How can afterschool best support STEM learning?

A summary of the report “Defining Youth Outcomes for Afterschool STEM”

Afterschool Alliance

SCIENCE, TECHNOLOGY ENGINEERING, MATH
STEM & afterschool

October 2014

Why define outcomes for afterschool STEM?

- **Rapid growth** of STEM programming in afterschool
- **Ongoing conversations** about the appropriate role of afterschool in STEM education
- **Increased focus** on assessment of STEM learning in out-of-school-time programs
  - Game Changers and the Assessment Predicament in Afterschool Science
  - The National Research Council's committee on Successful Out-of-School STEM Learning

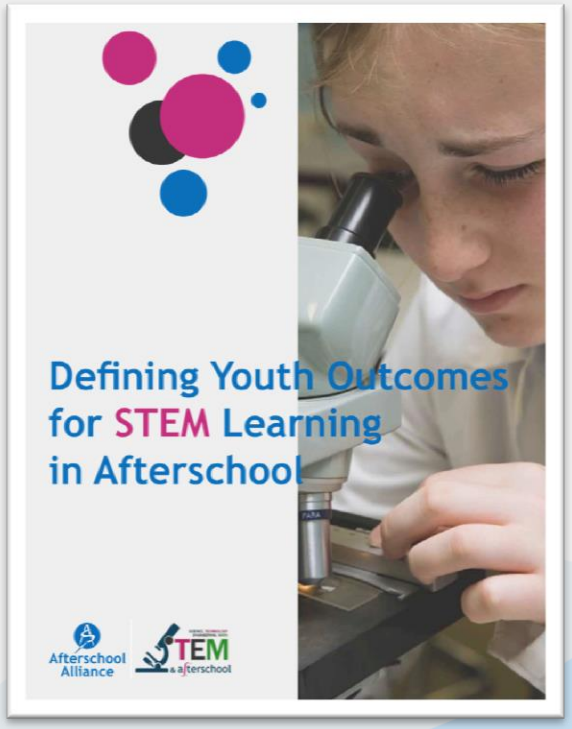
The afterschool field must weigh in to define appropriate outcomes!

Afterschool Alliance | STEM & afterschool

About the Study

Goal: Identify appropriate & feasible outcomes of youth participating in afterschool STEM programs.

- Provides a common framework & language for afterschool providers as they define program goals & describe impacts to stakeholders.
- Not intended as a set of mandatory expectations for all afterschool STEM programs.



Afterschool Alliance | STEM & afterschool

Study Leaders & Advisors

The Afterschool Alliance led the study, assisted by feedback from an advisory group of experts in afterschool & evaluation.

Study Team

- Anita Krishnamurthi, Afterschool Alliance
- Bronwyn Bevan, Exploratorium
- Vicky Ragan Coulon, Evaluation Research Associates
- Jen Rinehart, Afterschool Alliance

Advisory Group

- Gabrielle Lyon, Project Exploration
- Gil Noam, Program in Education, Afterschool & Resiliency (PEAR) & Harvard Medical School
- Elizabeth Reisner, Policy Studies Associates
- Tony Streit, Education Development Center
- Carol Tang, Coalition for Science After School (formerly)
- Debbie Zipes, Indiana Afterschool Network

Afterschool Alliance | STEM & afterschool

Study Methodology

- Outcomes & indicators were initially developed from research literature on youth development, the science learning & human development fields, as well as from evaluations of afterschool STEM programs.
- Then, a panel of afterschool providers & supporters reacted and revised these in three rounds to come to a consensus on the most appropriate & feasible learning outcomes for youth (also called the Delphi method).

Providers	Supporters
29 multi-site afterschool program leaders	**12** funders
18 statewide afterschool network leaders	**10** state education policy leaders
8 national afterschool network leaders	**3** national education policy leaders
55 total	**25** total

Afterschool Alliance | STEM & afterschool

Findings: Major Outcomes

Study results show that afterschool providers & supporters believe that afterschool STEM programs can support young people to:

A Develop interest in STEM and STEM learning activities

B Develop capacities to productively engage in STEM learning activities

C Come to value the goals of STEM and STEM learning activities

These outcomes represent the major developmental impacts on young people.

Afterschool Alliance | STEM & afterschool

Overview of the Framework

For each of the three outcomes, experts identified **two indicators** of progress toward that outcome, as well as a **set of sub-indicators** that are observable & potentially measurable.

Here's an example of an outcome, one of its indicators, and the corresponding sub-indicators:

OUTCOMES:
The major developmental impacts on youth participants

C Come to value the goals of STEM & STEM learning activities

INDICATORS:
Concrete ways that youth demonstrate progress toward intended outcomes

C-2 Awareness of STEM professions

SUB-INDICATORS:
Represent specific, measurable dimensions of the indicators

- Understand the variety of STEM careers within different fields of study
- Knowledge of how to pursue STEM careers
- Awareness that STEM is accessible to all

Snapshot of the Framework

Here's what the full framework looks like (found on page 18).

