variations on a theme

Characteristics of Out-of-School Time Science Programs Offered by Distinct Organization Types

by Sandra L. Laursen, Heather Thiry, Tim Archie, and Rebecca Crane

The out-of-school time (OST) domain offers a promising resource for enriching young people's experience of science, technology, and engineering (Afterschool Alliance, 2004). Belief is widespread that OST programs are ideal locations in which to learn science and that youth participation may increase access to science for underrepresented groups, such as girls or minorities, and enhance the science workforce (Afterschool Alliance, 2004; Afterschool Alliance & Coalition for Science After School, 2008; Chi, Freeman, & Lee, 2008; Congressional Commission, 2000; Friedman & James, 2007).

Indeed, many afterschool programs do offer science activities.[1] For example, an evaluation of the 21st Century Community Learning Centers program reported that 70 percent offered some science (Learning Point Associates, 2006); perhaps 10–15 percent were exclusively science-focused (N. Naftzger, personal communication).

SANDRA L. LAURSEN is a research associate and co-director of Ethnography & Evaluation Research (E&ER) at the University of Colorado Boulder. E&ER is an independent research unit that specializes in studies of education and career paths in science, technology, engineering, and mathematics. Sandra's research interests include inquiry-based learning, the status of women and underrepresented ethnic groups in the sciences, and professional development in teaching. She received a Ph.D. in physical chemistry from the University of California Berkeley.

HEATHER THIRY is a research associate with E&ER. Her research has focused on students' career pathways and decision making in the sciences and on improving educational outcomes for students traditionally underrepresented in STEM disciplines. She received her doctorate in educational foundations, policy, and practice.

TIM ARCHIE is a professional research assistant with E&ER. His research interests include informal and formal STEM education opportunities for K–12 students and the retention of university students and faculty in STEM disciplines. He is pursuing a doctorate in human dimensions of natural resources at Colorado State University.

REBECCA CRANE served as a professional research assistant with E&ER. She has studied gender issues in computer science, inquiry-based learning in mathematics, and out-of-school time science.

The Coalition for Science After School found that 88 percent of programs in its network offered science activities, yet most offered 40 or fewer hours of science programming per year (Chi et al., 2008).

Despite this broad interest, we know rather little about the scope or nature of OST youth programming focused on science (Chi et al., 2008). Friedman (2008) identifies several reasons for the inadequate state of knowledge. Variety poses a challenge for researchers, with OST sites in schools, museums, zoos, science and nature centers, aquariums, planetariums, and community centers; formats include afterschool clubs, camps, workshops, festivals, research apprenticeships, and more. Moreover, there is no single national network through which researchers might recruit nationally representative samples of programs. Diversity of activities and content in programs, as well as in the frequency, timing, and duration of programming, also make it difficult to study OST science. Thus, to date there have been no large-scale, national studies of characteristics or formats of science-focused OST programs.

These issues also complicate study of the youth outcomes of OST science. Most research and evaluation studies have documented youth outcomes at a single site. These studies have broadened our understanding of how youth engage with science in the afterschool space by documenting positive outcomes such as:

- Science learning: scientific concepts; technical, data-gathering, and analysis skills (e. g., Bell, Blair, Crawford, & Lederman, 2003; Bleicher, 1996; Etkina, Matilsky, & Lawrence, 2003; Ritchie & Rigano, 1996)
- Gains in teamwork and communication (Diamond, St. John, Cleary, & Librero, 1987; Ritchie & Rigano, 1996)
- Affective outcomes: positive emotions; growth of confidence, curiosity, or interest (Barab & Hay, 2001; Bouillion & Gomez, 2001; Diamond et al., 1987; Stake & Mares, 2001, 2005)
- Changes in identity: seeing oneself as a scientist; seeing science as relevant to everyday life; clarifying career ideas (Bouillion & Gomez, 2001; Diamond et al., 1987; Fadigan & Hammrich, 2004; Richmond & Kurth, 1999)
- Changes to life paths, such as greater likelihood of pursuing STEM undergraduate degrees and careers (Afterschool Alliance, 2011; Chi, Snow, Lee, & Lyon, 2011)

These science-specific outcomes augment more general benefits documented in the youth development literature (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 2004), such as reduction of risky behaviors and promotion of academic performance (Eccles, Barber, Stone, & Hunt, 2003). Variations by student characteristics—such as gender, age, and socioeconomic status—as well as by program design and implementation are important but less fully studied (Dubois, Doolittle, Yates, Silverthorn, & Tebes, 2006; Halpern, 2005; Rahm, Martel-Reny, & Moore, 2005).

Such findings suggest that engaging in well-designed science OST programs benefits participants. Early development of interest and competence in science, as well as exposure to professional role models and authentic experiences, may be important precursors that lead participants to take more, and more rigorous, science and mathematics courses in school, graduate from high school, and pursue degrees or jobs in science and technical fields. These fields offer well-paid, secure employment (Langdon, McKittrick, Beede, Khan, & Doms, 2011) and collectively generate innovation that fuels the nation's economy, improves human health, solves environmental challenges, and strengthens national security (Members of the 2005 "Rising Above the Gathering Storm" Committee, 2010).

Given these potential personal and societal benefits, it is essential to understand the design, structure, content, and goals of such programs. Only then can we hope to elucidate the conditions under which OST science programs may or may not achieve good outcomes for participants, thus identifying evidence-based "best practices" for the field. Such information also helps to determine the extent of youths' access to these experiences and to identify local and national opportunities to deepen and broaden access. Guided by similar thinking, recent efforts to "map" the OST landscape have explored youth exposure to science in general afterschool programs (Chi et al., 2008; Means, House, & Llorente, 2011; Noam et al., 2010). These studies have found that typical afterschool programs struggle to provide science programming because of a lack of resources and knowledge and limited access to professional development. They don't establish whether or how the same issues arise in OST programs that are specifically focused on science.

Several recent studies have mapped particular segments of the OST science community, taking the first steps to increase understanding of this domain and generating some insight into common program characteristics and concerns. For example, a recent survey of OST science programs serving older youth suggested that the majority target underserved students (Porro, 2010). Typical program elements include teamwork, inquiry-based learning, career awareness, and mentoring. An effort to map the diverse portfolio of projects funded by the National Science Foundation's Innovative Technology Experiences for Students and Teachers (ITEST) program documented that many of these projects rely on partner organizations and a mix of volunteers and paid staff to serve varied audiences including educators, researchers, youth, and policymakers (Parker, Na'im, & Schamberg, 2010). Like the programs for older youth, many ITEST projects serve underrepresented minority youth. The projects encompass a variety of program designs and formats, including summer, afterschool, and weekend programming; online or social networking components; and youth employment or internships. Finally, a study of youth science programs in museums and science centers (Sneider, 2010) found that these organizations provide a "wide range of learning experiences" for youth. Many science center programs serve older youth, provide adult mentors, and encourage youth, in turn, to teach the general public or to mentor younger students (Sneider, 2010).

