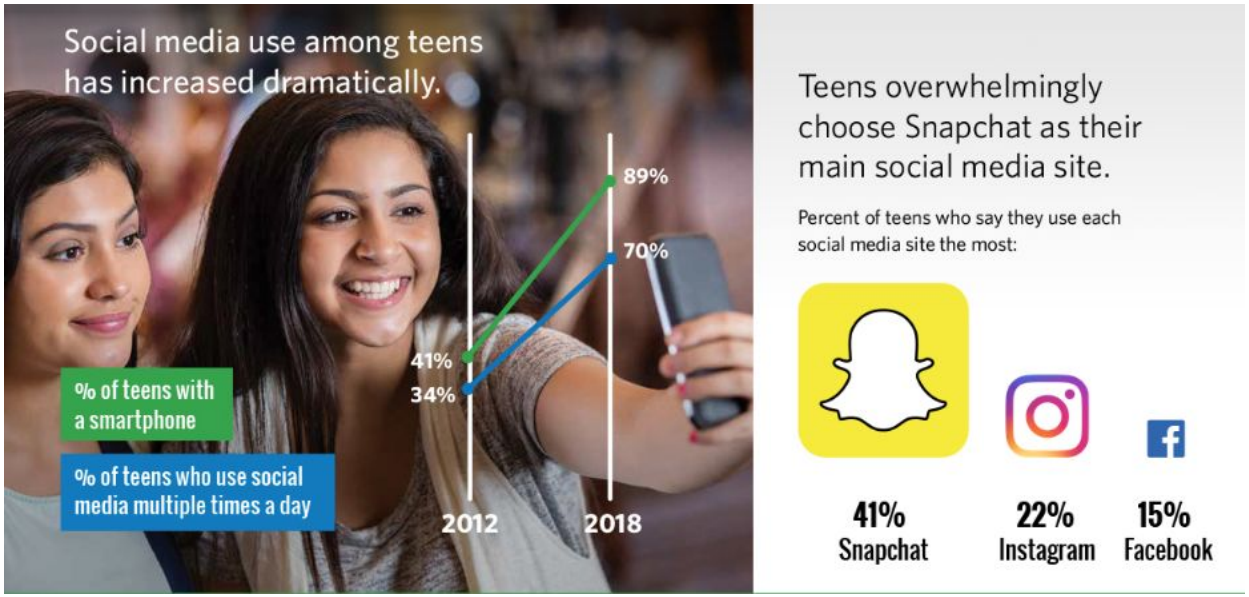
Youth and Afterschool

Select Publications

Improving STEM Program Quality in Out-of-School-Time: Tool Development and Validation
Ashima Mathur Shah, Caroline Wylie, Drew Gitomer, & Gil Noam in *Science Education*
The Dimensions of Success (DoS) tool defines 12 key components of informal, exploratory STEM programming that goes beyond the school day.

Paving the Road into College and STEM for Latino Students
Diley Hernandez, Marion Usselman, Shaheen Rana, Meltem Alemdar, & Analia Rao in *Journal of STEM Outreach*
Describes a suite of interventions aimed at students and families and designed to strengthen the pipeline of Latino students into post-secondary STEM education.

Social Media, Social Life: Teens Reveal Their Experiences
Common Sense Media
Sheds light on teens' changing social media habits and why some kids are more deeply affected by—and connected to—their digital worlds.



Youth and Afterschool

Select Publications

Students' Perceptions of STEM Learning After Participating in a Summer Informal Learning Experience

Thomas Roberts, Christa Jackson, Margaret Mohr-Schroeder, Sarah Bush, Cathrine Maiorca, Maureen Cavalcanti, D. Craig Schroeder, Ashley Delaney, Lydia Putnam, & Chaise Cremeans in International Journal of STEM Education

This study examined the impact of an informal STEM summer learning experience on student participants to learn how they felt this experience prepared them for their in-school mathematics and science classes, as well as how it influenced their perception of STEM learning.

