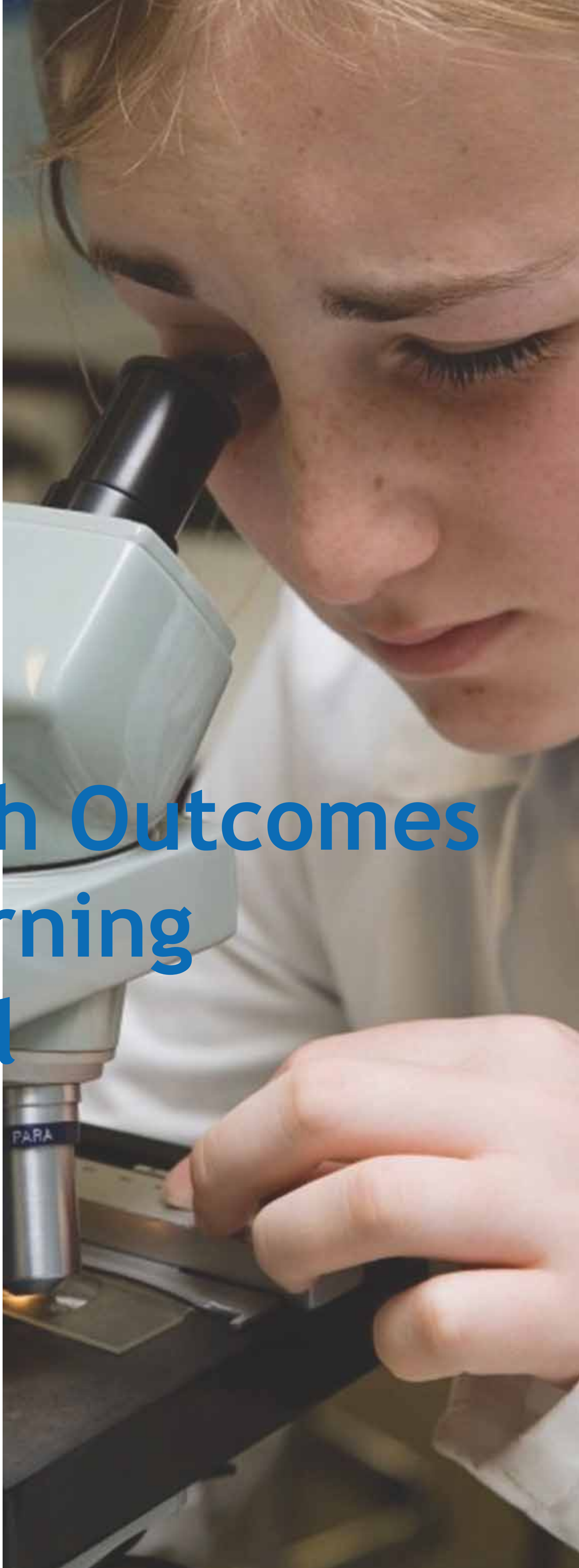
Defining Youth Outcomes for STEM Learning in Afterschool



Afterschool Alliance

SCIENCE, TECHNOLOGY, ENGINEERING, MATH
STEM & afterschool

Table of Contents

The Afterschool Alliance gratefully acknowledges support for this study from the S.D.Bechtel, Jr. Foundation and the Noyce Foundation

Executive Summary

Afterschool programs are increasingly recognized as playing a valuable role in improving science, technology, engineering and mathematics (STEM) education. However, the expectations for how such programs support young people's STEM engagement and learning are varied. The *Defining Youth Outcomes for STEM Learning in Afterschool* study aimed to identify what STEM learning outcomes these program leaders and supporters believe that afterschool programs could contribute to, what the indicators of progress toward such outcomes might be, and what types of evidence could be collected by afterschool programs, without regard to whether or not appropriate data collection tools currently exist.

While many afterschool programs already engage children and youth in STEM, their role in supporting children's STEM learning is expected to grow in importance with the advent of the Common Core Standards for Mathematics and English Language Arts (which include literacy in science and technical subjects) as well as the Next Generation Science Standards. Over the next several years—as federal education initiatives such as Race to the Top and Investing in Innovation are implemented, reauthorization of the Elementary and Secondary Education Act progresses and new state assessment measures are developed—policies that directly affect the funding and focus of many afterschool programs will take effect. Given this crucial time in the development of afterschool STEM programs, reaching greater clarity about appropriate afterschool STEM learning goals and outcomes is essential to helping frame how afterschool is best positioned to support STEM learning.

In the robust, fast-growing and diverse field of afterschool, achieving consensus on important learning outcomes is not trivial. Afterschool programs are highly distinct from one another, serving different age groups, relying on different localized resources and pursuing different types of learning goals. To make headway on a process of distilling the experience and insight of expert afterschool practitioners and national and state education leaders, the *Defining Youth Outcomes for STEM Learning in Afterschool* study used a Delphi methodology, which seeks to achieve consensus across disparate expert perspectives. Over three rounds, conducted using online instruments, we surveyed two groups of experts: a panel of 55 afterschool "providers" (experienced afterschool leaders who were responsible for selecting, designing, or leading programming; professional development; and delivering on outcomes at a program-wide level) and a panel of 25 afterschool STEM "supporters" (such as funders, national education policy leaders and state education department representatives who were responsible for funding, policy decisions and establishing outcomes for afterschool programs to which providers must answer). The selection of these experts is described in the full report.

The consensus set of outcomes and indicators produced through this study is not intended to represent a set of mandatory goals for all afterschool STEM programs, as the afterschool STEM field is diverse and impacts are entirely dependent upon the particular circumstances (age of participants, resources, goals, community context) of each program. Rather, the outcomes, indicators and sub-indicators identified through this study are intended to help provide a common framework and language for programs to utilize as they define appropriate goals for their programs and then describe the impact of their afterschool STEM program. This will allow for aggregation of impacts across programs so that we may better describe the contributions of afterschool programs to the larger issues in STEM education.

Results

The study yielded consensus about three major outcomes for children and youth participating in afterschool STEM programs and a set of indicators and sub-indicators that support these outcomes (see Table A).

These broad developmental outcomes and indicators of learning reflect constructs found in evaluation reports of afterschool STEM programs (Afterschool Alliance 2011) as well as the research literature pertaining to human development (e.g., Hidi & Renninger 2006; Holland et al. 1998; Lave & Wenger 1991), youth development (e.g., Barber et al. 2005; Eccles 2005) and science learning (e.g., NRC 2007; NRC 2009).

Table A.

Consensus Developmental Outcomes and Learning Indicators for STEM in Afterschool

Developmental Outcome	Indicators of Progress	Sub-Indicators
1. Youth develop interest in STEM and STEM learning activities	• Active participation in STEM learning opportunities • Curiosity about STEM topics, concepts or practices	• Active engagement and focus in STEM learning activities • Pursuit of out-of-school-time STEM learning opportunities • Pursuit of in-school STEM learning opportunities. • Active inquiries into STEM topics, concepts or practices • Active information-seeking about mechanical or natural phenomena or objects
2. Youth develop capacities to productively engage in STEM learning activities	• Ability to productively engage in STEM processes of investigation • Ability to exercise STEM-relevant life and career skills	• Demonstration of STEM knowledge • Demonstration of STEM skills • Demonstration of an understanding of STEM methods of investigation • Demonstration of mastery of technologies and tools that can assist in STEM investigations • Demonstration of ability to work in teams to conduct STEM investigations • Demonstration of applied problem-solving abilities to conduct STEM investigations
3. Youth come to value the goals of STEM and STEM learning activities	• Awareness of STEM professions • Understanding the value of STEM in society	• Development of an understanding of the variety of STEM careers related to different fields of study • Demonstration of knowledge of how to pursue STEM careers • Demonstration of awareness that STEM is accessible to all • Demonstration of an understanding of relevance of STEM to everyday life, including personal life • Demonstration of awareness of opportunities to contribute to society through STEM • Demonstration of knowledge of important civic, global, and local problems that can be addressed by STEM

While the expert panelists achieved overall consensus on these outcomes and indicators, there were several interesting distinctions that have implications for both policy and practice:

1. There was shared agreement that afterschool STEM is best positioned to demonstrate its contributions to the following three indicators of learning in a clear rank order: Active participation in STEM learning opportunities; Curiosity about STEM topics, concepts or practices; and Ability to productively engage in STEM processes of investigation. There was also agreement about the ability to impact a second cluster of indicators of learning, ranked lower, that include: Awareness of STEM professions; Ability to exercise STEM-relevant life and career skills; and Understanding the value of STEM in society.

This finding suggests two things. First that the afterschool field appears to be most confident about impacting indicators that relate clearly to the active ***doing*** *of STEM learning activities (entailing participation, developing questions, and actively inquiring). The field is positive, but not in a clearly ranked order, about its ability to support a second set of learning indicators related to understanding the practices and value of STEM in society. Second, the field appears to be less confident in how afterschool programs demonstrate that they contribute to children's coming to value the goals of STEM and STEM learning, as the two indicators related to this outcome were ranked in the second cluster of six indicators.*

2. Experts in the afterschool field feel most confident that their work supports young people's interests, inquiries, and engagement with STEM activities. These are sub-indicators of progress toward STEM learning that can be seen and documented in immediate ways, within one afternoon for example. They represent an important dimension of learning as they are essential to laying the foundation for further participation in and study of STEM. The experts feel comparatively less confident in achieving other longer term outcomes such as youth demonstrating STEM knowledge, an understanding of STEM methods of investigation, and pursuit of further in-school or out-of-school STEM learning activities.

The afterschool field's greater confidence in demonstrating more immediate learning indicators over longer term ones may reflect the uncertainty of attendance and other structural features that are an inherent part of the afterschool setting. Such features must be taken into account in policy measures intended to evaluate or direct the focus of afterschool STEM programs. The development of both short term and long term outcomes, and the relative contribution of afterschool, school, and other variables, may not be understood or articulated through current widely-used methods of evaluation and research, which focus on learning settings in isolation from one another.

3. When asked to rank their relative confidence in demonstrating children's progress towards the indicators of learning, all panelists included supporting children's development of STEM-relevant life and career skills in the second cluster of indicators. However, when asked to rank the sub-indicators in terms of those they felt best positioned to achieve, related sub-indicators such as the ability to work in teams or to apply problem-solving abilities to STEM investigations were among the top half of 17 sub-indicators ranked, with working in teams being the second most highly ranked of the 17.

The disparity between confidence levels in regard to achieving specific indicators of STEM-relevant skills (indicators associated with 21st century skills, which the afterschool field has embraced) and confidence about contributing to the larger construct of STEM-relevant skills suggests a possible lack of clarity about the relationship of discrete measurable outcomes (such as team work) and their relationship to essential dimensions of STEM literacy and practices.

4. When asked about the availability of assessment tools to document the consensus learning indicators, the study revealed that the afterschool STEM "supporters" (state and national education leaders and funders) are much more optimistic about the availability of such tools than the afterschool "providers."

This disparity suggests that there may be different standards for assessment between the two expert groups of panelists in this study. The provider group may either be unaware that tools exist or they may feel that they are not accessible or usable.

5. The sub-indicator "Pursuit of school STEM learning opportunities" garnered some of the least number of participants who felt highly confident the field could demonstrate this impact.

This finding is extremely important because to date many large scale studies of afterschool programs have used school achievement measures to assess the contributions of afterschool programs to children's learning and development. This consensus study found that the field believes it can make a contribution to children's pursuit of school STEM learning opportunities. However, it clearly communicated that among the list of 17 sub-indicators, this was one that they felt minimally confident about, and therefore would expect to see little demonstrated impact.