However, to date there has been no systematic study of the broader landscape of OST science programming. Our national study, Mapping Out-of-School Time Science (MOST-Science), begins to fill this lacuna by examining a national sample of OST programs focused on science, engineering, or technology.

Each of these recent mapping efforts focuses on a single segment of the OST science landscape; together they begin to reveal important characteristics and common threads that run across programs. However, to date there has been no systematic study of the broader landscape of OST science programming. Our national study, Mapping Out-of-School Time Science (MOST-Science), begins to fill this lacuna by examining a national sample of OST programs focused on science, engineering, or technology. Our research questions are:

- What features describe the landscape of U.S. science-focused OST programming?
- How do programs vary by activities, populations served, duration and frequency, desired outcomes, and other key factors?
- What patterns in these variables help to characterize current program offerings and define areas of future opportunity?

In this paper, we describe initial findings about the characteristics of these programs and their home organizations, including aspects of program design, structure, funding, staffing, and youth audience. We then discuss how organization types differ in these program aspects and draw out implications for practice.

Study Methods

To collect data for this study, we invited OST science program directors to fill out an online questionnaire.

Questionnaire Development

Questionnaire items were developed based on our research questions and on data from more than 40 interviews conducted with OST science program directors and with well-placed leaders and observers in the field. The items were reviewed by several experts and then piloted by several program directors. After refining the questionnaire based on this feedback, we launched it online using FileMaker's Instant Web Publishing feature.

The questionnaire distinguished between the host organization and the one or more programs it runs. Respondents could enter multiple programs offered by their organization. The survey included sections addressing:

- The organization's location and type and the respondent's position in it
- The organization's connections: partnering organizations, funding sources, national networks
- Engagement in program evaluation
- Program title and history
- Program audience
- Program structure and fees
- Program content and staffing
- Any arrangement of programs into "ladders" or sequences for youth progressing in age and ability

Altogether, the survey included 126 items in 10 main sections. Because many questions depended on prior answers, respondents moved through the questionnaire in a non-linear fashion and did not answer all questions about each of their programs. Contact us for copies of the questionnaire items.

Sampling

We established six criteria to bound our study sample, including programs that:

- Focus on science, engineering, or technology, as defined by the respondent
- Include youth in or entering grade 6 or higher

- Engage youth with their peers or the public
- Involve youth for multiple sessions
- Have existed for one year or longer
- Take place outside of school time

We selected these sampling criteria based on our research questions. We focused on the middle and high school years as the time when students' science interests may decline or strengthen and when students begin to make decisions about future careers (Tai, Liu, Maltese, & Fan, 2006). In naming our study MOST-Science, we used the term *science* broadly, including technology and engineering as well as life, physical, Earth, and space sciences. Disciplinary distinctions are often not firm at the lower levels of this grade range; they may matter more to adults than to young people. We excluded mathematics-focused programs based on our interest in engaging youth in hands-on investigation and design experiences, because these features are less often found in math programs. Finally, our choice to focus on group-oriented programs reflects our interest in the role of collaborative learning in youth outcomes.

The questionnaire was launched in November 2011 and closed in June 2012. We distributed the questionnaire through multiple mechanisms, trying to reach the widest possible sample. Invitations were issued through e-mail distribution lists and newsletters, direct e-mail invitations, our professional and personal networks, "MOSTcards" distributed at meetings and conferences, and social media.

In all, we sent nearly 2,300 e-mail invitations, more than 1,900 of which went to specific OST science programs. More than 300 additional invitations reached well-connected individuals in informal, K–12, afterschool, and higher education and in diversity initiatives across engineering and science disciplines. We know that some of these individuals shared our invitation with their own networks and that some programs received multiple invitations. However, we have no way to assess how many people representing how many programs received an invitation, so we cannot compute a response rate for the questionnaire. Our final data set includes 712 programs from 45 states, of which 417 programs (59 percent) met all six sampling criteria and answered one or more questions pertinent to this analysis. The sample size for any particular result varies, as not all respondents answered every question.

We cleaned these data, removing write-in responses for future analysis before importing the quantitative data into the SPSS 20 statistical package, which we used to calculate means, frequencies, and percentages for the organization- and program-level data.

How Do Program Features Vary by Organization Type?

We first describe the types of organizations contributing programs to our sample. We then examine how typical program characteristics vary across organization types, including aspects of the programs' youth audience, structure, and financial support.

Types of Organizations Hosting OST Science Programs

We collected data from 417 programs and classified their host institutions into eight organization types, as shown in Figure 1 (page 40). Respondents were asked to report on all of their organization's OST program offerings; some reported on a single program while others supplied data for up to six program offerings.

Roughly half of all programs in our sample were represented by just two organization types: nonprofit organizations and universities and colleges. Programs least represented in the sample were those hosted by private sector organizations and by government laboratories such as those run by the Departments of Energy, Commerce, and Defense. The majority of programs offered by private sector organizations were private summer camps, a fact that provides context for other results for this organization type.[2] We do not argue that this sample represents the distribution of OST science programs nationally. However, the breadth of the sample does enable us to examine differences in programs by their organization type.

Contact Time for Youth Participants

We asked about the annual contact hours for an "average participant" in each program. Some programs likely reported based on actual records, while other programs reported best guesses that included variation in a typical participant's choices. Approximately half of all programs reported that their youth participants averaged 80 hours or fewer in a year, while half reported 80 hours or more. Approximately 25 percent of programs reported average annual contact hours over 200. Responses ranged as low as four hours and as high as 740 hours.

