

“What We Mean when We Talk about Informal STEM Education”

Anita Krishnamurthi

Vice President, STEM Policy, Afterschool Alliance

Michael Feder

Senior Program Officer, Board on Science Education, National Academies of Science,
Engineering, & Medicine

Ellen Lettvin

Robert Noyce Senior Fellow in Informal STEM Learning, U.S. Department of Education

Margaret Glass

Director, Professional Development, Association of Science-Technology Centers

James Brown

Executive Director, STEM Education Coalition



Informal STEM 101

Anita Krishnamurthi, VP of STEM Policy

The Afterschool Alliance

1

Policy & Advocacy

- National policy
 - Families & children; STEM
- Advocacy day on Capitol Hill
- Lights On Afterschool



2

Research

- Translate & synthesize research
- Issue briefs & reports
- Collect data

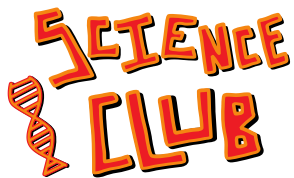
relating
research
to
practice



3

Field-Building

- 48 state networks
- Partnerships for policy, research, & practice
- Best practices & models
- Webinars, blogs, toolkits, & other resources



Science Club | Chicago, IL

Science Club - Inspiring Chicago Youth



Afterschool Alliance

Why STEM in Afterschool?

Youth Development Goals

- Empowering young people
- Socio-emotional competence
- 21st century skills like teamwork & collaboration, leadership, service, problem solving
- Positive relationships with adults

Environment

- Low-stakes
- Flexible in time and space
- **Community partnerships**

Approach to STEM Learning

- Hands-on, experiential
- Project-based
- Experimentation & failure
- New entry points to science for diverse learners
- **Connected to communities, home cultures, and student knowledge & experiences**

Real Programs, Real Impacts



Science Club

Chicago, IL

- Dramatic science skills increases - *Based on interview-based assessments & science fair scores*
- 100% of recent graduates chose STEM majors in college



Project GUTS

Santa Fe, NM

- 82% completed a working computer simulation model
- 80% would use modeling & simulation as a strategy to solve community social issues in the future



Girl Start

Austin, TX

- 91% demonstrated mastery of scientific inquiry & the engineering design process
- 84% were interested in taking STEM classes in middle or high school

Who is “Afterschool”?

Afterschool Providers

4-H; Boys & Girls Club;
YMCA/YWCA; Girls, Inc.;
Schools; Libraries; Parks &
Rec; Comm. Centers;
Religious Orgs

Partners

Universities; government
labs; science centers,
museums, zoos, aquaria;
industry; researchers

Key Players

National Organizations

Afterschool Alliance;
National Afterschool
Association; National
Summer Learning
Association

State & Local Orgs

Statewide Afterschool
Networks (48 states);
City intermediaries (e.g.
Every Hour Counts)



America After 3PM

DEMAND IS HIGH

More youth than ever before—

10.2 million

—are in afterschool programs.

For every child
in a program,



2 are waiting to get in.



- Household survey of how kids spend the hours after school
- Attendance & demand much higher in low-income, African-American, & Latino households



America After 3PM – STEM teaser

- **Coming Fall 2015!** Special report on STEM in afterschool
- Preliminary data analysis shows that:
 - Nearly 7 in 10 parents (69%) say their afterschool program offers STEM
 - More than half (53%) say that STEM was an important factor in choosing their child's program
 - 78% of parents with a child in an afterschool program agree that such programs help children gain interest and skills related to STEM



State of STEM in afterschool

- Providers enthusiastically embracing STEM
- Funders recognizing role of space
- Support systems growing rapidly
- Ongoing research on outcomes and assessments
- Public policy catching up



Support afterschool STEM

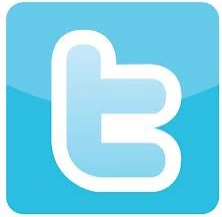
- **ESEA**

- 21st Century Community Learning Centers (21CCLC)
- Build a STEM ecosystem - Afterschool as eligible partner in other STEM improvement amendments, including professional development

- **America COMPETES**

- *Supporting Afterschool STEM Act* - S. 444; H.R. 831

Thank you!