The Promise of Digital Resources for Effective CTE STEM Career Exploration

Ashley Lewis Presser, Education Development Center

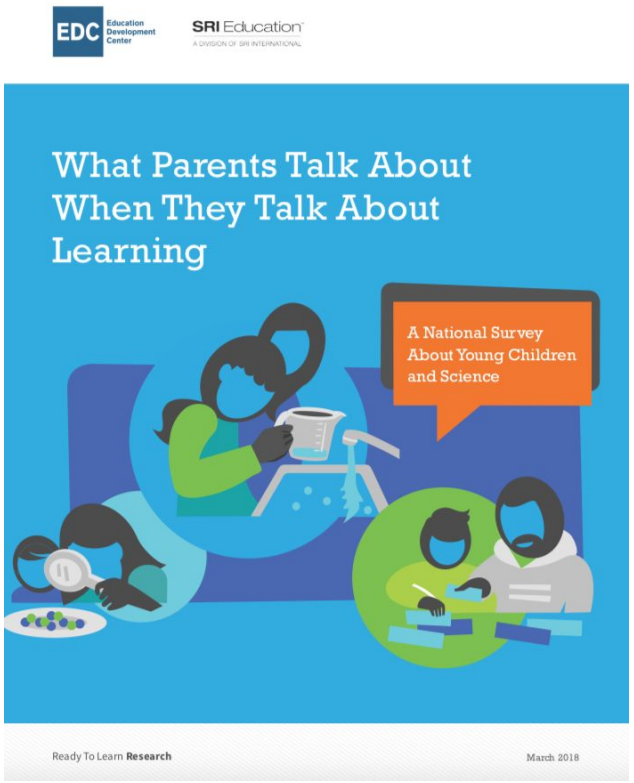
This report describes a project whose goal was to build an understanding about the perception of career and technical education (CTE) as an option for middle school students in pursuing skill-based STEM-related careers. The information was used to develop an innovative suite of digital tools designed to improve mentors' and school counselors' communication with middle school students.

Youth and Afterschool

Select Publications

[The Roots of STEM Success: Changing Early Learning Experiences to Build Lifelong Thinking Skills]
Helen Shwe Hadani & Elizabeth Rood, Center for Childhood Creativity at the Bay Area Discovery Museum
This report shares six key findings designed to help parents, informal and formal educators, and other caregivers understand the importance of an early STEM focus.

[What Parents Talk About When They Talk About Learning: A National Survey About Young Children and Science]
Todd Grindal, Elisa Garcia, Kea Anderson, & Phil Vahey, SRI International
A study to learn how parents of young children, particularly low-income parents, encourage and take part in their children's learning, especially their science learning. The team also investigated parent perceptions and reported use of science-related educational media, such as television shows, videos, online games, and mobile apps.



Youth and Afterschool

Other Resources & Notable Moments

A Guide to PEAR's STEM Tools: Dimensions of Success & Common Instrument Suite

The PEAR Institute: Partnerships in Education and Resilience

Overview of PEAR STEM Toolkit to quantify STEM outcomes: 1) a self-report survey for students called the Common Instrument Suite (CIS), and 2) a program quality observation tool called Dimensions of Success (DoS).

Building Partnerships: In Support of Where, When, & How Learning Happens

The Aspen Institute's National Commission on Social, Emotional, & Academic Development

This brief covers the critical role of youth development organizations in young people's growth and development, providing a framework and recommendations for ways that educators, policymakers, and funders can partner with youth development organizations and capitalize on formal and informal learning settings that support young people's growth and development.

Decoding STEM/STEAM: The Toy Association STEM/STEAM Strategic Leadership Committee Report

The Toy Association

Defines STEM/STEAM for the general public and teachers, to help parents and toy manufacturers better develop and select toys for children.