The average number of program contact hours differed widely by organization type, as shown in Figure 2 (page 41). Nonprofit organizations provided programs with more contact hours than did any other organization type. Programs in two categories, K–12 school districts and government labs, averaged 100 or fewer contact hours per year, with programs provided by government labs reporting the lowest average. Overall, contact time was high, in-

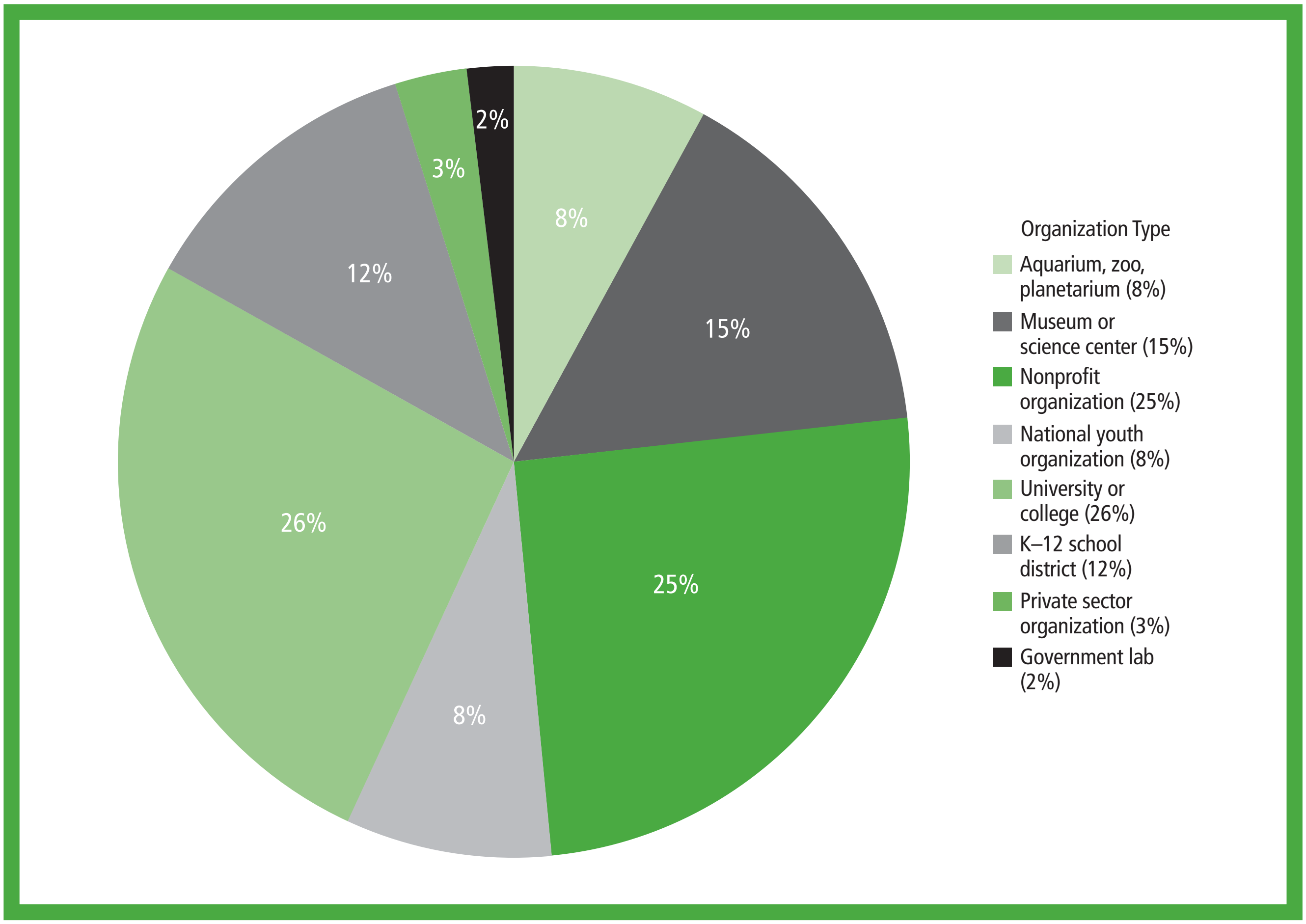

Figure 1. Percentage of Programs by Organization Type (*N* = 417)

dicating that many programs offered youth an experience of substantial depth; this finding also reflects our choice to exclude single-day programs.

Characteristics of Program Populations

We asked organizations to report the annual youth population for each program they described. The average population for each organization type is shown in Figure 3 (page 41). Private sector organizations showed a dramatically higher average annual population than all other organization types, at nearly 800. Approximately 90 percent of private sector programs were summer camps, which typically offer multiple sessions to large numbers of participants. Nonprofit organizations reported the next largest population, while programs offered by K–12 school districts served the fewest participants. These programs are likely limited to students in a particular district, whereas other organizations may recruit from a larger pool of participants. Programs by all other organization types served similar numbers of participants per year, at 100–200 youth.

Demographics of Youth Participants

We asked respondents to report the average demographics of their program participants by gender and ethnicity, as shown in Table 1 (page 42). On average, most programs across organization types served a high proportion of girls, 56 percent. National youth organizations reported the highest proportion of girls, at 82 percent, while private organizations, school districts, and government labs reported the lowest proportions, near 40 percent. All other organization types reported significant proportions of girl participants, perhaps indicating that many programs focus on engaging girls in science.

Overall, programs by nonprofit organizations served the most ethnically diverse populations, while programs by K–12 school districts and by aquariums, zoos, and planetariums served the least ethnically diverse populations. Private sector organizations and government labs reported programs with the highest average proportion of Asian students, while national youth organizations served the smallest proportion of Asian students. Programs by nonprofit organizations served the highest proportion of

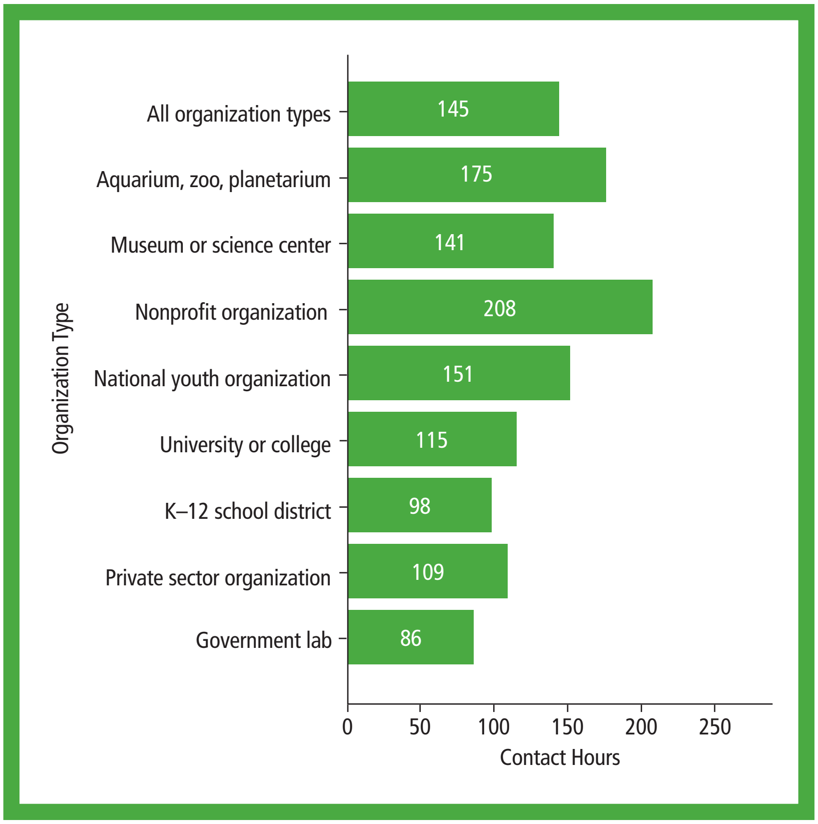

Figure 2. Average Annual Program Participant Contact Hours by Organization Type (*N* = 350)