Follow Us

@afterschool4all



Like Us

/afterschoolalliancedc



Read Us

Afterschool Snack Blog

www.afterschoolalliance.org/STEM

akrishnamurthi@afterschoolalliance.org

THE NATIONAL

ACADEMIES

Identifying and Supporting Productive STEM Programs in Out-of-School Settings

with funding from



Informal STEM Education 101

July 7, 2015

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

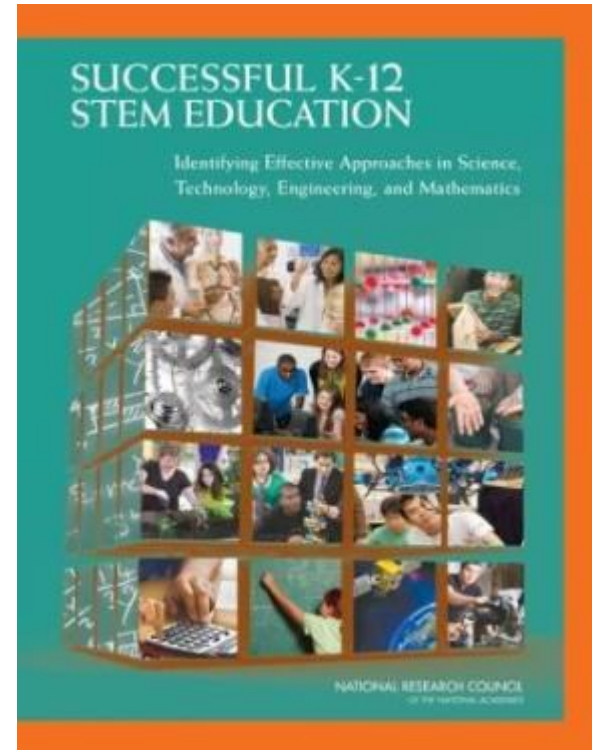
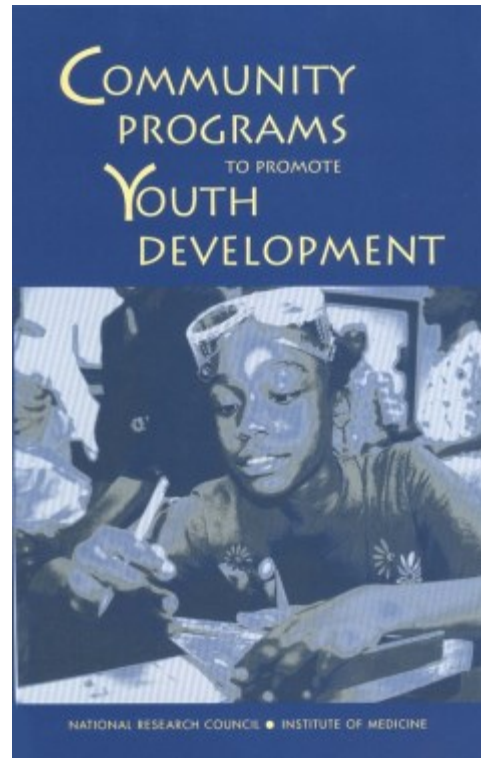
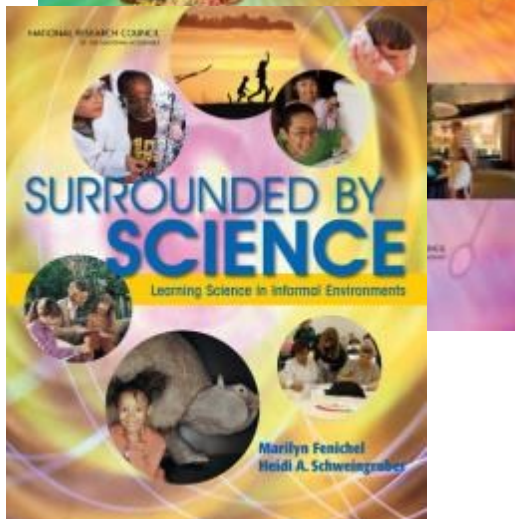
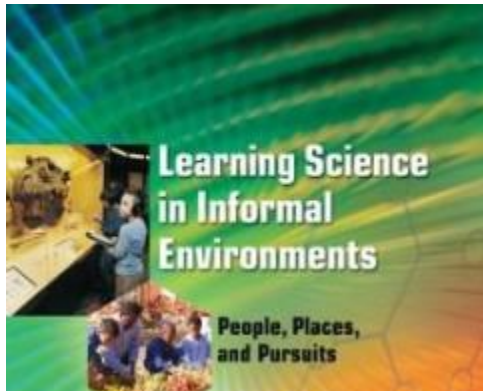
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

Study Goals

- Outline criteria for identifying effective out-of-school STEM programs
- Describe the strength of the evidence for the criteria

Related Reports

www.nap.edu



Contributors

Study Committee

Eric Jolly (Chair)
Bronwyn Bevan
Jane Buikstra
Jacquelynn Eccles
John Falk
Maya Garcia
Leslie Goodyear
Lynn S. Liben
Milbrey McLaughlin
Vera Michalchik
Nancy Peter
Cary Sneider
Jill Walahoski