Recommendations

Based on the findings described here and more fully in the report, we make the following recommendations to advance afterschool as a strategic partner in STEM education:

1. **Policy Makers**: We recommend that policy makers consider the outcomes and indicators articulated in this study (described in Table A and the section on "Findings" in the full report) to define the appropriate niche for afterschool programs in STEM education. In particular, we note that the afterschool field has expressed reservations about its ability to impact school STEM outcomes but has expressed higher confidence in its ability to impact other skills such as problem-solving abilities, demonstrating STEM skills, career awareness and "21st century skills" such as team work. These latter skills are as important as academic outcomes for the longer term to broaden access and participation and to maintain an interest in STEM fields and careers. It is hense vital that STEM education policies reflect this understanding.

2. **Practitioners**: We recommend that program leaders utilize the framework of outcomes, indicators and sub-indicators articulated in this study (see Table A) to map out how their work contributes to STEM education overall. While it is not realistic to expect that each program will achieve all of the outcomes and indicators described in the study, it is important to set appropriate and feasible goals that reflect the strengths and constraints of each program. Utilizing outcomes and indicators from a common framework to describe a program's impacts will allow for aggregation of the impacts of the afterschool STEM field as a whole.

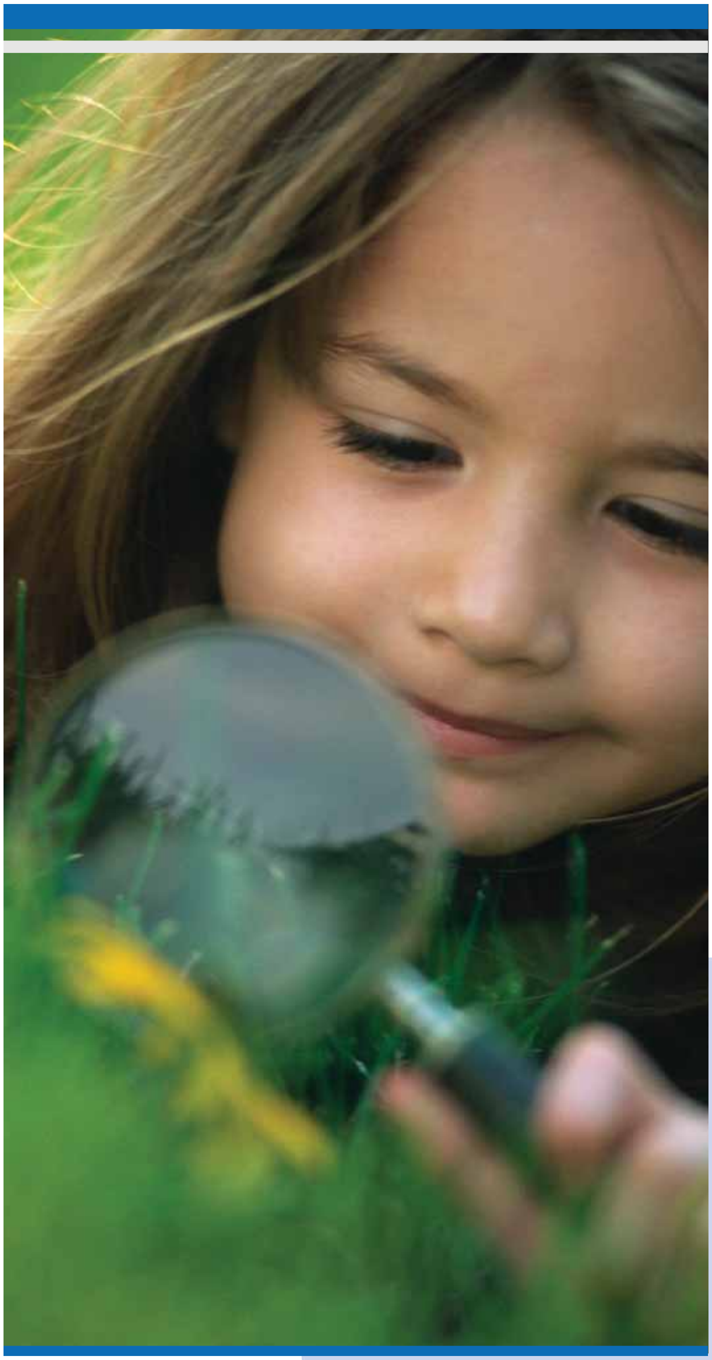
3. **Evaluation and Assessment Experts**: As noted earlier, there is a difference in perspective between the two groups of panelists in this study about the availability of assessment tools. We recommend that a group of evaluation and assessment experts, practitioners, and funders be convened to examine the status of available tools and map them to this framework of outcomes, indicators and sub-indicators. If tools are not available to measure some of these impacts, we recommend that this study's results be utilized to inform the design of new measures to assess afterschool STEM learning.

Areas for Additional Research

1. Based on the panelists' consensus that they felt more confident in documenting immediate rather than longer-term impacts, we recommend that the afterschool STEM field explore the development of new research and evaluation methodologies and instruments that can investigate STEM learning across settings, showing how immediate STEM learning outcomes in the afterschool setting relate to longer-term learning in the school setting, and vice versa. It may be only through such tools that the value and contributions of afterschool programs can be fully articulated and ultimately assessed. Indeed, this should be considered an area of investment and activity for the larger STEM education community and not just the afterschool STEM field.

2. We recommend that afterschool providers engage in a dialogue with STEM education leaders and researchers to more clearly articulate the relationship between discrete and measurable learning indicators or sub-indicators and the related overarching developmental STEM learning outcomes. This will help to clarify and resolve the apparent contradiction of expressing very low confidence in the afterschool STEM field's ability to achieve impacts as described by some indicators while expressing high confidence in the ability to achieve impacts described by sub-indicators related to that same indicator.

3. Finally, while the analysis did not detect statistical significance, we believe there are variations in perspective between the two groups of expert panelists included in this study and recommend further investigation to detect and resolve any real and meaningful differences between various stakeholders in afterschool STEM programs. Following up on this issue is sure to yield information about how to move the field forward to achieve its full potential and ideally provide a guide to funders as they seek areas for high-impact investments in the field.



Key Recommendations

Policy Makers
should utilize the outcomes and indicators described in this study to define the appropriate niche for afterschool programs in STEM education.

Program Leaders
should utilize the framework of outcomes and indicators described in this study to map out how their work contributes to STEM education overall.

Evaluation & Assessment Experts
should examine the outcomes and indicators described in this study and utilize its results to inform the design of new measures to assess afterschool STEM learning.

Afterschool programs are increasingly recognized as playing a valuable role in improving science, technology, engineering and mathematics (STEM) education.

Introduction

Afterschool programs are increasingly recognized as venues to effectively engage children and youth in science, technology, engineering and mathematics (STEM) disciplines. However, as more stakeholders get involved with the effort to engage youth in STEM through afterschool opportunities, afterschool providers are being asked to produce and document a wide range of outcomes—from exciting and engaging children about STEM to improving math and science standardized test scores to increasing the number of students who pursue STEM majors in college.

But among afterschool practitioners, education policy makers and researchers, and funders there is still a lack of consensus about what kinds of STEM-related outcomes are appropriate and realistic for afterschool programs to produce. Several important pieces of legislation, including the reauthorized Elementary and Secondary Education Act, will be passed over the coming years that will significantly impact the future of afterschool programming. Additionally, policy and program initiatives at the state and federal levels are including afterschool as a partner in STEM education reform but often in support of academic, school-based goals. For this reason, developing greater clarity about appropriate goals and outcomes across the afterschool STEM field could help to frame how the field is positioned to support STEM learning, including how specific types of programs may be best suited to address particular subsets of goals and outcomes.

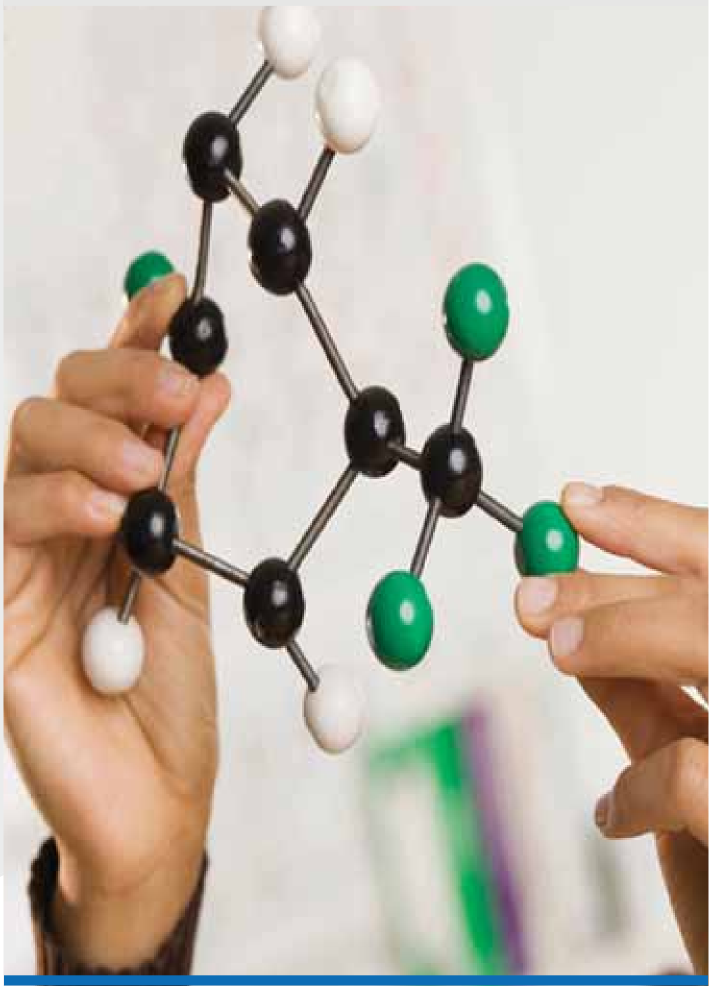
Thus far, the afterschool field has looked to the significant body of work that has accumulated in recent years to define a framework for youth outcomes and assessment of STEM learning in informal learning environments: most notably, the National Academy of Sciences' *Learning Science in Informal Environments* (LSIE; NRC 2009) which identified science learning proficiencies, and the National Science Foundation's (NSF) *Framework for Evaluating Impacts of Informal Science Education Projects* (Friedman 2008), which suggests categories for collecting project-level impacts in a systematic way. However, as noted in these reports, assessing the full impact of informal science education (ISE) projects is complex. Afterschool programs face a particular challenge, as they differ from other commonly discussed ISE settings (e.g., museums, mass media and gaming environments) in the following key ways:

- Afterschool programs sit at the junction of the school day and a free-choice learning environment—the best programs are not duplicative of school, but are designed to explicitly relate to school-day learning in ways that can help children bridge their learning and accomplishments across settings;

- Afterschool programs are driven by strong youth development goals, in addition to the larger goal of supporting overall student success;

- Afterschool programs are most commonly led and facilitated by non-STEM experts;

- Afterschool programs are more likely than other ISE settings to work with young people from populations historically underrepresented in STEM fields, and who often attend under-resourced schools that may have limited STEM learning options.