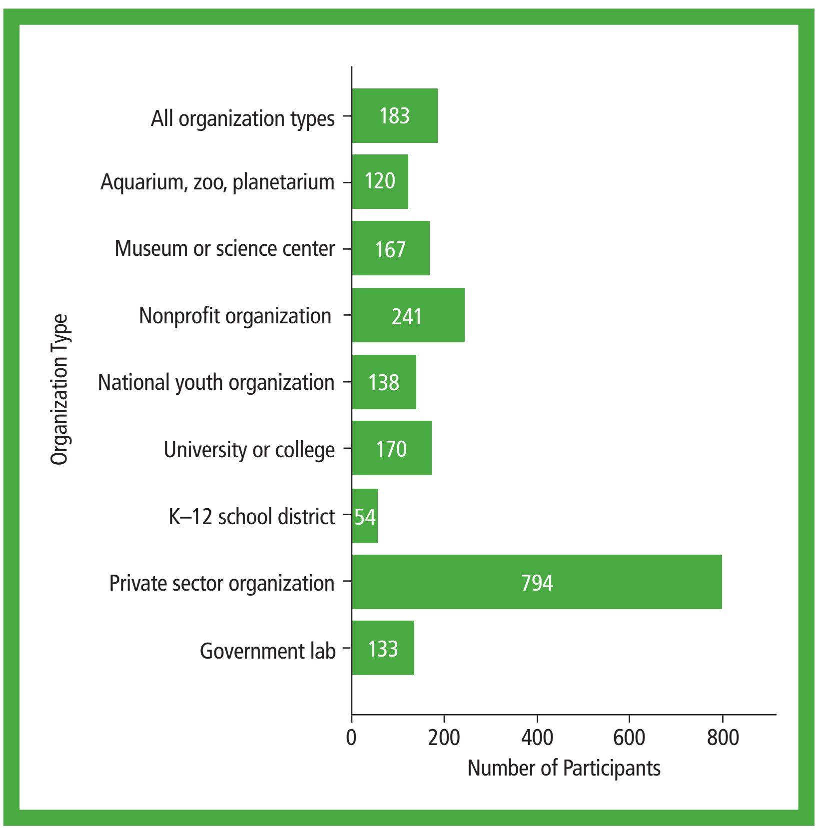

Figure 3. Average Annual Program Population by Organization Type (*N* = 341)

Black and Latino participants, while government labs served the lowest proportion. These results do not take into account program locations and variations in local populations.

Target Youth Audience

We sought to understand whether and how organizations targeted specific youth audiences or included all types of youth (Figure 4, page 43). Respondents reported on whether their program targeted girls, underrepresented minorities, youth with disabilities, and gifted and talented youth. The targeted audience may differ from a program's actual audience, depending on the local population, the success of its outreach and recruiting, and whether it includes non-targeted groups.

In general, girls were most commonly targeted, followed by underrepresented minorities, gifted and talented youth, and youth with disabilities. National youth organizations most frequently targeted girls, with 67 percent of programs thus directed. This finding reflects the gender-specific nature of some national youth organizations, such as Girl Scouts and Girls Inc.

Underrepresented minorities were targeted by programs across all organization types, with nonprofit organizations targeting minority youth at the highest rate (49 percent) and national youth organizations at the lowest rate (10 percent). Gifted and talented youth were targeted by programs of all organization types except national youth organizations and government labs. Youth with disabilities were targeted less frequently than any other group. No government lab reported targeting these youth; they were most often targeted by private sector organizations (27 percent) and K–12 school districts (23 percent).

Overall, national youth organizations appeared to more often identify girls as a target audience than did other organizations. Government labs and aquariums, zoos, and planetariums less often defined any target audience than did other organization types, with no group targeted by more than 20 percent of organizations. In future work, we plan to look at these characteristics in relation to the organization's scope and mission, considering is-

Table 1. Average Percentage of Program Participants by Gender and by Ethnicity, by Organization Type (N = 327)

ORGANIZATION TYPE	GIRLS	ASIAN	BLACK	LATINO	MULTI-RACIAL	NATIVE AMERICAN	OTHER	WHITE
Aquarium, zoo, planetarium	60.6%	12.5%	14.8%	11.8%	4.6%	0.9%	1.5%	58.4%
Museum or science center	57.9%	9.6%	25.6%	16.9%	6.0%	2.2%	4.4%	49.0%
Nonprofit organization	56.2%	8.3%	35.6%	33.7%	8.2%	3.0%	6.6%	26.6%
National youth organization	82.3%	3.3%	19.6%	28.3%	6.6%	3.7%	3.3%	48.4%
University or college	57.8%	11.6%	19.9%	17.5%	4.9%	3.2%	2.6%	49.3%
K–12 school district	40.2%	18.6%	10.2%	13.6%	5.7%	0.5%	2.8%	61.5%
Private sector organization	40.0%	23.7%	9.7%	10.4%	11.8%	2.6%	7.0%	49.8%
Government lab	42.6%	23.3%	7.0%	10.0%	6.0%	0.3%	0.5%	45.4%
All organization types	56.1%	12.0%	22.5%	20.8%	6.2%	2.4%	3.8%	46.9%

Note: Average percentages, as reported by respondents, do not total 100%.

sues such as expectations of publicly funded institutions, differences between scientific and educationally focused organizations, and the ability of local organizations to target specific local needs.

Financial Support of Youth Participants

To understand the range of program practices intended to support youth financially, we asked organizations about fee structures and scholarship opportunities (Table 2, page 44). Respondents were asked both whether participants pay, do not pay, or are paid a stipend to participate in their programs and whether scholarships are offered. Overall, the most common practice was to neither charge nor pay youth. National youth organization programs were most likely to require participants to pay (67 percent), but 85 percent of these also offered scholarships, a high proportion relative to other organization types. Our findings show that private sector programs were the least accessible for low-income participants. These programs often required participants to pay (38 percent) and were least likely to provide scholarships (33 percent).