Commissioned Authors

Brigid Barron
Rick Bonney, and
Colleagues
Bernadette Chi
Rena Dorph
Leah Reisman
David Hammer
Jennifer Radoff
Laura Huerta Migus
Shirin Vossoughi

Report Reviewers

Sue Allen
James Bell
William B. Bridges
Ilan Chabay
Ellen S. Gannett
Richard M. Lerner
Lester L. Lyles
Dale McCreedy
David Pines
Robert M. West

Workshop Participants

Too many to list

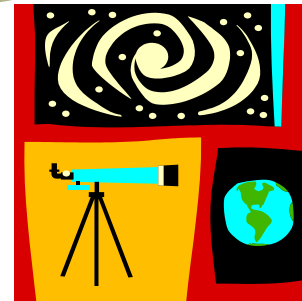
Overarching Perspective



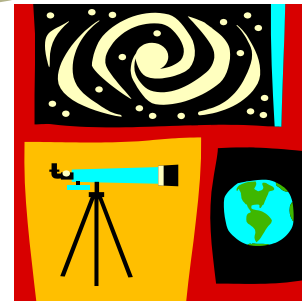
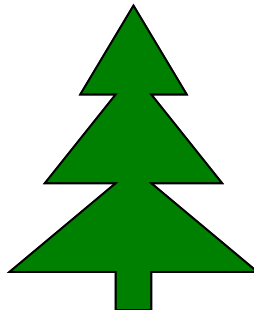
Overarching Perspective