Youth and Afterschool

Other Resources & Notable Moments

Environmental Education and STEM (E-STEM): A Selection of Resources and Opportunities Offered by NAAEE

Kristen Kunkle

The North American Association for Environmental Education (NAAEE) shares the programs and publications it has developed to advance E-STEM—the integration of environmental education into STEM.

***Connected Science Learning*, Issue 8**

National Science Teachers Association & Association of Science-Technology Centers

This issue features articles linking in-school and out-of-school STEM learning opportunities.

Learner Variability Is the Rule, Not the Exception

Barbara Pape, Digital Promise Global

This article explains the Learner Variability Project initiative, meant to build systems that help support teachers and edtech developers address learner variability.

No Such Thing podcast

Hosted by Marc Lesser, City University of New York's Master's Program in Youth Studies & MOUSE

This podcast covers learning with technology, the realities and the exciting potential. It's also about youth and the practitioners who support them as they grow their identity: youth developers, museum educators, teachers, mentors, counselors, and parents.

Youth and Afterschool

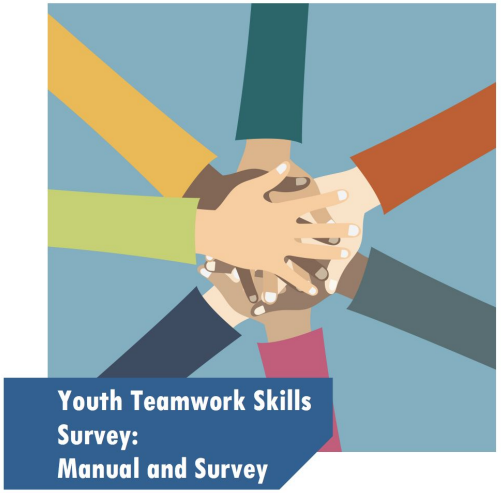
Other Resources & Notable Moments

Learning Agenda for Positive Youth Development in Low and Middle-Income Countries
YouthPower
The purpose of this learning agenda is to define priority questions in the field of Positive Youth Development in low and middle-income countries.

SciGirls Snapshots and SciGirls Strategies: Gender Equitable Teaching Practices in Career and Technical Education Pathways for High School Girls
Rita Karl, Brenda Britsch, Siri Anderson, Hilarie Davis, Alicia Santiago, & Bradley McLain
A series of short films on gender equity and culturally responsive strategies for educators to support girls in STEM, and a survey of 400 girls in non-traditionally female STEM career paths participating in an aligned identity-based research study.

The CREATE Framework: Learning Environments to Develop Creativity
Center for Childhood Creativity, Bay Area Discovery Museum
Describes how educators can build children's creative problem-solving skills through intentional experiences.

Youth Teamwork Skills Survey: Manual and Survey
Amy Grack Nelson, Science Museum of Minnesota
A validated survey that measures the teamwork and communication skills of middle and high school students participating in out-of-school time STEM programs.



Youth and Afterschool

Other Resources & Notable Moments

Family Engagement

The Family Engagement Project
Linda Kekelis & Kara Sammet, STEM Next Opportunity Fund
A multi-year project leveraging research, convenings, publications such as research briefs, and a national social media campaign to empower families to support their children's engagement in STEM.

Joining Together to Create a Bold Vision for Next-Generation Family Engagement: Engaging Families to Transform Education
Heather Weiss, M. Elena Lopez, & Margaret Caspe, Global Family Research Project
What we have learned over the past 50 years of research and policy, as well as the need for changes, and five promising, high-leverage areas that can serve as "building blocks" for the next generation of family engagement strategies.