As a consensus study, LSIE reviewed more than 2,000 published and unpublished reports to describe the current status of knowledge with respect to learning in informal settings. The report concluded that learning does happen in these settings; but it also noted that the quality of further assessment, evaluation and research on informal science learning, no matter its setting, would benefit from a community-wide discussion of the current research and issues in these areas. Significant work was done in the LSIE study to consider ISE project outcomes, using six strands of science learning to capture broadly how youth could be considered "proficient" in STEM. Particularly, the six strands encompassed in the framework highlight the ways in which the socio-emotional dimensions of learning (interest, identity and engagement with scientific practices) are intertwined with more traditionally acknowledged academic dimensions of STEM learning (such as skills, concepts and epistemologies). Thus, the LSIE volume, which complements the outcome categories provided by the NSF document, surfaces the ways in which the youth development context of afterschool programs—which work with children in a sustained way, sometimes over a period of years, and support their intellectual, emotional, social, and physical well-being—may provide an especially fruitful ISE setting for developing both academic and socio-emotional dimensions of STEM learning. This may be even more salient for the communities historically underrepresented in STEM fields that are served by afterschool programs. The intersection of socio-emotional and academic dimensions of learning may provide an entry point for young people who have historically been disenfranchised or not included in STEM education and pursuits.

The NSF framework, LSIE study and other research in this area have led to the development of a few assessment tools for afterschool STEM programs, such as the Dimensions of Success Afterschool Science Observation Tool (Noam et al. 2013) and the STEM Program Quality Assessment Tool (from the David P. Weikart Center for Youth Program Quality). Such tools are now beginning to be adopted by the afterschool community and the impacts of STEM learning in this space are starting to be documented more systematically (Afterschool Alliance 2011).

Additionally, the larger ISE community is beginning to consider a more systematic approach to assessing informal and afterschool science learning (NRC 2012). Hence, it is a critical time for developing a clearer understanding of appropriate and feasible outcomes for afterschool STEM learning. Such an understanding can inform both policy and assessment design, and provide a realistic vision for afterschool STEM.

What are appropriate and feasible outcomes for afterschool STEM learning?

Several large-scale, multi-year projects addressing this question are currently underway—such as the Science Learning Activation Lab funded by the Gordon and Betty Moore Foundation, NSF's ISE and ITEST (Innovative Technology Experiences for Students and Teachers) program evaluations, as well as NSF-funded research projects led by researchers such as Robert Tai and Sandra Laursen (e.g. "Collaborative Research on Out-of-School-Time Science Programs for Youth: Qualitative Research and Longitudinal Survey Design")—but the timelines for these projects are, appropriately, lengthy.

To address the issue of outcomes for afterschool STEM learning on a more immediate basis, and also to ensure that practitioner experiences and insights have informed this process, we asked afterschool providers and supporters to take part in a study that engaged them in a meaningful dialogue about what student learning outcomes they believed the afterschool field was best positioned to support. The afterschool field is very diverse with a wide range of stakeholders, and the outcomes will vary depending on the particular circumstances of each program. But practical knowledge, as distinct from scholarly or research-based knowledge, is seldom finely distilled and often highly contextual. Expert practitioners make choices based on a wide variety of factors (who the children are, what the potential of the learning setting is, etc.) combined with their understanding, theories, and beliefs developed through experience and reflecting the views of trusted experts (Smylie 1989). In the end, practical knowledge often has more impact than research-based knowledge on what actually happens in the field (Coburn et al. 2009; Coburn & Stein 2010; Nelson et al. 2009). A primary driver of our study was to articulate practitioner views and values in order to ensure that they were taken into account by researchers and policy makers at a time when the field of informal science education and the role of afterschool in ISE are becoming increasingly consolidated and codified.

The *Defining Youth Outcomes for STEM Learning in Afterschool* study aimed to identify what STEM learning outcomes afterschool program leaders and supporters believed that the afterschool field could contribute to, what the indicators of progress toward such outcomes might be, what types of evidence could be collected by the afterschool field and whether or not appropriate data collection tools currently exist. This report describes the results of that study. The results are intended to inform the larger policy discussion about how to define and assess STEM outcomes for youth participating in afterschool programs incorporating STEM. The intended audience for this report includes education policy makers so that they can have a realistic vision of what afterschool programs can accomplish (as compared to what can be expected from schools), leaders of afterschool programs so they can set appropriate and measureable goals, and researchers and evaluators of afterschool programs to inform their design of appropriate assessment tools.

The Afterschool Alliance, a nationally recognized leader in the afterschool field, led this study. An advisory group assisted the study team by reviewing the proposed constructs and providing feedback at various points during the study.

Study Team

Anita Krishnamurthi
Director of STEM Policy, Afterschool Alliance

Bronwyn Bevan
Associate Director of Program, Exploratorium

Vicky Ragan Coulon
Director, Evaluation Research Associates

Jen Rinehart
Vice President for Research and Policy, Afterschool Alliance

Advisory Group

Gabrielle Lyon
Co-founder and Executive Director, Project Exploration

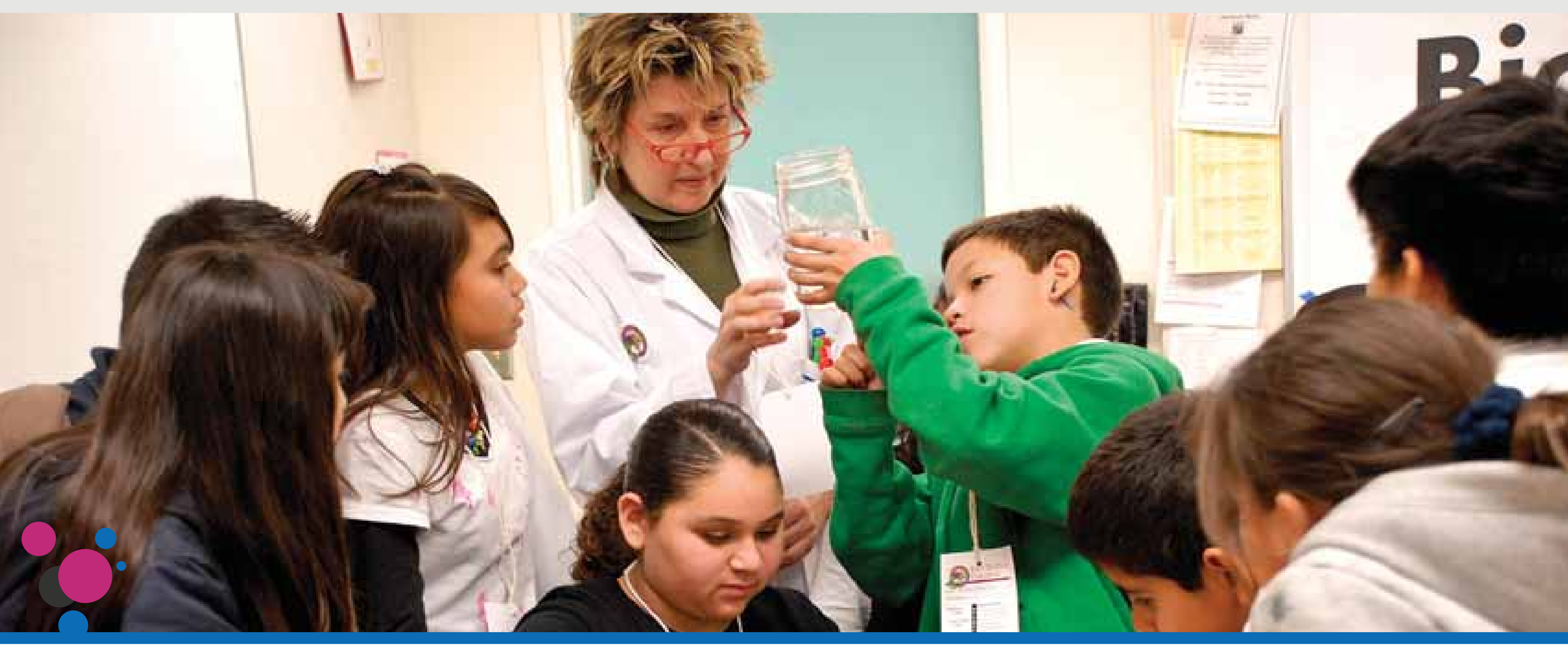
Gil Noam
Founder & Director, Program in Education, Afterschool & Resiliency (PEAR)
Associate Professor, Harvard Medical School and McLean Hospital

Elizabeth Reisner
Founder, Policy Studies Associates

Tony Streit
Senior Project Director, Education Development Center

Carol Tang
Director, Coalition for Science After School

Debbie Zipes
Executive Director, Indiana Afterschool Network



Methodology

The *Defining Youth Outcomes for STEM Learning in Afterschool* study used a modified "Delphi" methodology that involved iterative rounds of review by an expert panel to pinpoint consensus positions related to outcomes and indicators for STEM learning in afterschool.

The Delphi methodology is used to achieve consensus on complex issues where expert judgment is highly influential in practical decisions. Dalkey and Helmer (1963) state the objective of the Delphi method is to "obtain the most reliable consensus of opinion of a group of experts." The Delphi method enlists a group of experts (the "panel") who anonymously answer sequential questionnaires in a series of rounds. After each round, a researcher provides a summary of the responses from the previous round as well as the reasons provided for panelists' responses. Thus, panelists are encouraged to consider and possibly revise their earlier responses in light of the opinions of the other members of the panel. During this process, the range of responses decreases and there tends to be convergence to consensus (Jairath & Weinstein 1994). The process is concluded after a pre-defined stop criterion is met (e.g. number of rounds, achievement of consensus, stability of results, etc.). For this study, the justification for using the Delphi method includes the following:

- The Delphi method is appropriate to achieve group consensus without the group being physically present in one geographic location. Members of the expert panel chosen for this study were located throughout the United States. The time and expense to bring together such a panel was beyond the scope of this project.
- A panel of experts vs. a single expert may provide increased credibility of the findings. The study team strived to have the results of this study be representative of the entire afterschool field and therefore sought to have a varied panel in terms of areas of expertise and position.
- Soliciting information from a diverse set of experts in the afterschool field (program directors, expert practitioners, state education policy makers, funders and other stakeholders) engaged the field broadly and would be more likely to lead to close consideration of the results.

The Delphi method uses an expert panel to achieve consensus on complex issues through iterative rounds of surveys.

- Experts were not only asked anonymously for their opinions, but also ranked the importance of question topics—serving a dual purpose.
- The study team felt that panelist anonymity would increase the comfort level and/or confidence when responding to questions that required the use of personal knowledge and experience, rather than a more 'cautious institutional position' (Gupta & Clarke 1996).

Additionally, the Delphi design is flexible, lending itself to follow-up data collection (such as interviews) that can permit a richer or deeper analysis of data. The study team wanted the option to gain a more in-depth understanding of why panelists responded the way they did.

There are some known limitations of the Delphi methodology. Specifically, this methodology relies on expert panels that are presumed to be knowledgeable about the subject of the study. Thus the findings actually represent expert opinion, rather than indisputable fact. Another limitation is the time it takes to conduct a Delphi study. Each round takes up to four to six weeks, and the overall process can last for several months. Finally, the methodology has been critiqued by some as insufficiently anchored by quantitative approaches that can ascertain statistical significance of the results. Despite these limitations, the study team determined that a Delphi methodology was the best methodology to gather and synthesize information from practitioners and supporters to complement the reports cited earlier.

Study Implementation

The paragraphs below briefly describe the steps the study team used for the modified Delphi methodology[1] used in this study. The study took place between February and November 2012 with each of the three rounds lasting approximately four to six weeks. There were seven steps in all: Panel Selection, Round One Administration, Round One Analysis, Round Two Administration, Round Two Analysis, Round Three Administration and Round Three Analysis. At the closure of Round Three, the study achieved consensus about STEM learning outcomes in afterschool; these consensus results are reported in the next section.