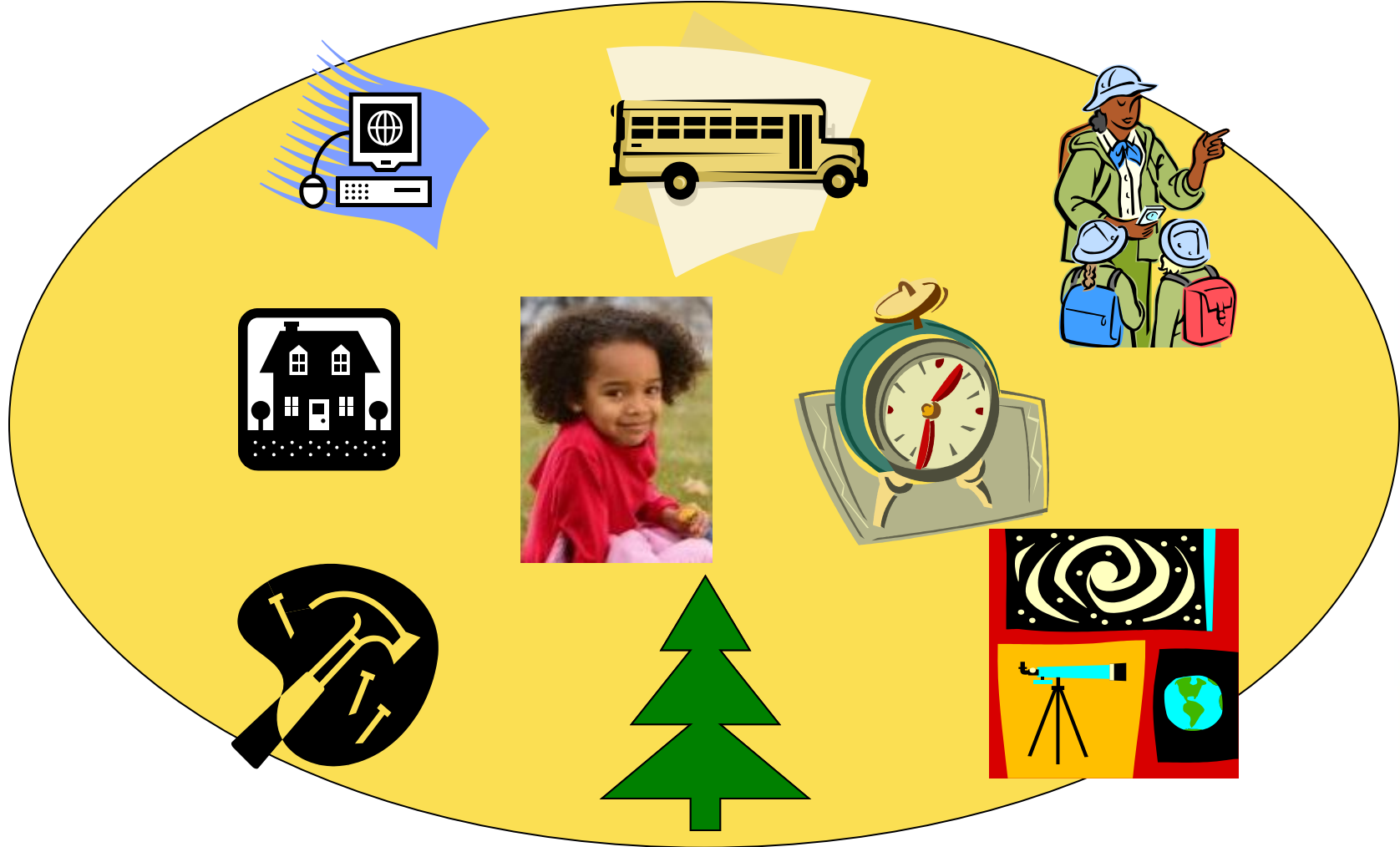
Overarching Perspective



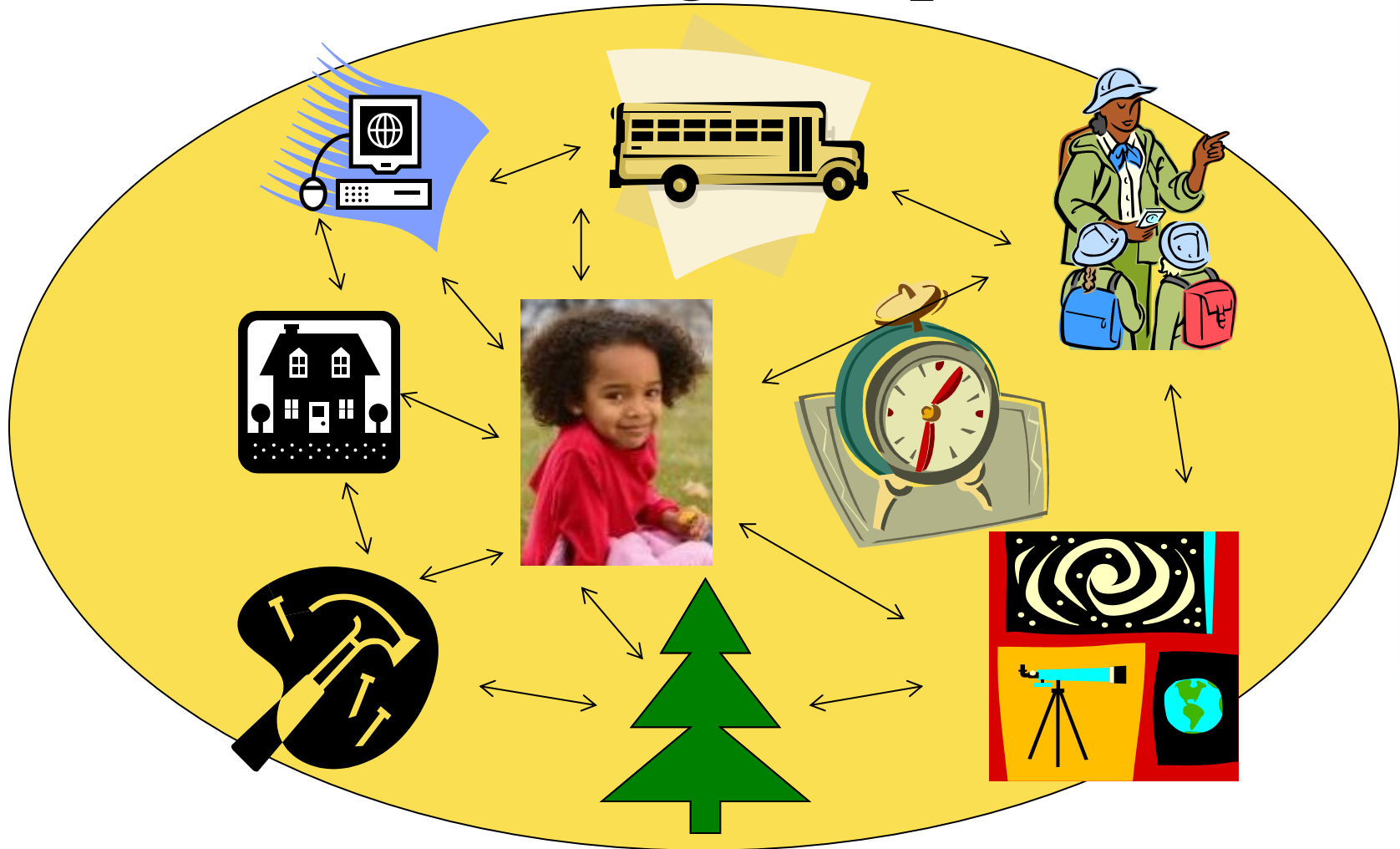
Overarching Perspective



Overarching Perspective



Overarching Perspective



What we Found

- There is a connection between well run programs and learning outcomes
- Out-of-School STEM programing is expanding but gaps still exist
- Evidence of impact is difficult to come by

Qualities of Productive Programs

**ENGAGING
RESPONSIVE
CONNECTIONS**

Qualities of Productive Programs

ENGAGING

Engage Young People Intellectually, Academically, Socially and Emotionally

- Program provides firsthand experiences with phenomena and materials.
- Program engages young people in sustained STEM practices.
- Program establishes a supportive learning community.

