Exploring the Out-of-School Time Science Landscape: Characteristics of Youth Science Education Programs Offered by Distinct Organization Types

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Abstract

Out-of-school-time (OST) science education programs are said to meaningfully deepen youth engagement with science, encourage them to pursue further science education, and raise interest in science-related careers. These programs may be particularly valuable for youth from communities that are traditionally underrepresented in scientific fields. However, due to the vast diversity of program types, little is known about the nature and distribution of programs across this educational landscape on a national level. Based on data from a national sample of 417 OST science programs, this paper describes findings about the characteristics of these programs and their home organizations, including youth audience, staffing, and program duration.

Study Objectives

Out-of-school time (OST) experiences offer a promising resource for enriching young people's experience of science, engineering, and technology (SET). OST science programs have been shown to increase students' confidence and interest in science (Barab & Hay, 2001; Diamond et al., 1987; Stake & Mares, 2001, 2005), contribute to their science identity development (Fadigan & Hammrich, 2004; Richmond & Kurth, 1999), foster gains in scientific thinking and understanding of scientific concepts (Bell et al., 2003; Bouillion & Gomez, 2001; Ritchie & Rigano, 1996) and increase the likelihood that youth will pursue science-related undergraduate degrees and careers (Afterschool Alliance, 2011a; Chi et al., 2011). These programs may also increase access to science for underrepresented groups, such as girls, minorities, or low-income youth (Afterschool Alliance, 2004, 2011b; PCAST, 2010).

Given the potential benefits of OST science, there is still little knowledge about the plethora of OST SET programs in the United States. Such information may determine the extent to which youth have access to OST SET opportunities, and identify the key characteristics of these experiences. Guided by similar thinking, recent efforts to "map" the out-of-school landscape have explored science content in general afterschool programs (Chi, Freeman & Lee, 2008; Noam et al., 2010; Means, House & Llorente, 2011). These studies have found that typical afterschool programs struggle to provide science programming because of a lack of resources, knowledge, and staff training. We don't know whether or how the same issues arise in SET-focused programs, and these studies are challenging to replicate in the OST SET arena. Friedman (2008) identifies several reasons for the inadequate state of knowledge about OST science programs. First among these is variety: sites in schools, museums, zoos, aquariums, and community centers; formats including after-school clubs, camps, workshops, research apprenticeships, and more. Such diversity also means that there is no single national network through which researchers might reach nationally representative samples of programs.

Despite these challenges, several recent studies have mapped segments of the OST SET landscape, generating insight into common program models and characteristics. A survey of programs serving older youth suggested that the majority of them target underserved students (Porro, 2010). These programs typically included 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 et al., 2010). Finally, a study of youth programs in science museums and science centers found that many of these programs serve older youth, provide adult mentors, and encourage the youth themselves to teach the general public or mentor younger students (Sneider, 2010).

All of these recent studies focus on a single segment of the OST SET landscape—e.g., older youth, ITEST programs, or science museums—and together begin to reveal important characteristics that run across programs. Yet to date there has been no systematic study of the broader national landscape of out-of-school science. In this paper, we examine a diverse national sample of OST SET programs serving older youth and describe findings about the characteristics of these programs and their home organizations.

Theoretical Framework

We turn to sociocultural theories of learning to explain and understand program design and student engagement in OST science environments. In these theories, the learner is situated within specific physical, social, and cultural contexts (Lave & Wenger, 1991; Rogoff, 2003). Sociocultural theories emphasize the intersection of people, places, and culture in learning and development. While our overall study explores many factors, including program providers' perceptions of student learning and other outcomes, the present paper focuses on the "place-based" elements of sociocultural theory (Bell et al., 2009). Sociocultural theories provide insight into how learners develop through culturally situated interactions and practices, yet, these theories also assert that the physical features of a learning experience or program, such as the physical space, or the available resources and materials, will influence learning processes and outcomes (Bell et al, 2009). Informal settings, in particular, offer the promise of access to authentic place-based elements of learning, such as scientific tools and artifacts, scientific locations (e.g., science museums or research settings) and activities (e.g., the authentic practice of professional scientists) that may afford a more immersive science experience than is typically available in formal schooling.

 Thus, before we explore youth outcomes from OST science programs, it is essential to understand the physical features and design of these programs. Some potential place-based program elements, such as the use of scientific tools and data, youth interactions with real scientists, and extended duration learning opportunities are difficult to replicate in formal school environments (Bell et al., 2009). This authenticity has been argued to spark deep learning and increased interest in science for youth (Afterschool Alliance, 2011a). However, we must first understand the activities, staffing, and resources within programs—and the range of these

elements within the national landscape of programs—to more fully understand youth engagement and learning within OST science contexts.