Panel Selection

The study team identified two categories of experts needed for the study: (1) Group One consisted of "providers"—experienced afterschool leaders who were responsible for selecting, designing, or leading programming; professional development; and delivering on outcomes at a program-wide level; (2) Group Two included afterschool STEM "supporters," such as funders, national education policy leaders and state education department representatives who were responsible for funding, policy decisions and establishing outcomes (to which providers must answer) for afterschool programs. The study team was interested if a consensus across both groups could be determined and to initiate a dialogue if there were significant differences. Once the categories for panelists were agreed upon, the study team, the six advisors and a handful of other supporters in the field nominated potential panelists. One hundred panelists were invited to join the study and asked to fill out a brief online survey to ensure they met the eligibility criteria and understood the terms of the study. Potential panelists were not informed of the identity of the other participating panelists and all invited panelists were informed of the modified Delphi methodology being used in this study. A total of 80 panelists agreed to participate in the study (see Table 1).

Round One Administration

The study team designed and administered a questionnaire to panelists to begin the process of determining and consolidating the study constructs. An "invitation only" online survey was used, allowing the researchers to track participant completion. Responses were not matched to participants in order to maintain their anonymity. Tracking respondents also allowed the team to narrow the panel for Round Two because only participants who completed the Round One survey were invited to participate in Round Two. Round One was administered in April-May 2012. Of the 80 panelists invited to answer the Round One questionnaire, 72 responded—a 90 percent response rate.

The purpose of Round One was to initiate a dialogue with participants about their views on what learning outcomes and indicators were feasible for the afterschool field, as a first step toward developing consensus among participants. To spark that dialogue, the study team provided a tentative framework (see Table 2) for learning outcomes and indicators in afterschool programs[2]. Participants were asked to agree or disagree with the proposed tentative constructs and to suggest missing constructs or modifications to the constructs in the framework. There were open-ended questions where participants could share thoughts on any matters. The responses to these questions included many general comments, such as the necessity and usefulness of this study, a large number of comments about appropriate forms of evidence (such as taking Advanced Placement classes serving as evidence of pursuit of STEM in school), comments related to issues of measurement, revisions to wording, and editorial comments.

Table 1.

Profile of Study Participants

Group One - Providers	Group Two - Supporters
29 multi-site afterschool program leaders	12 funders
18 state afterschool network leaders	10 state education policy leaders
8 national afterschool network leaders	3 national education policy leaders
Total = 55	Total = 25

[1] The larger participant sample size used in this study is a modification from a standard Delphi method sample of 18–20 participants, though the process still depends on an iterative group dynamic rather than statistical power to arrive at valid conclusions (Okoli & Pawlowski, p. 19).

The initial framework proposed three major developmental outcomes for children in afterschool STEM programs. These were:

1. Developing interest in STEM and STEM learning activities
2. Developing capacities to productively engage in STEM learning activities
3. Coming to value the goals of STEM and STEM learning activities

These broad outcomes were drawn from commonalities observed in evaluation reports of afterschool STEM programs (Afterschool Alliance 2011) and the research literature pertaining to human development (e.g., Hidi & Renninger 2006; Holland et al. 1998; Lave & Wenger 1991), youth development (e.g., Barber et al. 2005; Eccles 2005) and science learning (e.g., NRC 2007; NRC 2009). Additionally, the study team referenced the research and evaluation literature to identify potential indicators related to the proposed outcomes. For example, indicators of interest in STEM might include demonstrated active participation in STEM learning activities (Hidi & Renninger 2006) or demonstrated curiosity about STEM topics or practices (NRC 2009). Finally, to aid in identifying the relative feasibility of the proposed outcomes and indicators, the team included types of evidence that might be collected by afterschool programs to document or substantiate change in each of the suggested indicators. Table 2 presents this draft framework of outcomes, indicators and evidence.

The purpose of these steps was to help respondents more concretely envision whether or not a given indicator was feasible. For example, active participation in STEM learning activities (an indicator of developing interest) might be substantiated through evidence that a child was actively engaging in activities within an afterschool program or that the child was pursuing additional afterschool STEM learning opportunities both within and outside of that specific program. The exact nature of what those additional learning opportunities might be (internships, camps and more advanced activities) would vary according to availability of opportunity, interests of the child, age and other parameters. More detailed forms of evidence, or the methods that would be used to collect them, were not proposed because the framework was intended to represent the work of the field broadly (e.g., across age spans and location) and to therefore provide a common basis for developing more specific data collection strategies within specific age spans, content domains or localities.

[2] The study team considered two approaches to using a Delphi method for this study. One was to provide an open-ended set of questions, for example, asking participants to provide their thoughts on what outcomes they felt the afterschool field could best contribute to. The other approach was to provide a tentative framework of learning outcomes and request participants' feedback (e.g., additions, deletions and refinements). For the purposes of this study, the team began with a tentative framework (as described above) in order to more efficiently launch and pursue the process of developing consensus among participants.

Table 2:

First Draft of Outcomes Framework Used in Round One of Delphi Study

<table>
<tr><th>Outcome
Through STEM afterschool programs, children and youth</th><th>Outcome Indicators
You know or can see that children and youth demonstrate…</th><th>Evidence
If you had appropriate tools, you could document evidence such as children and youth are…</th></tr>
<tr><td rowspan="3">A.
Develop interest in pursuing STEM learning activities.

"I like to do this."</td><td>Desire to participate in STEM</td><td>• Consistently attending afterschool STEM learning activities
• Actively engaged and focused in afterschool STEM learning activities
• Enrolling in additional afterschool STEM programs
• Seeking opportunities to extend STEM learning experiences over time</td></tr>
<tr><td>Curiosity about STEM topics and fields</td><td>• Consistently asking questions
• Consistently seeking out information on their own (online, in books, TV, etc.)</td></tr>
<tr><td>STEM career awareness</td><td>• Gaining awareness of STEM careers
• Declaring interest in STEM majors in college
• Demonstrating knowledge of how to pursue STEM careers</td></tr>
<tr><td rowspan="2">B.
Develop capacities to productively engage in STEM learning activities.

"I can do this."</td><td>Ability to engage in STEM practices of inquiry</td><td>• Demonstrating STEM knowledge
• Demonstrating ability to apply STEM knowledge
• Demonstrating STEM skills
• Demonstrating understanding of STEM methods of investigation</td></tr>
<tr><td>STEM-relevant life and career skills</td><td>• Demonstrating improved communication skills
• Demonstrating ability to work in teams
• Demonstrating ability to problem-solve</td></tr>
<tr><td rowspan="3">C.
Develop expanded value for and commitment to pursuing STEM learning activities and pathways.

"This is important to me."</td><td>Positive attitudes toward engaging in STEM activities</td><td>• Demonstrating increased confidence in their ability to productively engage in STEM
• Demonstrating awareness that STEM topics and careers are accessible to people of all genders, ethnicities and socio-economic backgrounds</td></tr>
<tr><td>An understanding of the value of STEM in society</td><td>• Demonstrating understanding of relevance of STEM to everyday life
• Identifying important problems that can be addressed by STEM
• Demonstrating awareness of opportunities to contribute to society through STEM
• Demonstrating desire to seek higher education in STEM fields</td></tr>
<tr><td>Desire to participate in additional school STEM programs</td><td>• Demonstrating improved school attendance in STEM classes
• Enrolling in additional STEM classes in school
• Demonstrating academic improvement in STEM subjects
• Demonstrating improved school grades in STEM subjects</td></tr>
</table>

Round One Analysis

Quantitative and qualitative techniques were used to analyze, group and rank responses and to refine the constructs. The study team rigorously analyzed all responses and comments received and determined that many of the suggestions regarding additional outcomes or indicators were already included elsewhere; several were related to issues about the feasibility of measurement, while many others were related to the specifics of programming at particular sites. Details of the analysis methods used for this round are available in the summary shared with all respondents, which is presented in Appendix 1.

In Round One, 97 percent of study participants agreed that the proposed outcomes were achievable through STEM programs in afterschool. However, Round One feedback led to several revisions to both the wording and the relative position in the framework of the proposed indicators and the forms of evidence. The open-ended comment sections of the Round One questionnaire revealed that the attention of the panelists was primarily focused on the interface between indicators and evidence, including some attention to specific tools or specific approaches based on grade level or program focus. This alerted us to the need to include forms of evidence, not just as illustrations of the ways in which the indicators might feasibly be documented, but rather as another focus in the consensus development itself. We hence revised the framework terminology based on feedback from the first round of the survey—what had been called "Outcome Indicators" was changed to "Indicators" and what had been called "Evidence" was changed to "Sub-indicators." Table 3 shows the revised framework. A comparison of Tables 2 and 3 shows how several constructs were reworded or reframed to reflect the feedback. Because many of the comments related to examples of evidence, we consolidated some of the ideas to form a new sub-indicator that included a few examples of evidence mentioned by the panelists.

There was a high degree of agreement (within five percentage points of each other for answers that could be quantified) between the responses from Group One (afterschool providers) and Group Two (afterschool supporters) in Round One. Hence the study team made a decision to administer the same survey in Round Two to the two study groups, but to track their responses separately to see if there was a significant difference in responses from each group going forward.

The team used the results of the analysis to write the summary of Round One for panelists and to develop the Round Two questionnaire.

Round Two Administration

Round Two was administered in August 2012 and was designed to provide a means for panelists to come closer to consensus on the constructs. We integrated the comments and feedback into the proposed framework (see Table 3). We disaggregated the outcomes from the indicators, as we had reached consensus on the set of outcomes in Round One. In Round Two, we first asked panelists to rank, from 1 to 6, the order in which the field was best positioned to impact the following set of revised indicators:

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. Ability to exercise STEM-relevant life and career skills
5. Understanding the value of STEM in society
6. Awareness of STEM professions

Then they were asked to **rank within each indicator** which sub-indicators they felt the field was best positioned to impact. For example, for the indicator "Ability to productively engage in STEM processes of investigation," they were asked to rank in order the field's capacity to impact young people's:

- Demonstration of STEM knowledge
- Demonstration of STEM skills
- Demonstration of an understanding of STEM methods of investigation

We then asked panelists to **rate each sub-indicator by the confidence level** they could assign to the field being able to achieve this impact. In contrast to the question about ranking the sub-indicators, where we asked them to rank the sub-indicators in relationship to one another, the purpose of the question about rating was to indicate how confident they were about any one of the sub-indicators, irrespective of any other sub-indicators. We did this partly because in Round One many of the panelists' comments focused on the level of sub-indicators, alerting us to the importance of this category for the panelists, and partly to serve as a check on how to interpret their ranking of the indicators and sub-indicators.