Conferences & Meetings

- **A Recent Conference on Out-of-School STEM Learning in Rural Settings: Interim Report**
  Maine Mathematics and Science Alliance (September 13-14 in Alexandria, VA)
- **Hack the Framework**
  Hosted by CSforALL (July 27 in New York, NY)
- **Mo'Time for CS in Out-of-School Time**
  Hosted by CSforALL (October 8 in Detroit, MI)

Other Notable Publications and Moments

Back to the list of sectors

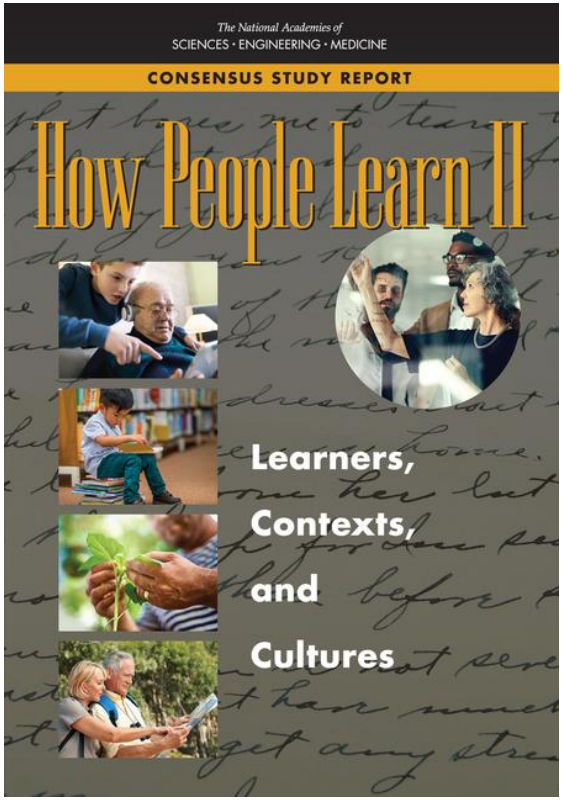
Field-Wide Research and Evaluation

Select Publications

[Are the Fields of Informal Science Education and Science Communication Adjacent or Connected? A Bibliometric Study of Research Journals from 2012 to 2016]
Kevin Crowley, on behalf of CAISE
A bibliometric analysis of selected ISE and science communication research journals.

[Charting the Intersection of Informal STEM Education and Science Communication: Results of a Social Network Study]
Martin Storksdieck, Bronwyn Bevan, Julie Risien, Roberta Nilson, & Kellie Wils, on behalf of CAISE
A survey of leading ISE and science communication researchers and practitioners mapping the relationships among people within and across the two fields.

[How People Learn II: Learners, Contexts, and Cultures]
National Academies of Sciences, Engineering, and Medicine
A follow-up to the 1999 *How People Learn* report synthesizes the past several decades of research, with important implications for individual learning, schooling, workforce training, and policy.



Field-Wide Research and Evaluation, continued

Select Publications

Shared Measures for Evaluating Common Outcomes of Informal STEM Education Experiences

Amy Grack Nelson, Megan Goeke, Ryan Auster, Karen Peterman, & Alexander Lussenhop

Conversations, developments, and case studies around shared measures, including examples of observational and survey tools to measure common ISE outcomes. From the forthcoming spring 2019 issue of *New Directions for Evaluation*.

The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education: Branches from the Same Tree

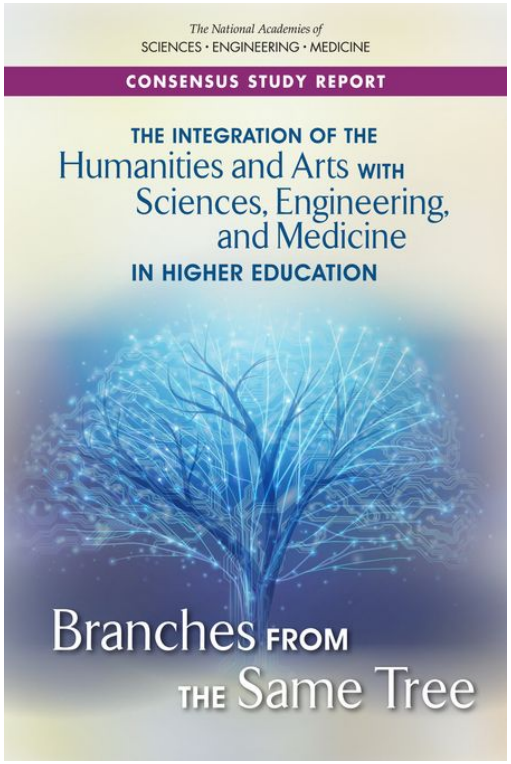
National Academies of Sciences, Engineering, and Medicine