Study Methods and Data Sources

Our mixed-methods study, Mapping Out-of-School-Time Science (MOST-Science), examines a national sample of OST programs focused on science, engineering, and/or technology. Our research questions are:

- *How can we describe the landscape of U.S. science-focused OST programming for older youth?*
- *How do programs vary by activities, populations served, duration and frequency, and other key factors?*
- *What patterns in these variables help to characterize current OST SET programming and define areas of future opportunity?*

Our study incorporates two data sources: 1) an in-depth questionnaire for program directors and staff, and 2) semi-structured interviews with OST SET program providers and well-placed leaders in the field.

To begin to develop a categorization scheme of the characteristics and features of OST SET programs, we conducted extensive reviews of the research literature, white papers and other relevant documents, and program web sites. We searched the web sites of members of the Association of Science and Technology Centers (ASTC), the Association of Zoos and Aquariums (AZA), the Coalition for Science Afterschool (CSAS), and the National Girls Collaborative Project (NGCP) to identify programs that provide extended SET learning experiences for youth in grades 6-12. Other large databases, such as 21st Century Learning Centers programs funded by the US Department of Education, contained only a small fraction of SET-specific programs, and thus were not systematically investigated. Our preliminary findings about program content and design from these document and web site reviews informed the development of the questionnaire and interview protocol.

Data Source #1: Program Questionnaire

The questionnaire was designed to collect data on program design, content, and youth participants. Questionnaire items were reviewed by several experts in the field; the revised version was then piloted by several program directors, who shared their comments in think-aloud interviews. Based on their feedback, items were further refined.

The questionnaire distinguished between the host organization and the one or more youth science programs it runs. It included sections addressing:

- the organization's location and type
- the organization's connections: partners, funding sources, involvement in national networks, and program evaluation
- program audience: grade level, targeted groups (e.g. girls, students with disabilities), demographics

- program structure: fee structure, stipends, scholarships, meeting schedule and frequency
- program content: staff background, training, program activities

Sampling and data sources

We established six criteria to limit our study sample to include programs that:

- focus on science, engineering and/or technology
- include youth in (or entering) grade 6 or higher
- engage youth with their peers and/or the public
- involve youth for multiple sessions
- have existed for one year or longer
- take place outside of school time.

We focused on older youth because science interest in middle school is a predictor of future science degree attainment (Tai, Liu, Maltese, & Fan, 2006). We also sought programs that have some longevity, incorporate group work, and meet multiple times because we felt these features would contribute to high-quality programs that could support youth engagement with science.

Distribution

We distributed the questionnaire through a variety of mechanisms in an attempt to reach the widest possible study sample. Invitations were issued through:

- e-mail distribution lists and newsletters of national alliances and networks, and funders
- direct e-mail invitations to programs identified through directories and membership lists
- our professional networks of educators, scientists and engineers, and distribution of materials at meetings and conferences

In all, we sent nearly 2300 email invitations, over 1900 of which went to specific OST SET programs. Over 300 additional invitations reached well-connected individuals working in informal, K12, afterschool and higher education and diversity initiatives, across SET disciplines. Because we have no way to assess how many people representing how many programs received an invitation, we cannot compute a response rate for the questionnaire. Our final data set includes 712 programs, of which 417 programs (59%) met all six sampling criteria.

Data Source #2: Semi-structured interviews

Interviews were conducted with 53 OST SET program providers and leaders in the field. We used "snowball sampling" methods to identify well-designed programs, and influential individuals in the field (Patton, 2002). Interviews were conducted from spring 2010 to fall 2011. We invited 85 OST science practitioners and leaders to participate in a telephone interview; 53 accepted for a response rate of 62%. Digitally recorded interviews lasted 30-80 minutes. Interviews were transcribed and entered into NVivo 9 software for analysis. Overall, 35 participants (65%) were program directors, 13 participants (25%) were well-placed leaders in the

OST science field, two interviewees (4%) were OST science researchers or evaluators, and three (6%) provided professional development or curriculum resources to the OST science field.

Program directors told us about the goals and objectives of their programs, their target audience and the demographic makeup of their student population, and the outcomes they had observed among participants. They described in detail the kinds of science content and "hands-on" activities in which students engaged. Respondents also talked about staffing, funding, resources, infrastructure, and evaluation. Leaders in the afterschool or OST science arenas provided valuable perspectives on educational policy and the larger field of OST science education.