Table 3:

Revised Framework of Youth Outcomes Used to Underpin Round Two

Outcome *Through STEM afterschool programs, children and youth…*	**Indicators** *You know or can see that children and youth demonstrate…*	**Sub-Indicators** *If you had appropriate tools, you could document the following types of evidence…*
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** *(Examples of evidence: persisting in a task or program; sharing knowledge and ideas; expressing enthusiasm, joy, etc.)* • **Pursuit of other out-of-school-time STEM learning opportunities** *(Examples of evidence: enrolling in programs; attending programs regularly; reporting performing STEM-related activities at home)* • **Pursuit of school STEM learning opportunities** *(Examples of evidence: 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** *(Examples of evidence: exploring ideas verbally or physically; questioning, hypothesizing, testing)* • **Active information-seeking about mechanical or natural phenomena or objects** *(Examples of evidence: 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. "I can do this."	**Ability to productively engage in STEM processes of investigation**	• **Demonstration of STEM knowledge** *(Examples of evidence: demonstrating increase in knowledge in specific content areas; making connections with everyday world; using scientific terminology)* • **Demonstration of STEM skills** *(Examples of evidence: formulating questions; testing, exploring, predicting, observing, collecting and analyzing data)* • **Demonstration of an understanding of STEM methods of investigation** *(Examples of evidence: demonstrating understanding of the nature of science; using evidence-based reasoning and argumentation; demonstrating engineering design practices)*
	Ability to exercise STEM-relevant life and career skills	• **Demonstration of mastery of technologies and tools that can assist in STEM investigations** *(Examples of evidence: developing capacity to use measurement and other scientific instruments; running computer programs for data analysis; developing effective methods to communicate findings)* • **Demonstration of ability to work in teams to conduct STEM investigations** *(Examples of evidence: communicating effectively with team members; collaborating effectively with team members; demonstrating leadership on the team)* • **Demonstration of applied problem-solving abilities to conduct STEM investigations** *(Examples of evidence: engaging in critical thinking; questioning, sequencing, reasoning)*
C. Come to value the goals of STEM and STEM learning activities. "This is important to me."	**Understanding of value of STEM in society**	• **Demonstration of an understanding of relevance of STEM to everyday life, including personal life** *(Examples of evidence: referencing examples of STEM in everyday life: everyday problems)* • **Demonstration of knowledge of important civic, global and local problems that can be addressed by STEM** *(Examples of evidence: contributing to projects that address a community need; developing awareness of how STEM is implicated in larger societal issues)* • **Demonstration of awareness of opportunities to contribute to society through STEM** *(Examples of evidence: engaging in a service-learning project)*
	Awareness of STEM professions	• **Development of an understanding of the variety of STEM careers related to different fields of study** *(Examples of evidence: gaining knowledge about relevant professions; gaining knowledge of where such jobs and careers exist)* • **Demonstration of knowledge of how to pursue STEM careers** *(Examples of evidence: acquiring knowledge of what courses are needed to prepare for or pursue STEM degrees; declaring STEM interests or majors)* • **Demonstration of awareness that STEM is accessible to all** (*Examples of evidence: expressing a desire to meet role models; declaring STEM interests and majors; desiring to become a role model to pave the way for others)*

Round Two Analysis

Quantitative and qualitative techniques were used to analyze the Round Two data. Of the 71 panelists invited to participate in Round Two, 59 responded to the questionnaire for a response rate of 83 percent. This drop-off rate is not uncommon in such iterative surveys and was within the bounds of the study team's expectations.

In Round Two we found some differences begin to emerge between the responses from Group One and Group Two. While there was consensus between both groups on the ranking of three of the indicators, we found differences between the groups in ranking of the remaining three indicators. These differences are illustrated in Table 4 below.

This variation suggested that we needed to explore this issue further in Round Three to see if we could reach consensus among the two groups for all indicators.

The sub-indicator rankings did not yield any major surprises; panelists ranked the sub-indicators they could directly impact higher than those that they had less control over. However, when we considered the results of the sub-indicator ratings, we found that in several cases, respondents reported high levels of confidence for particular sub-indicators—such as "demonstrating team work"—that were associated with indicators that had been ranked low such as "ability to exercise STEM-relevant life and career skills." In another case, the highest- ranked indicator, "active participation in STEM learning opportunities," had two sub-indicators upon which the panelists had little confidence in afterschool programs' ability to achieve impact: "pursuing additional out-of-school time STEM learning opportunities" and "pursuing STEM school opportunities." This implied that Round Three had to be designed to explore this possible contradiction and attempt to resolve it. Results from Round Two were summarized for the panelists and used in the design of the third round questionnaire. A detailed summary of Round Two results is presented in Appendix 2.

Table 4:

Ranking of Indicators by Groups One and Two

Indicator	Group One Rank (Afterschool Program Providers)	Group Two Rank (Afterschool STEM Supporters)	Both Groups Aggregated
Active participation in STEM learning opportunities	1	1	1
Curiosity about STEM topics, concepts or practices	2	2	2
Ability to productively engage in STEM processes of investigation	3	3*	3
Ability to exercise STEM-relevant life and career skills	4	6	5
Understanding the value of STEM in society	6	5	6
Awareness of STEM professions	5	3*	4

**tie*

Round Three Administration

The study team administered the third and final questionnaire to 59 panelists, of which 52 panelists responded (88 percent response rate).

From the outset, the study team defined the end point of the study as the achievement of consensus, and determined that consensus would reflect a majority opinion of the panel. However, given the variety of constructs we were attempting to gain consensus on, the team used the following methods:

- **Outcomes**: When we considered the outcomes, we found 97 percent agreement after Round One across both groups that the proposed outcomes were appropriate for afterschool STEM learning. This implied a clear consensus by majority.
- **Indicators**: In rounds two and three, the panelists were asked to rank the indicators according to those they felt the field was best positioned to successfully impact (where 1=best and 6=least). We assigned points to each indicator ranking as follows: One point for a #1 ranking, two points for a #2 ranking and three points for a #3 ranking. The sum of the points assigned to each indicator was calculated and then divided by the number of respondents ranking that indicator to determine an average score. The scores were then ordered from least to greatest, where the lowest score was ranked number one and the highest score ranked number six.
- **Sub-Indicators**: Panelists were asked to rank and rate the sub-indicators in Rounds Two and Three. The rankings were calculated using the same method as the indicators described above. In Round Two, panelists were asked to rate each sub-indicator by the confidence level they could assign to the afterschool field being able to achieve this impact. Ratings ranged from 1-5, where 1=most confident and 5=least confident. Sub-indicators could have the same confidence rating. We determined the confidence level of each sub-indicator by combining the percentage numbers in the top two (of five) levels of confidence. Ties were broken by the highest percentage in the next level of confidence. When considering ratings for the sub-indicators in Round Three, panelists were asked to rate the sub-indicators as "high," "medium" or "low." We used simple majorities (>50%) for each of the three categories to determine consensus in this case.

The Round Three questionnaire was administered in September-October 2012 and began by asking panelists to rate the three indicators on which there was a difference of opinion in Round Two. Next (as described above), since there appeared to be little correlation between some of the ratings panelists provided for the sub-indicators and those they provided for their parent indicators, we disaggregated the sub-indicators from the indicators and asked people in Round Three to explicitly re-rate the sub-indicators by a confidence level ("High", "Medium" or "Low").

In all of our questions up to this point, we had asked panelists not to consider issues of resources, methods, and personnel to document the impacts, but rather provide their feedback based simply on how confident they were that the field could achieve these impacts. But in this last round, partly because occasionally open-ended comments included reference to whether or not there were existing tools or resources to support the outcomes, we asked panelists to look ahead and think about what the field needed to achieve its full potential to provide effective STEM learning opportunities in afterschool. In addition to resources needed to achieve impact, we asked them if they believed there were assessment tools and instruments currently in existence that could be used to assess/document this impact. We made it very clear that their answers to this question were not part of the consensus seeking for the Delphi study, but would inform recommendations for further study regarding the development of new resources and assessment instruments for STEM learning in afterschool programs.

Round Three Analysis

The team again used quantitative and qualitative techniques to analyze the Round Three data. The results of this analysis are provided in the next section.

Findings

The Delphi study on youth outcomes for STEM learning in afterschool yielded some valuable insights from the afterschool field about outcomes, indicators and sub-indicators. There was early consensus across the expert panel about the outcomes that are achievable through STEM programs in afterschool. No panelist suggested a new outcome (that was not already addressed as an indicator or sub-indicator) or suggested deleting one of the proposed outcomes. After Round Three, panelists also came to consensus on which indicators of learning they believed the afterschool field was best positioned to support relative to the others.

Similarly, the panelists rated a set of sub-indicators by the confidence level they could assign to the likelihood that afterschool programs would be able to achieve the impact described by the sub-indicator. In each case, we asked the panelists to rate the sub-indicators without considering issues of resources and tools that might be an issue in documenting the impact but only to consider their confidence levels in achieving the impact. We did this because we believe that the resources and methods to document impacts may lag the field's ability to contribute to those impacts. Hence this study could point to areas where afterschool practitioners feel confident that they are making an impact but where there is a need for more resources and tools to document that impact. The final consensus from the Delphi panel (combining Group One and Group Two participants) after Round Three on these constructs is as listed below.

Outcomes

Outcomes represent the major developmental impacts on young people with respect to STEM learning.

The study results show that afterschool providers and supporters believe afterschool STEM programs can support young people to:

- Develop interest in STEM and STEM learning activities
- Develop capacities to productively engage in STEM learning activities
- Come to value the goals of STEM and STEM learning activities

Indicators

Indicators are the concrete ways that young people demonstrate progress toward the intended program outcomes with respect to STEM learning.

According to the study results, afterschool providers and supporters believe that afterschool programs may be best positioned, in the following rank order, to support and 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

Sub-Indicators

The sub-indicators represent specific, measureable dimensions of the indicators.

Study results indicate the afterschool providers and supporters have a ***high*** *level of confidence that afterschool programs are well positioned to support and expand young people's:*

- Active engagement and focus in STEM learning activities
- Demonstration of ability to work in teams to conduct STEM investigations
- Active inquiries into STEM topics, concepts or practices
- Development of an understanding of the variety of STEM careers related to different fields of study
- Demonstration of an understanding of relevance of STEM to everyday life, including personal life
- Demonstration of STEM skills
- Demonstration of applied problem-solving abilities to conduct STEM investigations
- Demonstration of awareness of opportunities to contribute to society through STEM

This set of sub-indicators, which panelists felt highly confident about, stress the **doing** of science (active engagement, inquiries) and developing skills to do science. These sub-indicators also address developing "21st century skills," such as working in teams and problem solving; as well as developing views into a possible future with science, including career choices and relevance to everyday living. Note that a "high level of confidence" was associated with a sub-indicator when a majority of respondents (>50%) assigned a "high" value to it (when choosing between high, medium and low levels of confidence).

Study results indicate the afterschool providers and supporters have a ***medium*** *level of confidence that afterschool programs are well positioned to support and expand young people's:*

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

This set of medium-level confidence sub-indicators is perhaps more specific in terms of links to STEM resources or expertise (knowledge, epistemologies, technologies), the availability of additional external opportunities (further out-of-school-time or school-based STEM) and larger systems level issues such as understanding how to pursue careers. Note that a "medium level of confidence" was associated with a sub-indicator when a majority of respondents (>50%) assigned a "medium" value (when choosing between high, medium and low levels of confidence) to it.

Other findings of interest:

- The sub-indicator "Pursuit of other out-of-school-time STEM learning opportunities" was the only one that did not fall neatly into the "high," "medium" or "low" categories. In no case did the group indicate that they had low confidence in the afterschool field's ability to support children's development of STEM learning dimensions described by any of the sub-indicators. (We define "low" level of confidence as a majority of respondents assigning a "low" value to any sub-indicator.)
- There were instances where respondents ranked an indicator lower on the list of what they believed the afterschool field could support and yet ranked related sub-indicators highly. For example, they ranked "ability to exercise STEM-relevant life and career skills" relatively low, and yet ranked sub-indicators for several STEM-relevant life skills—such as "demonstration of ability to work in teams" or "demonstration of applied problem-solving abilities"—highly. This disparity may suggest that respondents were unclear on how they contribute to the bigger goal and could document their impacts, and begs the question of whether the field is selling itself short, or whether it reflects a lack of clarity about how to articulate learning and indicators of learning. The tentative proposed framework provided in Table 3 is one way to help the field begin to map how its work contributes to STEM learning.