This consensus study examines the assertion that educational programs which mutually integrate learning experiences in the humanities and arts with STEM and medicine lead to improved educational and career outcomes for undergraduate and graduate students.

What Is STEM Identity?

Center for Advancement of Informal Science Education

A series of interviews with 13 STEM education researchers, science communication scholars, social psychologists, learning scientists, and informal science educators on how they are defining and measuring STEM identity.



STEM Trends

Other Resources & Notable Moments

National Science Foundation

Building the Future: Investing in Discovery and Innovation
As required by law, the National Science Foundation (NSF) developed this new strategic plan for fiscal years 2018 to 2022, which sets forth long-term goals and objectives and examples of specific, near-term performance goals.

NSF INCLUDES Report to the Nation
This report describes the NSF INCLUDES National Network, including its vision, partnerships, goals and metrics, leadership and communication, and potential for expansion, sustainability, and scale.

Science and Engineering Indicators 2018
State-by-state data on K–12 education, workforce, science and technology in the economy, and more, with a digest on important trends such as global science and technology capabilities.

Transforming the World Through Science **(Second Edition)**
This paper highlights where the discoveries born from early stage research lead and how the public's lives are transformed by NSF's sustained support of fundamental research.

STEM Trends

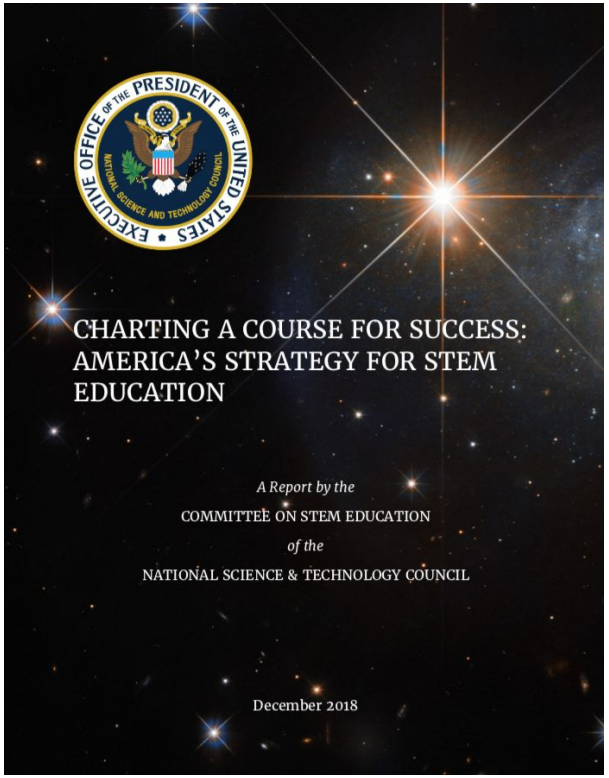
Other Resources & Notable Moments

U.S. Federal and National

[Charting a Course for Success: America's Strategy for STEM Education]

U.S. White House, Office of Science and Technology Policy, Committee on STEM Education of the National Science and Technology Council

The Federal Government's five-year strategic plan for STEM education is based on a vision for a future in which all Americans will have lifelong access to high-quality STEM education and the United States will be the global leader in STEM literacy, innovation, and employment.