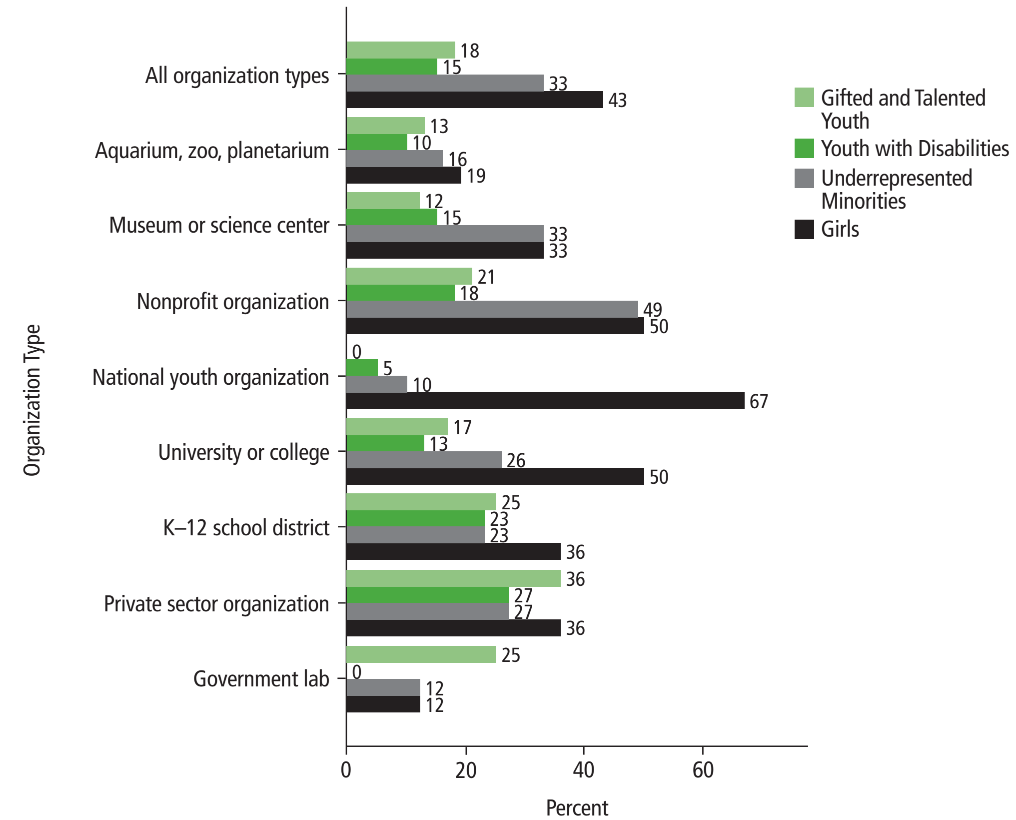

Figure 4. Average Percentage of Programs Identifying Specific Target Audiences, by Organization Type (*N* = 350)

Institutional Support: Funding and Networks

In addition to the financial support of youth, we asked organizations to report on support for their programs at the institutional level by public and private funders (Figure 5). Overall, respondents reported that their programs were supported by zero to seven outside funding sources. On average, about half of the organization types were supported by more than two public and two private funders. The rest were supported by one or two public and private funders. In general, larger organizations had more funding sources than did smaller organizations.

One interesting exception to this general rule is shown in the programs offered by national youth organizations, which averaged just over one public and one private funder each. This finding suggests a reason that these programs often charge youth to participate, as reported in the previous section. It may also mean that external funding is sought by the national organization rather than by the local chapters that responded to our questionnaire.

We also asked respondents to report on professional affiliations related to their organization and programs (Figure 6). On average, all organization types reported at least one professional affiliation, with a maximum of seven. Museums, science centers, aquariums, zoos, planetariums, and nonprofit organizations typically reported two to three professional affiliations, while all other organization types reported one to two professional affiliations. K–12 school districts, national youth organizations, and government labs appeared less well networked than were other organization types.

Staffing and Professional Development

We asked several questions about staffing and professional development in organizations. When asked if they had at least one full-time staff member, 90 percent of organizations that answered this question reported that they did. Private sector organizations reported the lowest levels of full-time staff, at 43 percent, reflecting a reliance of summer camps on seasonal staff.

Almost all (99 percent) organizations that responded reported that they had at least one staff member with an education background, and 99 percent also reported at least one staff member with a background in a scientific or technical field. National youth organizations reported the lowest rate of staff with science backgrounds (90 percent). We did not gather data on the percentage of staff who had education or science backgrounds, only on their presence.

All organizations reported providing initial training for employees; however, the opportunities for ongoing

	FEE STRUCTURE			SCHOLARSHIP	
	YOUTH PAY	YOUTH ARE PAID A STIPEND	YOUTH DO NOT PAY	NO SCHOLARSHIP OFFERED	SCHOLARSHIP OFFERED
AQUARIUM, ZOO, PLANETARIUM	9%	18%	73%	35%	65%
MUSEUM OR SCIENCE CENTER	26%	22%	52%	11%	89%
NONPROFIT ORGANIZATION	23%	13%	64%	40%	60%
NATIONAL YOUTH ORGANIZATION	67%	5%	29%	15%	85%
UNIVERSITY OR COLLEGE	21%	32%	46%	11%	89%
K–12 SCHOOL DISTRICT	18%	3%	79%	47%	53%
PRIVATE SECTOR ORGANIZATION	38%	0%	62%	57%	33%
GOVERNMENT LAB	0%	29%	71%	50%	50%
ALL ORGANIZATION TYPES	26%	17%	58%	26%	74%

Table 2. Program Fees and Scholarships by Organization Type (*N* = 260)

training varied across organization types. Roughly 50 percent of K–12 school districts provided ongoing training for program staff, while the average for all other organization types was better than 75 percent. The lower rate of staff training in K–12-based programs may reflect the use of teachers, who are assumed to have pedagogical or science content background, as staff.

What Features Distinguish Programs Offered by Specific Types of Organizations?

In the previous section, we discussed results for each questionnaire domain by organization type. When considering the cumulative results for each organization type, certain features stand out as distinguishing.

Several organization types showed features that relate to their dual expertise in science and education. For example, museums and science centers offered programs with above-average contact hours and average annual program populations to a fairly diverse and often specifically targeted audience. Programs from these organizations were commonly quite accessible in terms of their fee structure and scholarship availability. They drew upon a large number of public and private funders and were well networked. Staff were more often full time, educated in relevant areas, and trained for their program duties, reflecting the dual scientific and educational missions of these institutions. Though often operating at more modest scales, programs from aquariums, zoos, and planetariums showed similar features. Programs from colleges and universities likewise reflect the scientific, educational, and logistical expertise typically available in higher education institutions.