Outcome	Indicators	Sub-Indicators
A. Develop an interest in STEM and STEM learning activities. "I like to do this."	**Active participation in STEM learning opportunities**	**Active engagement and focus in STEM learning activities** *Persisting in a task or program; sharing knowledge and ideas; expressing enthusiasm, joy, etc.* **Pursuit of other out-of-school-time STEM learning opportunities** *Enrolling in programs; attending programs regularly; reporting performing STEM-related activities at home* **Pursuit of school STEM learning opportunities** *Participating more actively in school STEM activities; enrolling in courses; selecting special programs or schools; improving academic achievement*
	Curiosity about STEM topics, concepts or practices	**Active inquiries into STEM topics, concepts or practices** *Exploring ideas verbally or physically; questioning, hypothesizing, testing* **Active information-seeking about mechanical or natural phenomena or objects** *Conducting internet searches for more information; getting books/journals about STEM; watching TV programs on science, etc.*
B. Develop a capacity to productively engage in STEM learning activities.	**Ability to productively engage in STEM processes of investigation**	**Demonstration of STEM knowledge** *Demonstrating increase in knowledge in specific content areas; making connections with everyday world; using scientific terminology* **Demonstration of STEM skills** *Formulating questions; testing, exploring, predicting, observing, collecting and analyzing data* **Demonstration of an understanding of STEM methods of investigation** *Demonstrating understanding of the nature of science; using evidence-based reasoning and argumentation; demonstrating engineering design practices*
		Demonstration of mastery of technologies and tools that can assist in STEM investigations *Developing capacity to use measurement and other scientific instruments; running computer programs for*

Findings: Indicators

According to the study results, afterschool programs may be best positioned, in this **rank order**, to support & expand young people's:

1. Active participation in STEM learning opportunities
2. Curiosity about STEM topics, concepts or practices
3. Ability to productively engage in STEM processes of investigation
4. Awareness of STEM professions
5. Ability to exercise STEM-relevant life and career skills
6. Understanding the value of STEM in society

Ranking of indicators shows most confidence about impacts that relate to "doing"

Findings: Sub-Indicators

High Confidence

- ✓ Active engagement and focus in STEM learning activities
- ✓ Ability to work in teams to conduct STEM investigations
- ✓ Active inquiries into STEM topics, concepts or practices
- ✓ Understanding of the variety of STEM careers related to different fields of study
- ✓ Understanding of relevance of STEM to everyday life, including personal life
- ✓ Demonstration of STEM skills
- ✓ Applied problem-solving abilities to conduct STEM investigations
- ✓ Awareness of opportunities to contribute to society through STEM

Experts expressed **high confidence** that afterschool could make these impacts on youth.

This set stresses the **DOING of science**: developing STEM skills & 21st century skills like teamwork and problem-solving.

This set also includes **career connections** & the relevance to **everyday life**.

Findings: Sub-Indicators, cont.

Medium Confidence

- ✓ Understanding of STEM methods of investigation
- ✓ Knowledge of how to pursue STEM careers
- ✓ Mastery of technologies and tools that can assist in STEM investigations
- ✓ Knowledge of important civic, global, and local problems that can be addressed by STEM
- ✓ Pursuit of in-school STEM learning opportunities
- ✓ Awareness that STEM is accessible to all
- ✓ Active information seeking about mechanical or natural phenomena or objects
- ✓ Demonstration of STEM knowledge

Experts express **less confidence** in this set, but still believe STEM afterschool can deliver these outcomes.

In this set, youth demonstrate **very specific types of knowledge**.

Summary of Findings

Overall, afterschool experts are most confident about sub-indicators that are more immediate, e.g. impacts that can be documented in the **short-term**.

Practitioners and funders expressed **differing perspectives** in regard to (1) relative rankings of indicators and sub-indicators and (2) the availability of assessment tools.

- Practitioners expressed the **least confidence about school-related outcomes** e.g. enrolling in future STEM classes, improving academic performance, etc., whereas funders were much more optimistic.
- Funders were highly optimistic that appropriate assessment tools currently existed, whereas practitioners did not indicate that this was true.