Global

[OECD Science, Technology and Innovation Outlook 2018: Adapting to Technological and Societal Disruption]

The Organisation for Economic Co-operation and Development

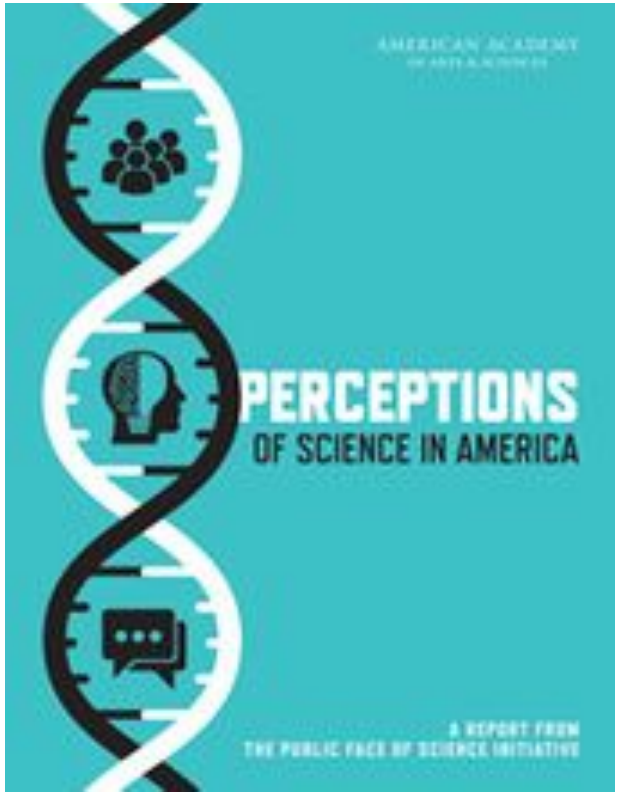
A biennial review of key trends in science, technology, and innovation policy in OECD countries and a number of major partner economies, including the opportunities and challenges related to enhanced data access, the impacts of artificial intelligence on science and manufacturing, and the influence of digitalization on research and innovation.

Polling and Messaging

Climate Change in the American Mind
Yale Program on Climate Change Communication and *George Mason University Center for Climate Change Communication*
This report documents trends in Americans' concern about climate change, as reflected in several key indicators that have been tracked since 2008.

Crossing the Boundaries: Mapping the Gaps Between Expert and Public Understandings of Bridging STEM Learning Environments
Kevin Levay, Andrew Volmert, & Nat Kendall-Taylor, FrameWorks Institute
Identifies areas that communicators must target to increase understanding of, and boost support for, the policies and programs to better connect and bridge STEM learning environments.

The Public Face of Science
American Academy of Arts & Sciences
A three-year project dedicated to exploring the complex and evolving relationship between scientists and the public in a series of reports, including *Perceptions of Science in America* and *Encountering Science in America.*