A different set of strengths was exhibited by programs that were most effective in reaching large and diverse youth audiences. For example, nonprofit organizations offered the

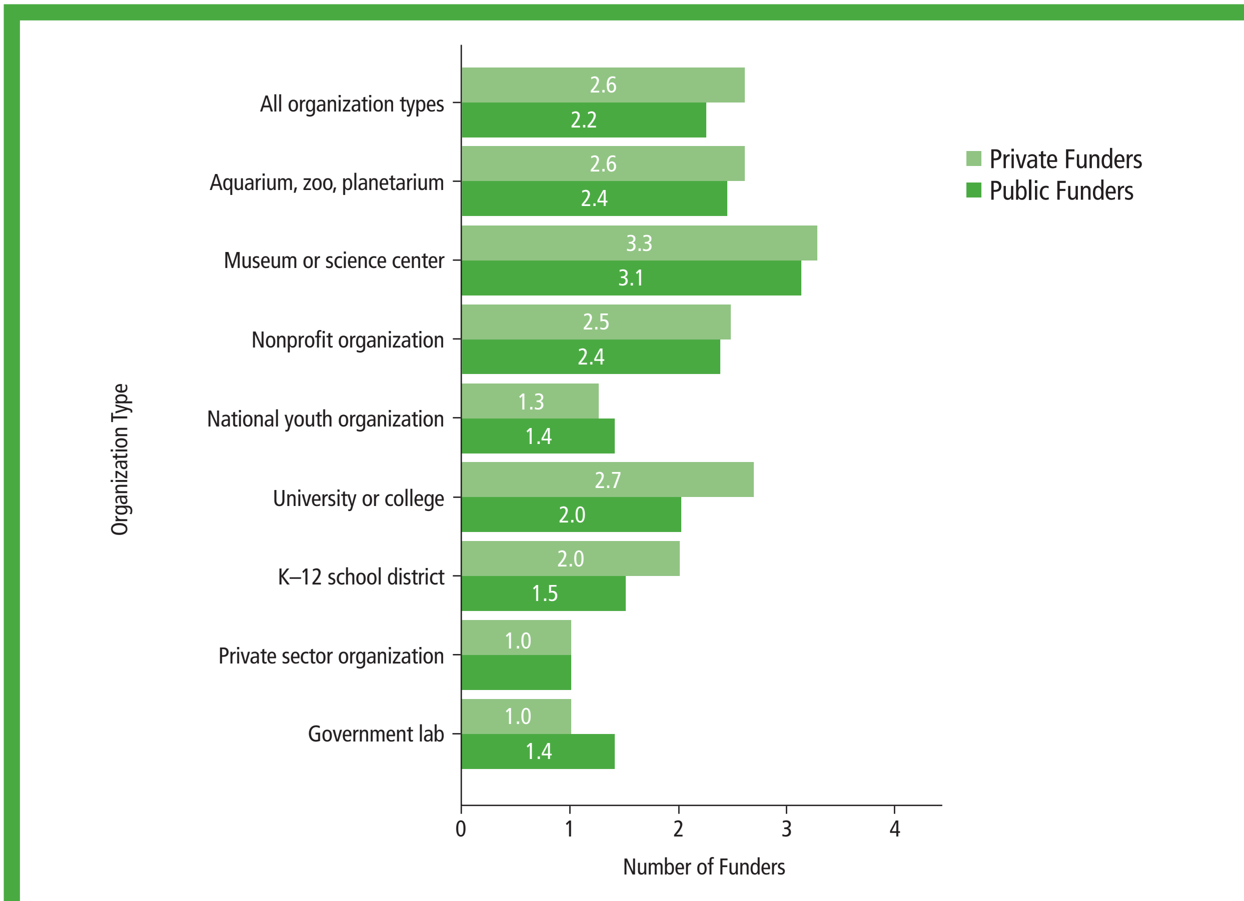

Figure 5. Average Number of Program Funders by Organization Type (*N* = 208)

highest number of contact hours to a high number of participants per year, suggesting the high local impact of their programs. They often targeted minority youth or girls and accordingly served the most diverse audiences. Programs offered by nonprofit organizations were generally accessible in terms of fee structure and scholarship opportunities as compared to those offered by other organization types. They generally had an above-average number of funders, were well networked, and were staffed with educated and trained personnel.

Similarly, national youth organizations also provided an above-average number of contact hours to a smaller yet diverse audience. Many of the organizations we surveyed were

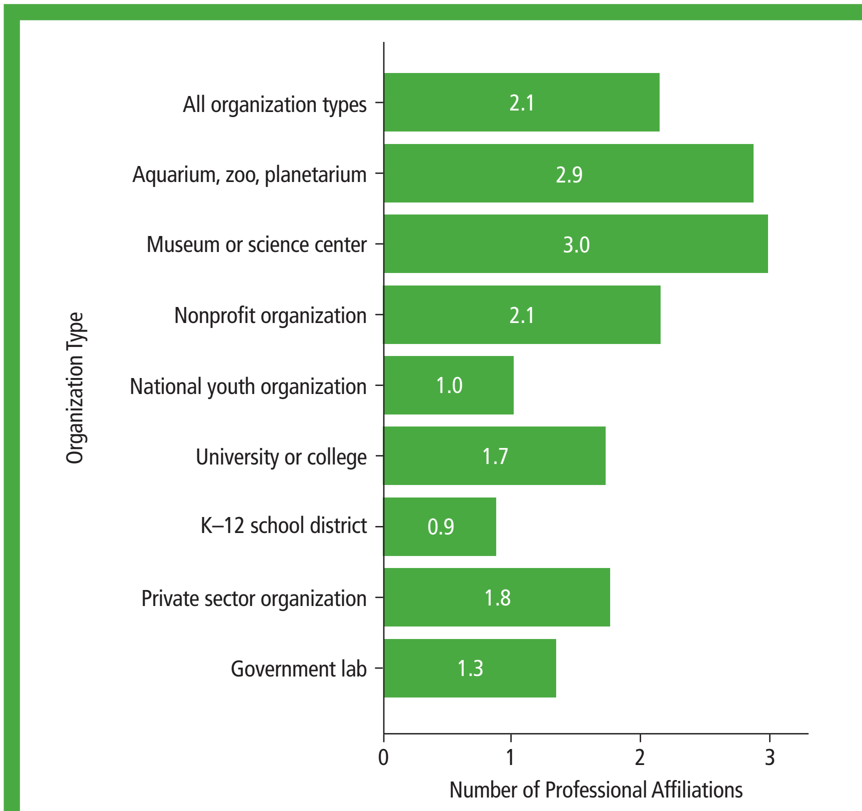

Figure 6. Average Number of Professional Affiliations (*N* = 207)

gender-specific and thus targeted girls at a much higher rate than did other organization types. Though these organizations required youth to pay for programs more often than did other types, this requirement was ameliorated by the high rate at which they offered scholarships. Among national youth organizations, personnel less often included individuals with STEM backgrounds than did personnel from any other organization type. These features of nonprofits and national youth organizations may be typical of organizations that emphasize positive youth development.