RESPONSIVE CONNECTIONS

Qualities of Productive Programs

ENGAGING RESPONSIVE

Respond to Young People's Interests, Experiences, and Cultural Practices

- Program positions STEM as socially meaningful and culturally relevant.
- Program supports young people to collaborate and to take on leadership roles in STEM learning activities.
- Program positions staff as co-investigators and learners alongside young people.

CONNECTIONS

Qualities of Productive Programs

ENGAGING RESPONSIVE CONNECTIONS

Connect STEM Learning in Out-of-School, School, Home and Other Settings

- Program connects learning experiences across settings.
 - Program leverages community resources and partnerships.
 - Program actively brokers additional STEM learning opportunities.
-

Recommendations

- Build a map and bridge the gaps
- Connect young people to STEM learning opportunities
- Build an infrastructure that will last
- Provide professional development
- Support innovative evaluation approaches
- Research how STEM learning ecosystems work

Thank You

The reports can be downloaded for free at
www.nap.edu



Informal STEM at U.S. Department of Education

Dr. Ellen Lettvin

Noyce Senior Fellow in Informal STEM
Office of Innovation and Improvement

7/7/15



STEM INVESTMENT AT ED:

STEM IS A PRIORITY IN OVER 60 FUNDING OPPORTUNITIES

Career and Technical Education: Basic Grants to States *

Education Research Grants – Effective Teachers and Teaching

Green Ribbon Schools *

Hispanic Serving Institutions STEM and Articulation Programs

Investing in Innovation (I3) *

Magnet Schools Assistance Program *

Math Science Partnerships *

Minority Science and Engineering Improvement Program

Race to the Top *

Ready to Learn *

Special Education Research Grants – Professional Development

Teacher Incentive Fund (TIF)

Teachers for a Competitive Tomorrow (TCT)

Teacher Quality Partnerships

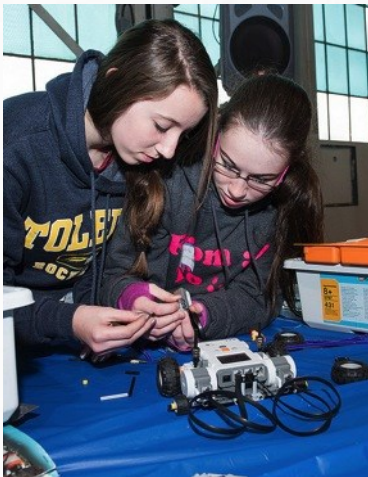
21st Century Community Learning Centers *



STEM-RICH PARTNERSHIPS (21ST CCLC):

NASA

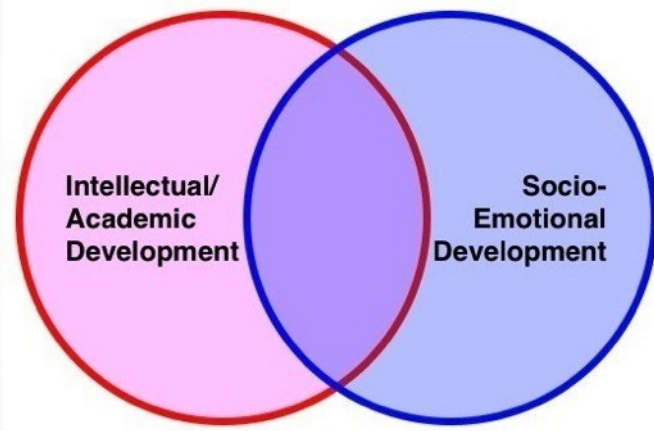
- Student teams solve real-world engineering design challenges, engage with high-quality STEM content, interact directly with NASA scientists and engineers
- Professional development and technical assistance build staff capacity by supporting acquisition of new content knowledge and development of new teaching strategies
- Pilot collaboration (winter, 2014):
 - 3 challenges offered at 20 sites in 3 states
 - Implementation study to characterize program quality, lessons learned
- Expanded collaboration (winter, 2015)
 - 6 challenges offered at 80 sites in 10 states
 - Program evaluation to capture learning outcomes, program quality