Differences in perspectives

While there was a broad level of consensus across both groups on the outcomes for afterschool STEM learning, there were some differences regarding the ranking of the indicators and the rating of the sub-indicators. Given the small sample size, the differences are not statistically significant. However, we believe these differences may be of interest and should be studied in greater depth to reveal possible differences in expectations between the two groups, which reflect the diversity of the afterschool field as a whole. As a reminder, "afterschool providers" comprised Group One and includes those who are responsible for selecting, designing, or leading programming, professional development, and delivering on outcomes at a program-wide level. Group Two is made up of "afterschool STEM supporters" and includes external stakeholders who are responsible for funding, and establishing policy and outcomes (to which providers must answer) for afterschool programs.

Indicators

There are two issues worth noting here:

1. Group One participants appear to express inconsistent opinions about how to describe program impacts. For example, they ranked the indicator "understanding the value of STEM in society" the lowest despite the commonly expressed belief among practitioners that afterschool programs play a significant role in helping children see the relevance of STEM in their daily lives and communities. Furthermore, when assigning confidence levels to achieving the sub-indicators, half of Group One expressed a high level of confidence in achieving "demonstration of awareness of opportunities to contribute to society through STEM." This appears to be a contradiction in that Group One felt highly confident that the field could support young people's awareness of how to contribute to society through STEM, but the least confident in the field's ability to help young people understand the value of STEM in society.

2. Group Two participants seem to have low confidence that afterschool programs can impart real and tangible STEM skills. They ranked the indicator "ability to exercise STEM-relevant life and career skills" as the lowest impact afterschool programs can have. In fact, they ranked "understanding the value of STEM in society" higher than the "ability to exercise STEM-relevant life and career skills" by a small margin. We are uncertain of how to interpret this result, as afterschool programs are typically noted as a powerful place for children to build social and career skills (such as problem solving, teamwork, etc.).

Sub-Indicators

The consensus ratings for the sub-indicators across both groups measured simple majorities (>50%) when categorizing the responses into high-medium-low level of confidence in achieving a particular impact. However, when the study team considered the responses of each group separately, we found some differences in the levels of agreement between the two groups of respondents.

Specifically we found that Group Two participants were more optimistic (by 10 percentage points or more) in their high levels of confidence about the likelihood that afterschool programs could achieve an impact in two areas:

- Development of an understanding of the variety of STEM careers related to different fields of study (Group Two: 75% vs. Group One: 59%)
- Demonstration of STEM skills (Group Two: 75% vs. Group One: 50%)

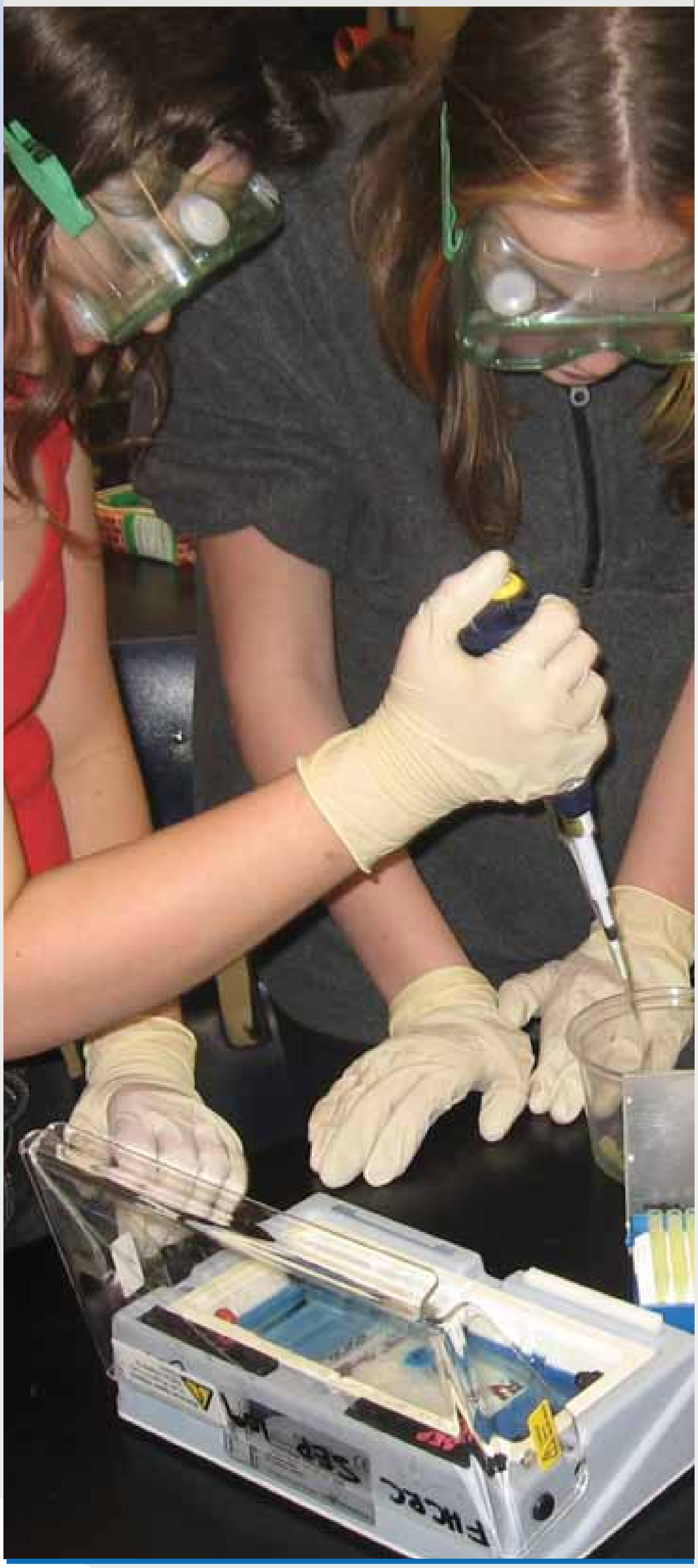
In contrast, though both groups had medium levels of confidence in the field's ability to show impacts in the following areas, it is notable that there were higher percentages of people in Group One who expressed high confidence (by 10 percentage points or more) about the field's ability to show these impacts:

- Demonstration of STEM knowledge (Group One: 33% vs. Group Two: 17%)
- Demonstration of knowledge of important civic, global and local problems that can be addressed by STEM (Group One: 35% vs. Group Two: 25%)
- Demonstration of knowledge of how to pursue STEM careers (Group One: 13% vs. Group Two: 0%)
- Demonstration of awareness that STEM is accessible to all (Group One: 25% vs. Group Two: 8%)
- Pursuit of other out-of-school-time STEM learning opportunities (Group One: 36% vs. Group Two: 25%)

Finally, we note that while both groups expressed a medium level of confidence in afterschool programs ability to impact the "pursuit of school STEM learning opportunities," 25 percent of Group Two expressed high confidence while only 10 percent of Group One expressed high confidence.

Resources

We asked both groups to comment on resources they felt were needed to achieve the impacts described by the sub-indicators. They could choose between funding, professional development for staff, partnerships with STEM-rich organizations, partnerships with STEM professionals, access to STEM curriculum, or write in a choice they believed was missing. Appendix 3 illustrates the responses to this question.



Funding was not the most dominant need expressed—rising to a high of >75% for only one indicator: supporting children's mastery of tools and technologies. Professional development was the most often-cited needed resource (for 14 of 17 indicators). Confirming some initial results from surveys conducted by the Afterschool Alliance, people believed partnerships with STEM-rich organizations (museums, science centers, universities, etc.) as well as with STEM professionals were important. We did not ask them for the reason why partnerships were so important, but we believe this reflects a desire for resources related to professional development, career exposure and other similar needs.

A few participants cited increased parental engagement and better partnerships with schools as needed resources that were not included in the pre-defined list.

Assessment

Both groups provided input on whether they believed assessment tools currently existed to document the impacts described by the sub-indicators. The most interesting thing we noted in responses to this question was the difference of opinion almost across the board between Group One and Group Two. Group One, afterschool providers, was consistently more pessimistic about the availability of tools while Group Two, afterschool supporters, was much more positive that tools existed.

This suggests three possibilities:

1. Group Two is much more knowledgeable and optimistic about assessment tools that may exist;
2. Group One is not currently aware of existing tools they could utilize to document these impacts; or
3. Group One is aware of some of the same existing tools but finds them inappropriate or impractical to use. Additional dialogue is needed between the state education policy makers and funders and the practitioners they support to become better informed about what tools exist and what the constraints of using those tools might be.

Analysis and Recommendations

The study yielded consensus about three major outcomes for children and youth participating in afterschool STEM programs and a set of indicators and sub-indicators that support these outcomes (see Table 3 on page 18).

While the expert panelists achieved overall consensus on these outcomes and indicators, there were several interesting distinctions that have implications for both policy and practice:

1. There was shared agreement that afterschool STEM is best positioned to demonstrate its contributions to the following three indicators of learning in a clear rank order: Active participation in STEM learning opportunities; Curiosity about STEM topics, concepts or practices; and Ability to productively engage in STEM processes of investigation. There was also agreement about the ability to impact a second cluster of indicators of learning, ranked lower, that include: Awareness of STEM professions; Ability to exercise STEM-relevant life and career skills; and Understanding the value of STEM in society.

This finding suggests two things. First, that the afterschool field appears to be most confident about impacting indicators that relate clearly to the active **doing** *of STEM learning activities (entailing participation, developing questions and actively inquiring). The field is positive, but not in a clearly ranked order, about its ability to support a second set of learning indicators related to understanding the practices and value of STEM in society. Second, the field appears to be less confident in how afterschool programs demonstrate that they contribute to children's coming to value the goals of STEM and STEM learning, as the two indicators related to this outcome were ranked in the second cluster of six indicators.*

2. Experts in the afterschool field feel most confident that their work supports young people's interests, inquiries and engagement with STEM activities. These are sub-indicators of progress toward STEM learning that can be seen and documented in immediate ways, within one afternoon for example. They represent an important dimension of learning as they are essential to laying the foundation for further participation in and study of STEM. The experts feel comparatively less confident in achieving other longer term outcomes such as youth demonstrating STEM knowledge, an understanding of STEM methods of investigation, and pursuit of further in-school or out-of-school STEM learning activities.

The afterschool field's greater confidence in demonstrating more immediate learning indicators over longer term ones may reflect the uncertainty of attendance and other structural features that are an inherent part of the afterschool setting. Such features must be taken into account in policy measures intended to evaluate or direct the focus of afterschool STEM programs. The development of both short term and long term outcomes—and the relative contribution of afterschool, school, and other variables—may not be understood or articulated through current widely used methods of evaluation and research, which focus on learning settings in isolation from one another.

STEM programs can support young people to:

- **Develop interest in STEM & STEM learning activities.**
- **Productively engage in STEM learning activities.**
- **Value the goals of STEM & STEM learning activities.**

3. When asked to rank their relative confidence in demonstrating children's progress toward the indicators of learning, all panelists included supporting children's development of STEM-relevant life and career skills in the second cluster of indicators. However, when asked to rank the sub-indicators in terms of those they felt best positioned to achieve, related sub-indicators such as the ability to work in teams or to apply problem-solving abilities to STEM investigations were among the top half of 17 sub-indicators ranked, with working in teams being the second most highly ranked of the 17.

The disparity between confidence levels with regard to achieving specific indicators of STEM-relevant skills (indicators associated with 21st century skills, which the afterschool field has embraced) and confidence about contributing to the larger construct of STEM-relevant skills suggests a possible lack of clarity about the relationship of discrete measurable outcomes (such as team work) and their relationship to essential dimensions of STEM literacy and practices.

4. When asked about the availability of assessment tools to document the consensus learning indicators, the study revealed that the afterschool STEM "supporters" (state and national education leaders and funders) are much more optimistic about the availability of such tools than the afterschool "providers."