Programs hosted by K–12 school districts provided below-average contact hours to the smallest number of annual participants. They also had the least ethnically diverse participants, despite often targeting all underrepresented groups. Such targeting may not translate into program participation if these groups are not well represented in the school district. School-district-based programs provided fewer opportunities for ongoing training compared to other organization types. These characteristics may reflect variation in the designs and missions of school-based programs, ranging, for example, from academically focused programs focused on closing an achievement gap in the district to small science clubs spearheaded by a single teacher.

Comparing these features highlights the potential for mutually beneficial partnerships between organizations of different types—for example, to meld the scientific resources of a museum with the ability of a local nonprofit to reach underserved students of color or to draw on university outreach to provide programming for local and regional chapters of a national youth organization. The data also suggest potential for science-focused organizations to partner with K–12 school districts on OST programming.

Moreover, because organizations may be networked primarily with others of a similar type, characteristics held in common across organization types may go unrecognized, meaning that useful lessons and expertise may go unshared across these informal boundaries.

Implications for Practice

This study is the first to distinguish characteristics of youth OST science programs by organization type. Leaders of science-focused OST programs might use the characteristics of these programs to benchmark their own activities. Differences among programs sponsored by other types of organizations may not be evident to those working in a particular sector. Moreover, because organizations may be networked primarily with others of a similar type, characteristics held in common across organization types may go unrecognized, meaning that useful lessons and expertise may go unshared across these informal boundaries.

A striking finding is the high variability in some characteristics by organization type. Programs vary notably in the size and demographics of the youth populations they serve and in their desire or ability to target particular groups. The relative strength of programs for girls in the data set may suggest that policy and programming efforts to encourage girls in science are finally bearing fruit. Other results suggest opportunities and unfilled niches for practitioners to pursue—for example, programs for gifted and talented youth are relatively common across organization types, but there is a distinct lack of programs targeting youth with disabilities. To meet this need, organizations with scientific and educational resources might seek out partners or service providers who work with specific disability communities to identify ways to serve youth with disabilities. Creative partnerships of these types may in turn be able to access a greater variety of funding sources; funders may develop new initiatives to encourage new, cross-cutting forms of partnership.

This variability, while interesting, also points to the difficulty of conducting studies like this one: The variation inherent in programs' home institutions, designs, and audiences means that there are no single points of contact by which researchers can reach or engage program leaders. The onus is on researchers to communicate the value of answering research questions that may seem merely academic to hardworking youth program leaders who are immersed in mentoring young people and running and sustaining their programs.

Out-of-classroom experiences are an ideal venue for building "personal connections with the ideas and excitement of STEM fields" (President's Council, 2010, p. xi) and can "play a key role in supporting the future of the country's STEM workforce" (Afterschool Alliance, 2012). Our findings offer encouragement about the range, variety, and strengths of organizations sponsoring OST science programs—yet they also show that some youth subgroups are underserved. Our results do not speak to the sheer magnitude of need for high-quality science-rich OST programming.

Future Work

Overall, the results ring true to descriptions and explanations offered by practitioners, indicating that our study has high content validity and suggesting the promise of the more detailed analyses now underway. We plan to explore our questionnaire data with a focus on program-specific issues, independent of organization type, and to examine possible relationships between these two ways of slicing the data. For example, we will look more closely at differences in programs by intensity, duration, and structure of contact hours, comparing, for example, intensive forms such as camps with extended forms such as afterschool programs. We will also explore linkages between youth populations served and program design choices. Finally, we will combine these and other questionnaire data with a rich body of data from in-depth interviews with more than 50 program leaders and other well-placed observers so that we can better understand the circumstances, constraints, and opportunities that give rise to these patterns in program design and characteristics.

Acknowledgments

We thank Melissa Arreola-Pena and Annette Brickley for research assistance and Linda Hardesty and Jim Hickam for technical assistance. We acknowledge Robert Tai for helpful conversations. This work was supported by the Noyce Foundation and by a grant from the National Science Foundation Informal Science Education program (DRL-1010953).

Several individuals offered expert advice at crucial junctures, including Jamie Alonzo, Kathleen Archuleta, Pam Garza, Andrea Hamilton, Sylvia James, Anita Krishnamurthi, Gabe Lyon, Karen Peterson, Irene Porro, Cary Sneider, Marley Steele-Inama, Maryann Stimmer, Tony Streit, Carol Tang, and Kathleen Traphagen. We thank Deb Bialeschki and the American Camping Association, Inc., for assistance in reaching private sector camps in their membership. We are grateful to many other individuals who provided valuable feedback and assistance along the way.

References

Afterschool Alliance. (2004). *America after 3 p.m.: A household survey on afterschool in America.* Retrieved from http://www.afterschoolalliance.org/press_archives/america_3pm/Executive_Summary.pdf

Afterschool Alliance. (2011, September). *STEM learning in afterschool: An analysis of impact and outcomes*. Retrieved from http://www.afterschoolalliance.org/STEM-Afterschool-Outcomes.pdf

Afterschool Alliance. (2012, June). *Afterschool programs as partners in STEM education: Policy recommendations.* Retrieved from http://afterschoolalliance.org/Alliance_STEM_Policyasks_FINAL.pdf

Afterschool Alliance & Coalition for Science After School. (2008, January). *Afterschool programs: At the STEM of learning* (Afterschool Alert Issue Brief 26, 1–4). Retrieved from http://www.afterschoolalliance.org/issue_briefs/issue_STEM_26.pdf

Barab, S. A., & Hay, K. E. (2001). Doing science at the elbows of experts: Issues related to the science apprenticeship camp. *Journal of Research in Science Teaching*, *38*(2), 70–102.

Bell, R. L., Blair, L. M., Crawford, B. A., & Lederman, N. G. (2003). Just do it? Impact of a science apprenticeship program on high school students' understandings of the nature of science and scientific inquiry. *Journal of Research in Science Teaching*, *40*(5), 487–509.