STEM-RICH PARTNERSHIPS (21ST CCLC):

INSTITUTE OF MUSEUM AND LIBRARY SERVICES

- Students experience STEM-rich Tinkering and Making, engage with high-quality STEM content and activities, interact directly with Maker experts
- Professional development and technical assistance build staff capacity, support acquisition of new content knowledge and development of new teaching strategies
 - Improvisational problem solving, no one “right way”
 - Creative solutions, self-expression
 - Developing and building out an idea – testing, learning from feedback, re-designing, re-testing, persisting through frustrations
 - STEM as a means not an end: work with STEM tools, concepts, phenomena
 - Establish linkages between school-day learning and out-of-school applications
- Pilot collaboration (2015), reaching 25 sites in 5 states; implementation study



STEM-RICH PARTNERSHIPS (21ST CCLC)

NATIONAL PARK SERVICE

- Students engage in Citizen Science and Environmental Monitoring, engage with high-quality STEM content and activities, interact directly with park rangers
 - Professional development and technical assistance build staff capacity, support acquisition of new content knowledge and development of new teaching strategies
 - Citizen science: collection and analysis of data relating to the natural world by members of the general public in collaboration with professional scientists.
 - Focus on phenology - study of the timing of natural events in plants and animals using established monitoring protocols - reinvigorated with changing climate (e.g., When do frogs begin to call? When do wildflowers bloom? When do songbirds return?).
 - Link school-day learning and out-of-school applications
 - Pilot collaboration (2015), reaching 11 sites in 5 states; implementation study
- Focus on reaching students in Bureau of Indian Education schools**