K-12 Science Education

Other Resources & Notable Moments

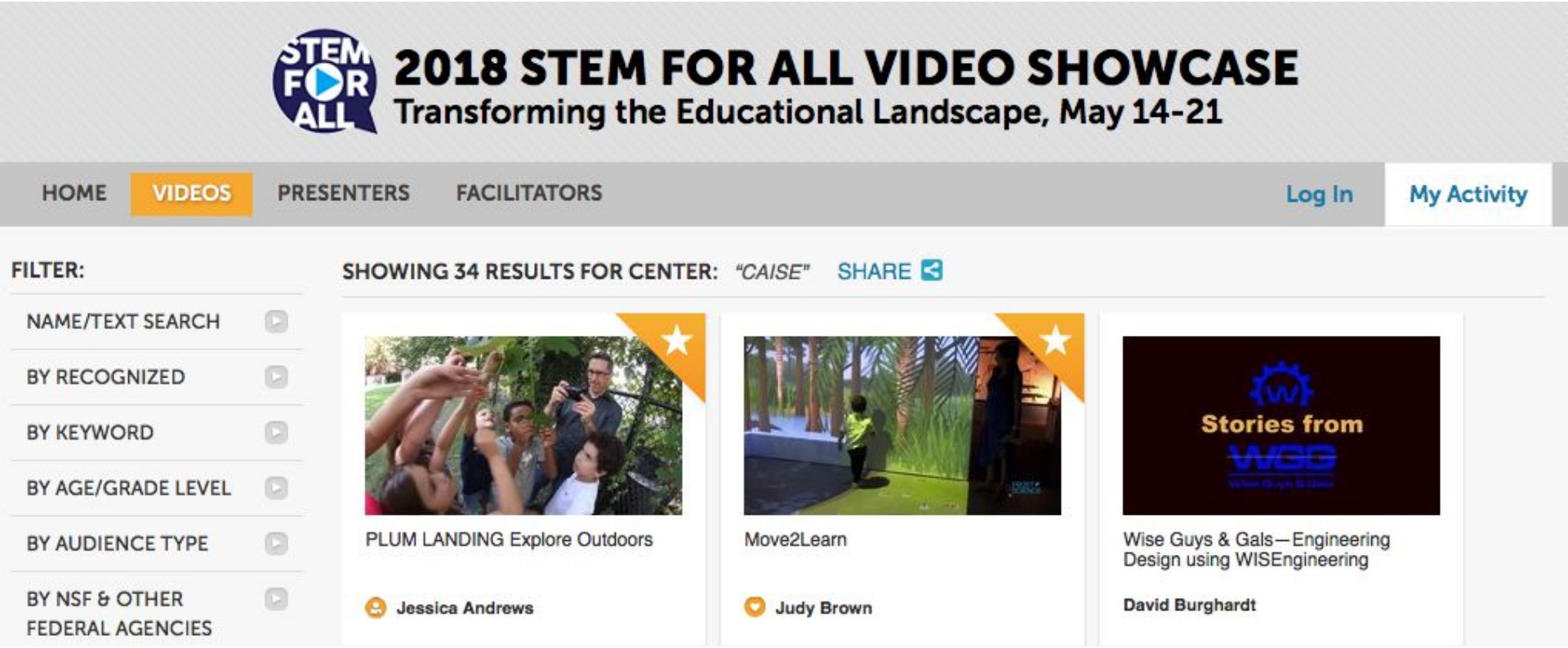
English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives
National Academies of Science, Engineering, and Medicine
Strategies for ensuring that English learners have opportunities to develop proficiency in both STEM subjects and language.

Essential Practices for K-12 Science Classrooms
National Academies of Science, Engineering, and Medicine
An interactive infographic highlights essential practices for science classrooms from the 2012 report *A Framework for K-12 Science Education*.

Design, Selection, and Implementation of Instructional Materials for the Next Generation Science Standards: Proceedings of a Workshop
National Academies of Science, Engineering, and Medicine
Summarizes a 2017 workshop held to address the need for more coordination and support in the design and implementation of instructional materials that reflect the principles of the Next Generation Science Standards and *A Framework for K–12 Science Education*.

Resources from the Community for Advancing Discovery Research in Education (CADRE):

- The Use of Theory in Research on Broadening Participation in PreK-12 STEM Education: Information and Guidance for Prospective DRK-12 Grantees
- Considerations for STEM Education from PreK through Grade 3
- Creating Inclusive PreK-12 STEM Learning Environments



NSF STEM for All Video Showcase

Since 2015, NSF has invited federally funded STEM and computer science education projects to produce and share videos showcasing their work and impact. In 2018, **713 presenters** and co-presenters shared **214 short videos** depicting projects aimed at transforming education.