Bleicher, R. E. (1996). High school students learning science in university research laboratories. *Journal of Research in Science Teaching*, *33*(10), 1115–1133.

Bouillion, L. M., & Gomez, L. M. (2001). Connecting school and community with science learning: Real world problems and school-community partnerships as contextual scaffolds. *Journal of Research in Science Teaching*, *38*(8), 878–898.

Catalano, R. F., Berglund, M. L., Ryan, J. A. M., Lonczak, H. S., & Hawkins, J. D. (2004). Positive youth development in the United States: Research findings on evaluations of positive youth development programs. *The Annals of the American Academy of Political and Social Science*, *591,* 98–124.

Chi, B., Freeman, J., & Lee, S. (2008). *Science in after-school market research study*. Berkeley, CA: Coalition for

Science After School, Center for Research, Evaluation and Assessment, Lawrence Hall of Science. Retrieved on October 20, 2009, from http://www.scienceafterschool.org/pdfs/CSAS_Market_Study2008.pdf

Chi, B. S., Snow, J. Z., Lee, S., & Lyon, G. (2011, April). *How out-of-school programs effectively engage underrepresented students in science: Youth development, science and Project Exploration.* Paper presented at the 2011 American Educational Research Association (AERA) annual meeting, New Orleans, LA.

Congressional Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development. (2000, September). *Land of plenty: Diversity as America's competitive edge in science, engineering, and technology.* Retrieved from http://www.nsf.gov/pubs/2000/cawmset0409/cawmset_0409.pdf

Diamond, J., St. John, M., Cleary, B., & Librero, D. (1987). The Exploratorium's Explainer Program: The long-term impacts on teenagers of teaching science to the public. *Science Education*, *71*(5), 643–656.

DuBois, D. L., Doolittle, F., Yates, B. T., Silverthorn, N., & Tebes, J. K. (2006). Research methodology and youth mentoring. *Journal of Community Psychology*, *34*(6), 657–676.

Eccles, J. S., Barber, B. L., Stone, M., & Hunt, J. (2003). Extracurricular activities and adolescent development. *Journal of Social Issues*, *59*(4), 865–889.

Etkina, E., Matilsky, T., & Lawrence, M. (2003). Pushing to the edge: Rutgers Astrophysics Institute motivates talented high school students. *Journal of Research in Science Teaching*, *40*(10), 958–985.

Fadigan, K. A., & Hammrich, P. L. (2004). A longitudinal study of the educational and career trajectories of female participants of an urban informal science education program. *Journal of Research in Science Teaching, 41*(8), 835–860.

Friedman, A. (Ed.). (2008). *Framework for evaluating impacts of informal science education projects* [Report to The National Science Foundation, Directorate for Education and Human Resources, Division of Research on Learning in Formal and Informal Settings (DRL)]. Retrieved from informalscience.org/evaluations/eval_framework.pdf

Friedman, L. N., & James, S. M. (2007). Science in afterschool: Undisputed advantage. In T. K Peterson & S. Fix (Eds.), *Afterschool advantage: Powerful new learning opportunities*. Moorestown, NJ: Foundations, Inc.

Halpern, R. (2005). *Confronting the big lie: The need to reframe expectations of afterschool programs*. Paper commissioned by the Partnership for After-School Education (PASE). Retrieved from http://www.pasesetter.org/reframe/documents/halpern.pdf

Langdon, D., McKittrick, G., Beede, D., Khan, B., & Doms, M. (2011, July). *STEM: Good jobs now and for the future* (ESA Issue Brief #03-11). Washington, DC: U.S. Department of Commerce, Economics, and Statistics Administration, Office of the Chief Economist.

Learning Point Associates. (2006, July). *21st Century Community Learning Centers (21st CCLC) analytic support for evaluation and program monitoring: An overview of the 21st CCLC program: 2004–05*. Retrieved from http://www.ed.gov/programs/21stcclc/2006report.doc

Means, B., House, A., & Llorente, C. (2011, April). *Challenges in designing and conducting research on afterschool programs.* Paper presented at the 2011 American Educational Research Association (AERA) annual meeting, New Orleans, LA.

Members of the 2005 "Rising Above the Gathering Storm" Committee. (2010). *Rising Above the Gathering Storm, revisited: Rapidly approaching Category 5*. Prepared for the Presidents of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. Washington, DC: National Academies Press.

Noam, G., Dorph, R., Dahlgren, C., Larson, J., Goldstein, D., & Sheldon, J. (2010, May). *Are quality science learning experiences typical of typical after-school settings?.* Paper presented at the 2010 American Educational Research Association (AERA) annual meeting, Denver, CO.

Parker, C., Na'im, A., & Schamberg, M. (2010, June). *ITEST Management Information System (MIS) 2009: Final report describing active ITEST projects.* Retrieved from http://itestlrc.edc.org/sites/itestlrc.edc.org/files/MIS_Final_combined.pdf

Porro, I. (2010, June). *Motivated by challenge or challenged by motivation?* Paper presented at the ITEST Afterschool Convening, Minneapolis, MN.

President's Council of Advisors on Science and Technology. (2010, September). *Prepare and inspire: K–12 education in science, technology, engineering, and math (STEM) for America's future* [Report to the President]. Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf

Rahm, I., Martel-Reny, M.-P., & Moore, J. C. (2005). The role of afterschool and community science programs in the lives of urban youth. *School Science & Mathematics, 105*(6), 283–291.

Richmond, G., & Kurth, L. A. (1999). Moving from outside to inside: High school students' use of apprenticeships as vehicles for entering the culture and practice of science. *Journal of Research in Science Teaching*, *36*(6), 677–697.

Ritchie, S. M., & Rigano, D. L. (1996). Laboratory apprenticeship through a student research project. *Journal of Research in Science Teaching*, *33*(7), 799–815.

Sneider, C. (2010). *Youth programs at museums and science centers: Part I. Landscape study* [Report prepared for the California Academy of Sciences]. Portland, OR: Portland State University.

Stake, J. E., & Mares, K. R. (2001). Science enrichment programs for gifted high school girls and boys: Predictors of program impact on science confidence and motivation. *Journal of Research in Science Teaching*, *38*(10), 1065–1088.

Stake, J. E., & Mares, K. R. (2005). Evaluating the impact of science-enrichment programs on adolescents' science motivation and confidence: The splashdown effect. *Journal of Research in Science Teaching*, *42*(4), 359–375.

Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). Planning early for careers in science: *Science, 312*(5777), 11.

Notes

[1] In this paper, we use *science* to mean science, engineering, and/or technology.

[2] Several other types of organizations also offered camps. Comparison of the camp format with other formats is a program-level analysis that will be discussed in future reports.