Current Status

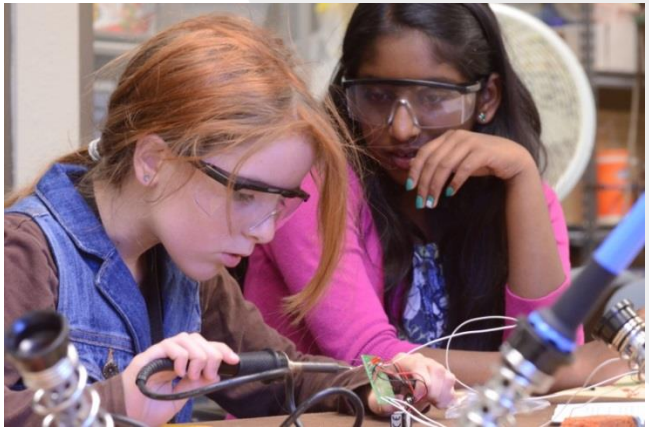
1. This framework has garnered **widespread attention** & is being used by some afterschool programs to describe their youth outcomes.
2. Researchers, evaluators & programs are working on assessment tools for afterschool STEM programs. Many of these tools reflect outcomes that align with the framework developed in this study.
   - **Portland Metro STEM Partnership's** STEM Common Measurement System
   - **The Program in Education, Afterschool & Resiliency's (PEAR)** Common Instrument assesses youth's engagement and interest.
   - The **Science Museum of Minnesota & the University of Minnesota** are developing tools to measure teamwork & collaboration skills.
3. **Additional research** about learning in OST STEM is occurring, particularly on learning across settings.
   - Research + Practice Collaboratory

Using the Framework

Your current STEM programming may already align with parts of the framework! Here's an example from Techbridge in Oakland, CA:

Every week at Techbridge, girls do hands-on projects in science, technology & engineering, and explore related careers.

In one afterschool session, girls tackled a design challenge to engineer a prosthetic leg.



Facilitators made several observations:

- Girls were **collaborating** with others to imagine creative solutions to problems, thinking critically while in their groups.
- They were **discussing** pros and cons of ideas with their group members, **combining the ideas** of different group members.
- While commenting on their designs, they were **questioning** why components may not work the way they expected, and **brainstorming** ways to **troubleshoot** problems.

All of these observations map to Outcome B, and hit both indicators, as well as several sub-indicators.

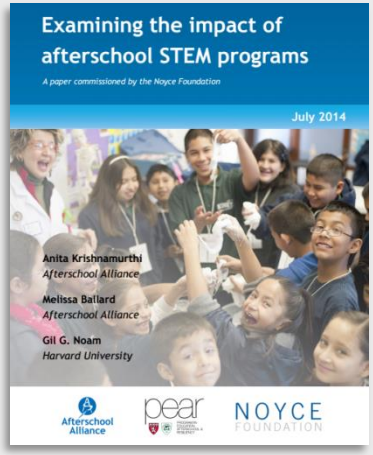
Afterschool Alliance | STEM & afterschool

More Resources on Youth Outcomes

Don't miss our guide for practitioners that lays out several ways that the findings of the report, "Defining Youth Outcomes for Afterschool STEM" can be used to help shape and improve your program. Visit our Publications page for these resources:

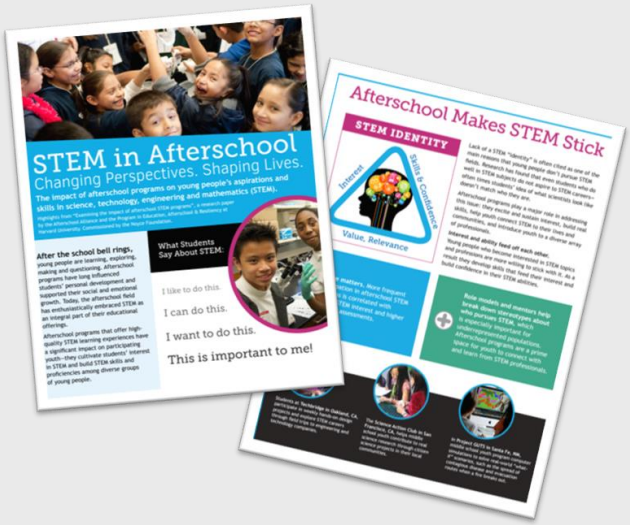
Practitioner's Guide

Ways to use the report on youth outcomes in your own afterschool program. This is a Prezi presentation.



Examining the Impact of Afterschool STEM Programs

Research on STEM learning in afterschool & an analysis of evaluation data from strong afterschool STEM programs.



STEM in Afterschool: Changing Perspectives, Shaping Lives

A handout that can be used to communicate the impact of afterschool STEM programs on youth.

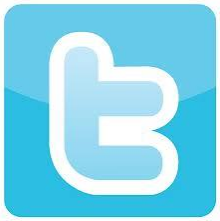
Afterschool Alliance | STEM & afterschool

More Questions?

Email us: info@afterschoolalliance.org

Download the full report here:

www.afterschoolalliance.org/STEM_Outcomes_2013.pdf



Follow Us

@afterschool4all

Like Us

/afterschoolalliancedc

Read Us

Afterschool Snack Blog