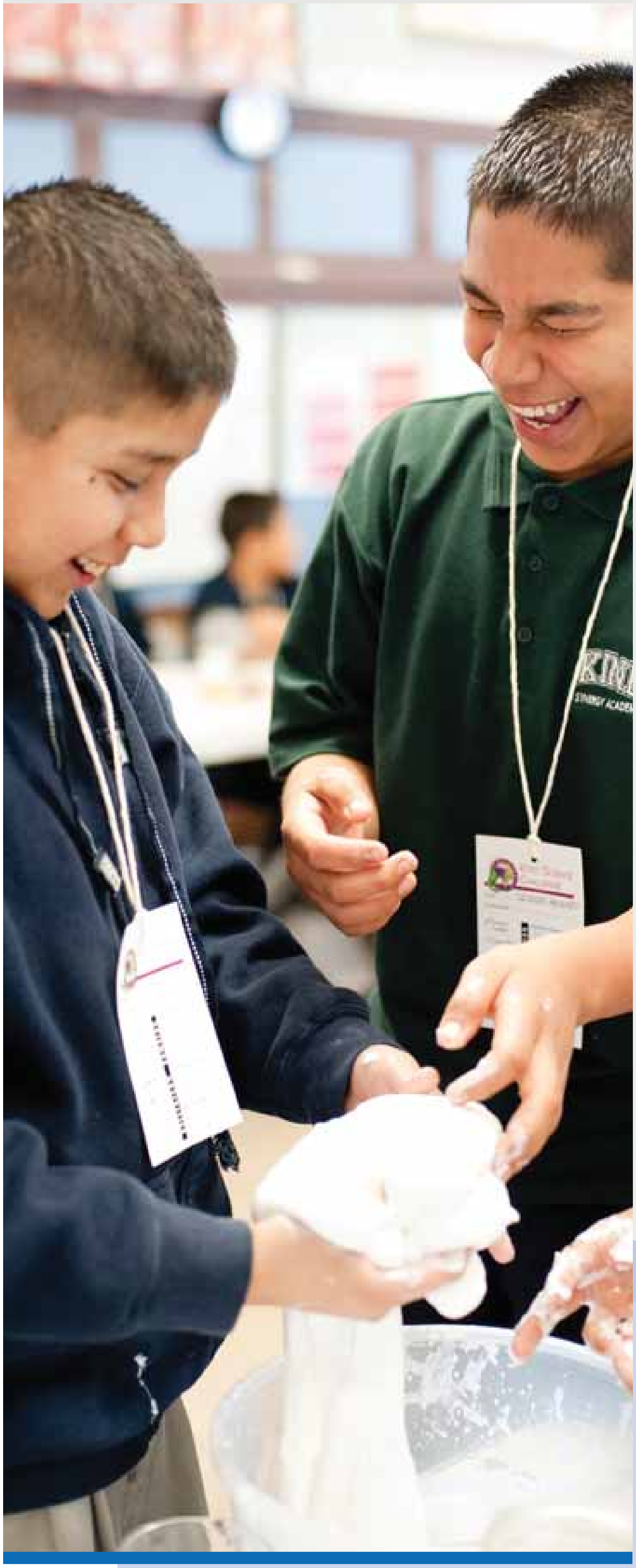
This disparity suggests that there may be different standards for assessment between the two expert groups of panelists in this study. The provider group may either be unaware that tools exist or they may feel that they are not accessible or usable.

5. The sub-indicator "pursuit of school STEM learning opportunities" garnered some of the least number of participants who felt highly confident the field could demonstrate this impact.

This finding is extremely important because to date many large-scale studies of afterschool programs have used school achievement measures to assess the contributions of afterschool programs to children's learning and development. This consensus study found that the field believes that it can make a contribution to children's pursuit of school STEM learning opportunities. However, it clearly communicated that among the list of 17 sub-indicators, this was one that they felt minimally confident about, and therefore would expect to see little demonstrated impact.

97%

of afterschool program providers and afterschool STEM supporters are in agreement that the proposed outcomes are appropriate for STEM learning.



Recommendations

Based on the findings described here and more fully in the report, we make the following recommendations to advance afterschool as a strategic partner in STEM education:

1. **Policy Makers**: We recommend that policy makers consider the outcomes and indicators articulated in this study (as described in Table 3 and the section on "Findings") to define the appropriate niche for afterschool programs in STEM education. In particular, we note that the afterschool field has expressed reservations about its ability to impact school STEM outcomes but has expressed higher confidence in its ability to impact other skills such as problem-solving abilities, demonstrating STEM skills, career awareness and "21st century skills" such as teamwork. These latter skills are as important as academic outcomes for the longer term to broaden access and participation, and to maintain an interest in STEM fields and careers. It is vital that STEM education policies reflect this understanding.

2. **Practitioners**: We recommend that program leaders utilize the framework of outcomes, indicators and sub-indicators articulated in this study (see Table 3) to map out how their work contributes to STEM education overall. While it is not realistic to expect that each program will achieve all of the outcomes and indicators described in the study, it is important to set appropriate and feasible goals that reflect the strengths and constraints of each program. Utilizing outcomes and indicators from a common framework to describe a program's impacts will allow for aggregation of the impacts of the afterschool STEM field as a whole.

3. **Evaluation and Assessment Experts**: As noted earlier, there is a difference in perspective between the two groups of panelists in this study about the availability of assessment tools. We recommend that a group of evaluation and assessment experts, practitioners, and funders be convened to examine the status of available tools and map them to this framework of outcomes, indicators and sub-indicators. If tools are not available to measure some of these impacts, we recommend that this study's results be utilized to inform the design of new measures to assess afterschool STEM learning.

Areas for Additional Research

1. Based on the panelists' consensus that they felt more confident in documenting immediate rather than longer-term impacts, we recommend that the afterschool STEM field explore the development of new research and evaluation methodologies and instruments that can investigate STEM learning across settings, showing how immediate STEM learning outcomes in the afterschool setting relate to longer-term learning in the school setting and vice versa. It may be only through such tools that the value and contributions of afterschool programs can be fully articulated and ultimately assessed. Indeed, this should be considered an area of investment and activity for the larger STEM education community and not just the afterschool STEM field.

2. We recommend that afterschool providers engage in a dialogue with STEM education leaders and researchers to more clearly articulate the relationship between discrete and measurable learning indicators or sub-indicators and the related overarching developmental STEM learning outcomes. This will help to clarify and resolve the apparent contradiction of expressing very low confidence in the afterschool STEM field's ability to achieve impacts as described by some indicators while expressing high confidence in the ability to achieve impacts described by sub-indicators related to that same indicator.

3. Finally, while the analysis did not detect statistical significance, we believe there are variations in perspective between the two groups of expert panelists included in this study and recommend further investigation to detect and resolve any real and meaningful differences between various stakeholders in afterschool STEM programs. Following up on this issue is sure to yield information about how to move the field forward to achieve its full potential and ideally provide a guide to funders as they seek areas for high-impact investments in the field.

References

Afterschool Alliance (2011). STEM Learning in Afterschool: An Analysis of Impacts and Outcomes. Available at http://www.afterschoolalliance.org/STEM-Afterschool-Outcomes.pdf

Barber, B. L., Stone, M. R., Hunt, J. E., & Eccles, J. S. (2005). Benefits of activity participation: The roles of identity affirmation and peer group norm sharing. In J. L. Mahoney, R. W. Larson & J. S. Eccles (Eds.), Organized activities as contexts of development: Extracurricular activities, after-school and community programs (pp. 185-210). Mahwah, NJ: Lawrence Erlbaum Associates.

Coburn, C. E., Honig, M. I., & Stein, M. K. (2009). What's the evidence on district's use of evidence? In J. D. Bransford, D. J. Stipek, N. J. Vye, L. Gomez & D. Lam (Eds.), The role of research in educational improvement (pp. 67-87). Cambridge: Harvard Education Press.

Coburn, C. E., & Stein, M. K. (Eds.). (2010). Research and practice in education: Building alliances, bridging the divide. Lanham, Maryland: Rowman & Littlefield.

Eccles, J. S. (2005). The present and future of research on activity settings as developmental contexts. In J. L. Mahoney, R. W. Larson & J. S. Eccles (Eds.), Organized activities as contexts of development: Extracurricular activities, after-school and community programs (pp. 353-371). Mahwah, NJ: Lawrence Erlbaum Associates.

Friedman, A. (Ed.). (2008). Framework for Evaluating Impacts of Informal Science Education Projects. (Available at: http://insci.org/resources/Eval_Framework.pdf)

Gupta, U.G. & Clarke, R.E. (1996). Theory and Applications of the Delphi Technique: A bibliography (1975-1994). Technological Forecasting and Social Change 53, 185-211.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. Educational psychologist, 41(2), 111-127.

Holland, D., Lachicotte Jr., W., Skinner, D., & Cain, C. (1998). Identity and agency in cultural worlds. Cambridge: Harvard University Press.

Jairath N. & Weinstein J. (1994). The Delphi methodology: a useful administrative approach. Canadian Journal of Nursing Administration 7, 29–42.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press.

National Research Council. (2007). Taking science to school: Learning and teaching science in grades K-8. Washington, D.C.: National Academies Press.

National Research Council. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. Washington, D.C.: The National Academies Press.

National Research Council. (2012). Assessment of Informal and Afterschool Science Learning. Commissioned papers available at http://sites.nationalacademies.org/DBASSE/BOSE/DBASSE_071087#.ULkF72eJun4

Nelson, S. R., Leffler, J. C., & Hansen, B. A. (2009). Toward a research agenda for understanding and improving the use of research evidence. Portland, OR: Northwest Regional Educational Laboratory.

Noam, G., Shah, A., Gitomer, D., Wylie, C., Buehler, J., Papazian, A. (in preparation). Dimensions of Success: An Observation Tool for STEM Programming in Out-of-School Time. Program in Education, Afterschool, and Resiliency (PEAR) at Harvard University and McLean Hospital

Smylie, M. A. (1989). Teachers' views of the effectiveness of sources of learning to teach. Elementary School Journal, 89(5), 543-558.

Appendix 1 – Summary of Round One of the Delphi Survey

Eighty representatives from the two groups were invited to join Round One of the study and 72 participated, an overall participation rate of 90 percent. Group One had 53 of 55 invitees participate (96 percent), and Group Two had 19 of 25 participate (76 percent).

All panelists answered the same online questionnaire in April-May 2012 to gather input on an initial framework of outcomes, indicators and forms of evidence, and to begin the process of coming to consensus.

Panelists were asked to review an initial framework proposed by the study team and suggest revisions, additions or deletions to the indicators and evidence for each outcome, add other comments about the outcomes; and suggest additional outcomes. Additional space was provided for other comments about the framework overall. Data were collected from 72 respondents completing seven quantitative items and 22 open-ended questions (whether panelists answered some open-ended questions depended on their answers to "yes" or "no" lead questions).   The open-ended questions yielded more than 500 qualitative data points (many responses included more than one idea and were divided into separate "data points" for analysis).

The data collected from Round One were analyzed using quantitative methods to determine basic frequencies and qualitative methods to determine trends from open-ended responses. Qualitative data were organized so that each individual idea (or "data point") was pulled apart from within one person's response. Each data point, therefore, represented a distinct idea mentioned by an individual respondent and could fit under the most relevant element of the framework. All data points were then analyzed by content, with similar responses grouped iteratively together in a larger category, which could then be quantified to represent the number of respondents mentioning the concept. Data from both groups were combined after an initial analysis of the data showed similar trends in responses from both groups.