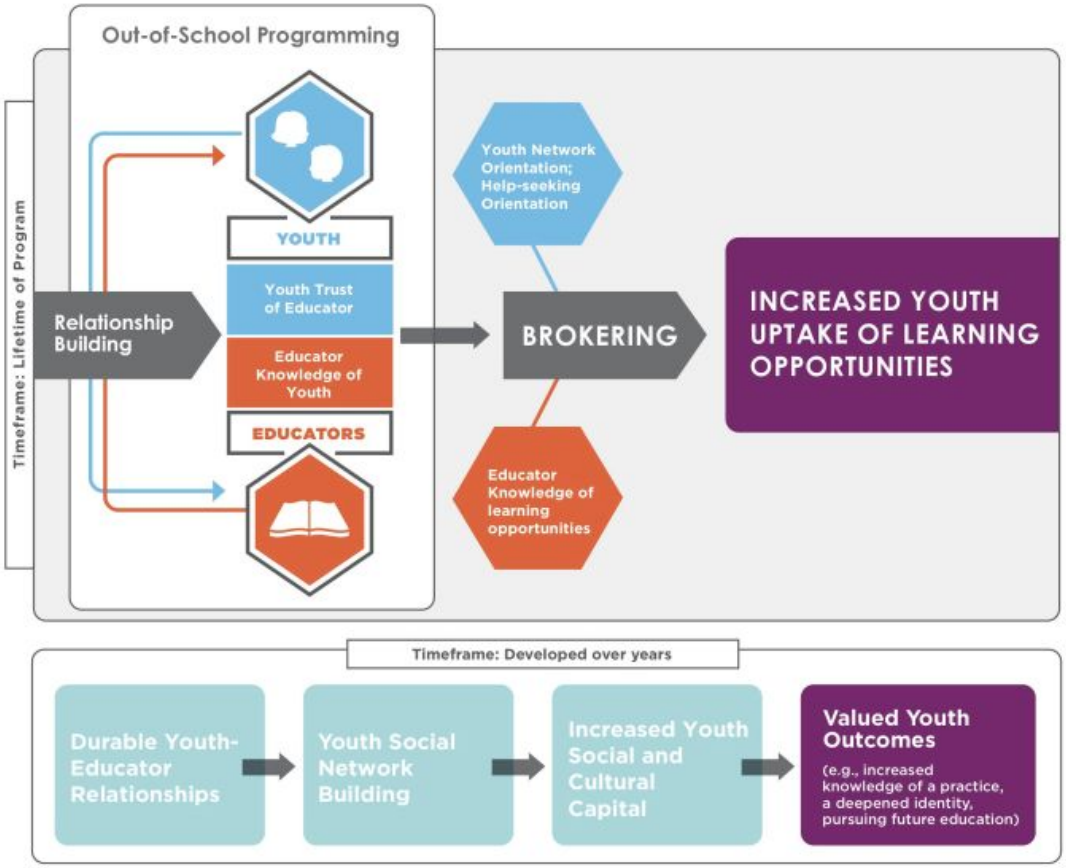
Last year, **34 informal STEM learning projects** from the AISL portfolio participated, and **14 projects** were awarded special recognition (the most of all the resource centers!). **Browse them all.**

Learning Ecosystems and Collective Impact

[Brokering Youth Pathways: A Toolkit for Connecting Youth to Future Opportunity]
Hive Research Lab
This toolkit shares ways in which various out-of-school educators and professionals have approached the challenge of "brokering" or connecting youth to future learning opportunities and resources.

[STEM Learning Ecosystems: Critical Approaches]
Bronwyn Bevan in *Spokes*
An article about what it means to adopt an ecological perspective on STEM learning.

[When Collective Impact Has an Impact: A Cross-Site Study of 25 Collective Impact Initiatives]
ORS Impact and Spark Policy Institute
An exploration of how the collective impact approach contributes to an initiative's ability to achieve systems and population change.



Thank you for reading!

We welcome your feedback on what you found useful, how we might improve this resource, and what should be included in 2019.
Email caise@informalscience.org.

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