STEM LEARNING ECOSYSTEMS

WWW.STEMECONSYSTEMS.ORG

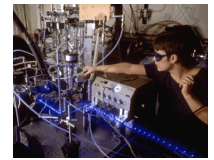
**STEM-Rich
Institutions**



**Business
Community**



**Institutes of
Higher
Education**



Learner centric



**Formal P-12
Education**



Family



**Out-of-School
Programs**



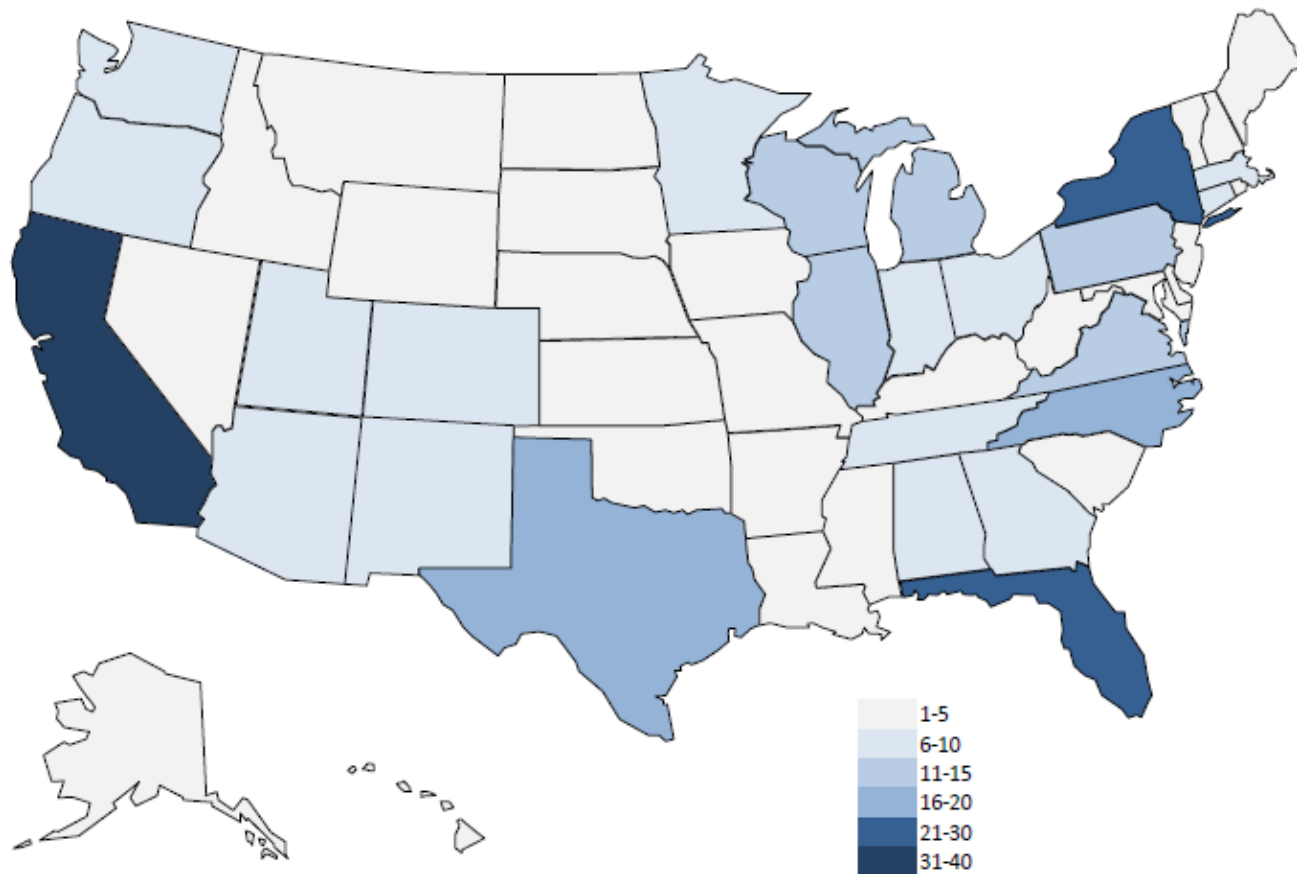


A global organization providing ***collective voice*** and ***professional support*** for science centers, museums, and related institutions, whose innovative approaches to science learning inspire people of all ages about the wonders and the meaning of science in their lives.



- Incorporated in 1973 with 20 founding science center and museum members
- Over 400 institutions (centers, museums, universities, research laboratories, corporations) in all 50 U.S. states
- An estimated 73 million visits were made to ASTC's science center and museum members in the U.S. in 2013

U.S. Science Center



exhibits

field
trips

science
classes

curriculum
development

maker
spaces

teacher
training

afterschool
programs

lifelong
learning

youth
employment

community
dialogues

citizen
science

research
activities

meet
the
scientist





Representing the science center and museum field worldwide

Science Centers and Museums:


- inspire a desire to experience and learn in a STEM-rich setting.
- offer creative complements to the formal education environment.
- encourage interest, exploration and even career choices in science.



Representing the science center and museum field worldwide

Science Centers and Museums:

- translate complex science into comprehensible, relevant form.
- build trust between the scientific establishment and the general public.



Non-school learning environments provide valuable venues for informal STEM learning experiences - generating interest, engagement, capacity, confidence, academic performance, and pursuit of academic and career paths.



Science Centers = Centers for Science

COMMUNITY ORGANIZATIONS

CORPORATIONS

UNIVERSITIES

LIBRARIES

THINK TANKS



RESEARCH LABORATORIES

ZOOS

AQUARIUMS

PLANETARIUMS

MEDIA ORGANIZATIONS

SCHOOLS



ISE Professional Support

Skills Development

- Conference
- Publications
- Communities of Practice
- Professional Development and Leadership Institute

Operational Support

- Surveys and Research
- Traveling Exhibition Services
- Grants, Partnerships, and Contributions



Girls in Engineering



[Home](#) | [Contact](#) | [Sitemap](#) | [Login](#)



[ABOUT](#)

[WORKSHOPS](#)

[ENGINEERING](#)

[RESOURCES](#)

[SHOWCASE](#)

Showcase Categories



- [Girls RISEnet Hubs in Action](#) (28)
- [Newsworthy Events](#) (36)
- [Girls RISEnet Newsletters](#) (19)

Resources Tag Cloud

, research/report/data,
science instructional
strategies, STEM,
girl-friendly strategies,
outreach/recruitment,
gender,
disparities/stereotypes,
workforce, careers,
technology/computer
science, women/mujeres,
women, diversity, minorities,

SHOWCASE



July 28, 2014

Science Central's Ms. Tech Camp

With support from a Girls RISEnet Minigrant, Science Central, a hands-on science center in northeast Indiana, partnered with the Boys and Girls Club of Fort Wayne and the Fort Wayne Urban League, as well as the general public, to host our first ever exclusive [girl's technology camp](#). Abi Martin, the Special Program's Manager, has a passion for promoting STEM education for girls. The camp ran 5 days from 12:30 pm until 5:00 pm for 24 girls during the week of July 28 through August 1, 2014.