Outcomes:

The results of analyzing these data showed that there was a high degree of consensus on the proposed outcomes. A few panelists provided some responses regarding additional outcomes—most concrete suggestions had been already included as an indicator or as a form of evidence while the remaining were general comments not specifically related to issues related to outcomes. A few remaining data points were instances of single data points such as staffing, science fairs and the arts.

Indicators:

There were several data points specifically related to indicators. Several were already included in the framework as either outcomes or as forms of evidence, a few were related to issues of measurement, otherswere related to career awareness and the rest covered issues of identity, revisions to wording, editorial comments, etc.

Evidence:

A majority of the comments in the section on evidence were related to forms of evidence that the study team judged to be age-specific, such as taking AP classes, or opportunity-specific, and not necessarily relevant to the entire afterschool STEM field that the framework is intended to address. Several "evidence" data points were suggestions for revisions or rewording, or were determined to have been addressed elsewhere in the framework, and a few addressed issues of measurement and career awareness. A small number of comments were related to identity, programming and confidence. All other data points in this category were mentioned less than four times.

Round One Summary:

Round one provided the panelists with many opportunities to weigh in on an initial proposed framework for outcomes and indicators and to offer their comments and suggestions for reworking this framework. Although there were many comments and suggestions offered in Round One, the study team determined that most of the comments and suggestions had been addressed elsewhere in the framework, or were specific to programming issues or editorial in nature and not applicable to a framework of general outcomes and indicators that could be applied to the afterschool field.

In Round One we found 97 percent agreement that the following outcomes were achievable through STEM programs in afterschool.

Through STEM afterschool programs, children and youth:

1. Develop interest in STEM and STEM learning activities;
2. Develop capacities to productively engage in STEM learning activities;
3. Come to value STEM fields and activities.

However, a few themes emerged as areas of concern in Round One that had to be considered for Round Two:

- The issue of whether career awareness was an indicator of interest or of values.
- The issue of whether identity was an outcome, an indicator or a type of evidence.
- Issues around the feasibility of collecting some of the types of data.
- The issue of whether pursuit of in-school STEM learning opportunities was an indicator of interest or of values.

Appendix 2 – Summary of Round Two of the Delphi Survey

The study team utilized the input gathered in Round One to design the questionnaire for Round Two. A second questionnaire was developed and administered in August 2012 to the same group of panelists who completed Round One (one panelist from Round One was on extended leave and could not participate). Based on feedback from Round One the study team made changes to the proposed framework indicators: adding new ones, revising existing ones and recategorizating.

Additionally we revised the framework terminology based on some of the issues encountered in Round One—what was called "Outcome Indicators" was changed to "Indicators" and what was called "Evidence" was changed to "Sub-indicators." The study team also provided "Examples of Evidence" to accompany the sub-indicators. As many comments in Round One related to whether particular indicators and sub-indicators were exclusive to one outcome, we disaggregated the indicators and sub-indicators from the outcomes.

There was a high degree of agreement between the responses from Group One (afterschool practitioners) and Group Two (afterschool supporters) in Round One. Hence the study team made a decision to administer the same survey to the two study groups but track their responses separately to see if there was a significant difference in responses from each group going forward.

Because panelists almost unanimously approved the outcomes proposed in Round One, the study team focused Round Two on the revised indicators and sub-indicators. The Round Two questionnaire provided a means for panelists to come closer to consensus by asking them to rank the revised indicators and sub-indicators according to those they felt the field was best positioned to achieve and to rate the sub-indicators according to the level of confidence the panelists had that the field could achieve these impacts. 59 out of 71 panelists responded to the Round Two questionnaire for a response rate of 83 percent.

Data collected from Round Two were analyzed using quantitative methods (basic frequencies, counts, percentages). Nine open-ended comments provided by the panelists in Round Two were reviewed and considered by the study team, though no formal qualitative analysis was conducted.

Indicators:

In analyzing the data for Round Two, we noted that Group One (afterschool program leaders) and Group Two (afterschool STEM supporters) respondents had slightly different views on which indicators they believed the afterschool field to be best positioned to impact.

Table 4:

Ranking of Indicators by Groups One and Two

Indicator	Group One Rank (Afterschool Program Providers)	Group Two Rank (Afterschool STEM Supporters)	Both Groups Aggregated
Active participation in STEM learning opportunities	1	1	1
Curiosity about STEM topics, concepts or practices	2	2	2
Ability to productively engage in STEM processes of investigation	3	3*	3
Ability to exercise STEM-relevant life and career skills	4	6	5
Understanding the value of STEM in society	6	5	6
Awareness of STEM professions	5	3*	4

*tie

The results suggest that although there is a high level of agreement among the two groups, the afterschool STEM supporter group may believe more strongly that the afterschool field can impact student awareness of STEM professions than the afterschool leader group believes. At the same time the afterschool STEM supporter group appears to believe that supporting young people to develop their ability to exercise STEM relevant life and career skills (team work, problem solving, and mastery of STEM technologies and tools) is the least likely impact of programs, whereas the afterschool leader group was more confident in the field's ability to achieve this impact.

Ranking of sub-indicators:

Panelists were also asked to rank the sub-indicators within each indicator in the order they felt the afterschool field is best positioned to have an impact. The ranking was a forced choice between the sub-indicators in an effort to determine how panelists would rank the sub-indicators within an indicator. The ranking choices offered ranged from 1-3, with 1=Most Impact and 3=Least Impact. There were no major surprises in the responses to this question, with panelists ranking the sub-indicators they could impact directly higher than those that they had less control over.

Rating of sub-indicators:

Panelists were also asked to "rate" each sub-indicator by the confidence level they could assign to the afterschool field being able to achieve this impact. Ratings ranged from 1-5 where 1=Most Confident and 5=Least Confident. Sub-indicators could have the same confidence rating, in other words a respondent could indicate that they were "most confident" about many or even all of the sub-indicators within an indicator. Here, we found a surprising result: In several cases respondents reported high levels of confidence for particular sub-indicators, such as "demonstrating teamwork" that were associated with indicators that were ranked low in terms of the field's ability to achieve impact such as "ability to exercise STEM-relevant life and career skills." In another case the indicator ranked most highly, "active participation in STEM learning opportunities," had two sub-indicators that the panelists had little confidence could achieve impact, "pursuing additional OST STEM learning opportunities" and "pursuing STEM school opportunities" (only 27 percent felt confident about achieving this impact).

Both groups rated their confidence in "active engagement and focus in STEM learning activities" and "demonstration of ability to work in teams to conduct STEM investigations" very highly. When analyzing the results disaggregated by group, we noted that while many of the sub-indicators received similar ratings from the two groups, there were a few crucial differences. In particular, it appears that Group One (afterschool leaders) respondents rated their confidence in sub-indicators reflecting a building-up of knowledge and skills relatively low while Group Two (afterschool STEM supporters) respondents rated it relatively higher. It is also noteworthy that Group One respondents were pessimistic about influencing school performance through their afterschool STEM offerings while Group Two respondents seemed to express more optimism about this impact.

The data and input obtained thus far appear to be hinting at some interesting potential conclusions about afterschool STEM learning. It is clear from the Round Two data that Group One (afterschool leaders) respondents are much more confident about things they can directly influence and control than impacts that may be secondary and not directly under their influence. At the same time it appears that in some cases, Group Two respondents (afterschool STEM supporters) believe that the field should be able to demonstrate evidence of impact in areas that Group One respondents do not feel they can influence.

Additional space was provided for other comments for the study team. Nine unique comments were made that varied in content, from a concern about making global judgments about the field when there is so much variation in the quality of programming, another observation that the field needs to start career awareness work as early as possible, to an observation that the indicators may provide good benchmarks for program improvement. Two comments were related to the questions themselves—one expressing the difficulty in deciding and one saying there is a difference in asking panelists to rate what the field has the ability to influence vs. what a panelist hopes the field could have the ability to influence.

Appendix 3 — Resources Needed by Afterschool STEM Programs

Sub-indicators - Resources needed to achieve this impact (Check all that apply)	Funding	More professional development for staff	Partnerships with STEM-rich organizations (science centers, universities, labs, etc.)	Partnerships with STEM professionals	Better access to STEM curriculum	Other
Active engagement and focus in STEM learning activities *(Examples of evidence: persisting in a task or program; sharing knowledge and ideas; expressing enthusiasm, joy, etc.)*	66%	92%	70%	52%	70%	2%
Demonstration of ability to work in teams to conduct STEM investigations *(Examples of evidence: communicating effectively with team members; collaborating effectively with team members; demonstrating leadership on the team)*	42%	86%	38%	38%	48%	2%
Active inquiries into STEM topics, concepts or practices *(Examples of evidence: exploring ideas verbally or physically, questioning, hypothesizing, testing)*	46%	88%	60%	50%	56%	2%
Development of an understanding of the variety of STEM careers related to different fields of study *(Examples of evidence: gaining knowledge about relevant professions; gaining knowledge of where such jobs and careers exist)*	40%	50%	74%	90%	26%	4%
Demonstration of an understanding of relevance of STEM to everyday life, including personal life *(Examples of evidence: referencing examples of STEM in everyday life, everday problems)*	36%	80%	74%	78%	40%	2%
Demonstration of STEM skills *(Examples of evidence: formulating questions, testing, exploring, predicting, observing, collecting and analyzing data, etc.)*	54%	90%	46%	36%	70%	2%
Demonstration of applied problem-solving abilities to conduct STEM investigations *(Examples of evidence: engaging in critical thinking, questioning, sequencing, reasoning)*	46%	90%	42%	36%	56%	2%
Active information seeking about mechanical or natural phenomena or objects *(Examples of evidence: conducting Internet searches for more information; getting books/journals about STEM; watching TV programs on science, etc.)*	40%	66%	54%	38%	40%	4%
Demonstration of an understanding of STEM methods of investigation *(Examples of evidence: demonstrating understanding of the nature of science; using evidence-based reasoning and argumentation; demonstrating engineering design practices)*	54%	88%	66%	56%	64%	4%
Demonstration of mastery of technologies and tools that can assist in STEM investigations *(Examples of evidence: developing capacity to use measurement and other scientific instruments; running computer programs for data analysis; developing effective methods to communicate findings)*	80%	90%	62%	46%	64%	10%
Demonstration of awareness of opportunities to contribute to society through STEM *(Examples of evidence: engaging in a service-learning project)*	46%	72%	70%	66%	34%	4%
Demonstration of STEM knowledge *(Examples of evidence: demonstrating increase in knowledge in specific content areas; making connections with everyday world; using scientific terminology)*	52%	84%	60%	52%	66%	4%
Demonstration of knowledge of important civic, global and local problems that can be addressed by STEM *(Examples of evidence: contributing to projects that address a community need; developing awareness of how STEM is implicated in larger societal issues)*	46%	84%	72%	66%	54%	6%
Demonstration of awareness that STEM is accessible to all (*Examples of evidence: expressing a desire to meet role models; declaring STEM interests and majors; desiring to become a role model to pave the way for others)*	42%	70%	76%	80%	32%	2%
Pursuit of other out-of-school-time STEM learning opportunities *(Examples of evidence: enrolling in programs; attending programs regularly; reporting doing STEM-related activities at home)*	52%	58%	56%	48%	26%	14%
Demonstration of knowledge of how to pursue STEM careers *(Examples of evidence: acquiring knowledge of what courses are needed to prepare for or pursue STEM degrees; declaring STEM interests or majors)*	38%	64%	64%	76%	34%	6%
Pursuit of school STEM learning opportunities *(Examples of evidence: participating more actively in school STEM activities; enrolling in courses; selecting special programs or schools; improving academic achievement)*	38%	68%	46%	48%	26%	20%

Afterschool Alliance
afterschoolalliance.org
1-866-KIDS-TODAY