Intersections

Connecting science center educators and National Writing Project teachers

- 10 partnerships funded to develop, pilot, and refine programs at the intersection of science and literacy learning
- participate in a national network to share and disseminate learning
- assess and promote promising practices and approaches that strengthen science literacy learning in formal and informal settings



Learning Labs in Libraries and Museums

YOUmedia Network Learning Labs

Home

About the CoP ▾

Discussions ▾

Resources ▾

search

Q

▾



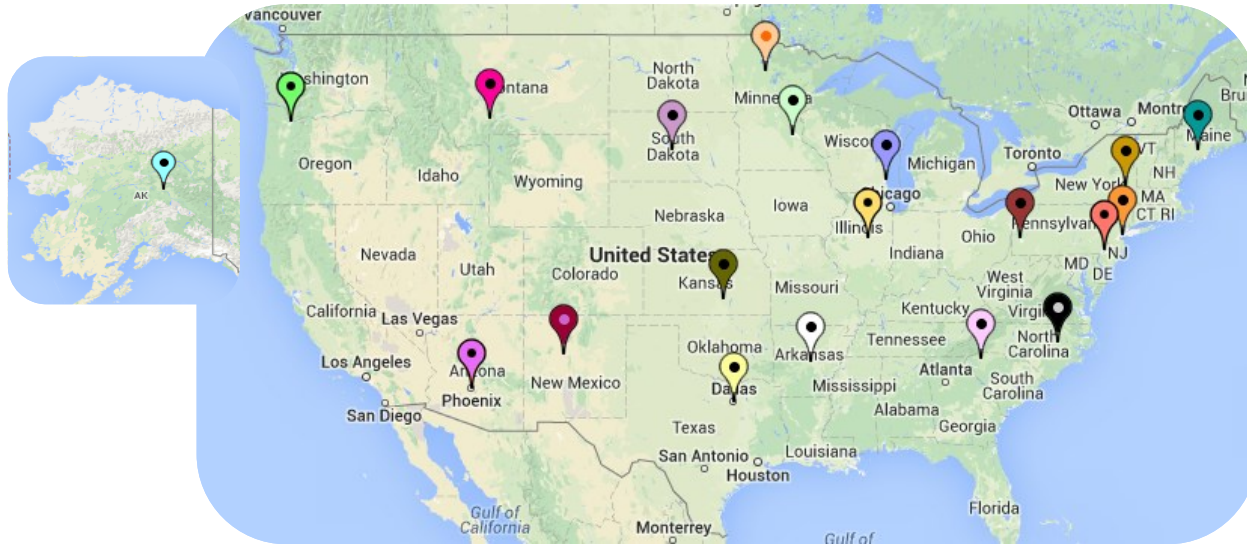
Mentors and youth at The MiX (Richmond, VA)

Welcome to the
YOUmedia Learning Labs
Community Site!

An open community of educators and mentors who share knowledge, questions, and collaborate with colleagues across the YOUmedia Learning Labs network.

[Join the CoP today.](#)

Afterschool Alliance



Twenty Minigrants of \$1,500 ASTC-Member Institutions

- Arizona Science Center, Phoenix, AZ
- The Bakken Museum, Minneapolis, MN
- Betty Brinn Children's Museum, Milwaukee, WI
- Carnegie Science Center, Pittsburgh, PA
- Children's Discovery Museum, Normal, IL
- Children's Discovery Museum, Augusta, ME,
- Explora Science Center & Children's Museum of Albuquerque, Albuquerque, NM
- Exploration Place, The Sedgwick County Science and Discovery Center, Wichita, KS
- The Franklin Institute, Philadelphia, PA
- Headwaters Science Center, Bemidji, MN
- Imagination Station Science and History Museum, Wilson, NC
- miSci – museum of innovation and science, Schenectady, NY,
- Museum of Discovery, Little Rock, AR
- Museum of the Rockies in Bozeman, MT
- Oregon Museum of Science and Industry, Portland, OR
- Perot Museum of Nature and Science, in Dallas, TX
- Roper Mountain Science Center, Greenville, SC
- South Dakota Discovery Center, Pierre, SD
- Staten Island Children's Museum, Staten Island, NY
- University of Alaska Museum of the North, Fairbanks, AK

Afterschool Alliance



Afterschool for All Challenge

- Youth representatives from museum programs met with Members of Congress to advocate for afterschool programs



- New Jersey Academy of Aquatic Sciences
- Newark Museum
- The Franklin Institute
- National Aquarium
- Natural History Museum of Utah



The Next Generation Science Standards (NGSS) emphasize learning by understanding and application. This points to an increased need for hands-on inquiry and discovery.

Educators and teachers need training and resources to effectively use the framework and to implement state versions of new STEM curricula.

Science centers and museums play a vital role in meeting these needs.





Non-school environments for informal science provide valuable, cost effective venues for teacher training and support.

- **Future teachers obtain skills to address STEM ed challenges in the classroom.**
- **Teachers collaborate with peers, obtain mentoring and professional development support.**
- **Teachers report that the flexibility and creativity from this training directly transfers to their teaching during the regular school day.**

Thank you!



Informal STEM Education 101: A Briefing for Policymakers on the Basics of

“What We Mean when We Talk about Informal STEM Education”

Thank You!