Analysis Methods

For analysis, the questionnaire data were exported from Filemaker Pro version 11 into Excel. We then cleaned these data, removing write-in responses for qualitative analysis before importing the quantitative data into IBM SPSS version 20. We used SPSS to calculate means, frequencies, and percentages for the organization- and program-level data included in this analysis. We created dummy variables for categorical program-level and organizational-level variables and then used these dummy variables to conduct an ordinary least squares regression to analyze predictors of ethnic diversity of youth participation in OST SET programs.

Interview data were analyzed using domain analysis (Spradley, 1980) in which transcripts are searched for units of meaning. Groups of codes that cluster around themes were assigned to domains. Domains were generated both deductively, exploring concepts from our theoretical framework and research questions, and inductively, exploring other themes that emerged from the data. Taxonomies were constructed linking domains to coded examples. Matrix tables of frequencies for responses on particular themes added a dimension of comparison across domains, to identify differences among sub-groups in the sample or organizational types.

Results

We first describe the types of organizations contributing programs to our questionnaire, as this categorization is used as an independent variable for examining other program characteristics. We then report on program staffing, curriculum and activities, and youth audience. Finally, we discuss the factors that predict diversity among youth participants.
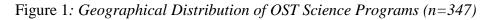
Type of Organization Hosting OST Science Programs

We collected data from 417 programs housed within seven distinct types of organizations: university or college; non-profit organization; museum or science center; K-12 school district; national youth organization; aquarium, zoo, or planetarium; private sector organization, and government lab. Respondents were asked to report on all of their organization's OST program offerings; some reported on a single program while other organizations supplied data on up to six programs.

Roughly half of all programs in our sample were represented by just two organization types: universities and colleges, and non-profit organizations (26% and 25% of the sample, respectively). Programs least represented in the sample were those hosted by private sector organizations and by government labs (3% and 2%, respectively). Museums and science centers comprised 15% of the sample; aquariums, zoos, and planetariums were 12% of the sample, and K-12 school districts and national youth organizations each comprised 8% of the sample. Overall, we do not argue that this sample represents the distribution of OST SET programs nationally, but the breadth of the sample does enable us to analyze program differences by their organization type.

Regional Variations in OST Science Programs

The national map highlights regional variations in the presence or absence of OST SET programs, as demonstrated in Figure 1. For the most part, OST youth science opportunities are well represented on the East and West Coasts, and in the Southeast and Midwest. On the other hand, the Rocky Mountain West, Southwest, and North Central regions of the country appear to offer fewer OST science programs. Additionally, two programs in our sample were located in Alaska, and four in Hawaii. Not surprisingly, programs cluster near cities and highly populated areas, with fewer programs located in rural areas.

Figure 1: *Geographical Distribution of OST Science Programs (n=347)*

Staffing and Professional Development

Because staffing and training are critical "place-based" elements of student learning, we investigated these domains in the questionnaire. Almost all organizations (90%) reported at least one full-time staff member. Private sector organizations reported the lowest levels of full-time staff (43%), reflecting a reliance of summer camps on seasonal staff.

Almost all (99%) of organizations had at least one staff member with an education background, and 99% also had at least one staff member with a background in a STEM field. National youth organizations reported the lowest rate of staff with STEM background (90%). We did not gather data on the percentage of staff with educational or STEM backgrounds, only their presence.

All organizations reported providing initial training for employees; however, the opportunities for ongoing training varied across organizational types. Roughly 50% of K-12 school districts provided ongoing training for program staff, while the average for all other organization types was above 75%. The lower rate of staff training from K-12-based programs may reflect that school district-level professional development focuses on the formal, rather than the informal, learning environment.

To some extent, organizational type and location influenced programs' ability to employ full-time staff, provide training, and offer access to practicing scientists. These physical elements of learning influence the quality of youth experiences. In particular, access to practicing scientists may expose students to the tools, practices, and norms of science (Lave & Wenger, 1991). Yet organizations differed in their capacity to provide these experiences. On one end of the continuum, for example, lay a 4-H program in the Appalachian region whose director described his difficulties in recruiting and training volunteers for robotics and engineering programs, and in accessing professional engineers in rural areas:

> *You have to get different volunteers… you have to get somebody who is willing to commit the time to learn because nobody knows how to program an NXT robot until they sit down and done it. And once they do it, it's not that hard, and the kids can learn it too. But there's just such a apprehension, they're like, "Oh, I can't learn that!" and "I'm gonna have to get an engineer to figure this out," when really, you don't. You just need a parent who's gonna be committed to the technology. I live in [a rural] county, there's not any engineering firms here, so there's a lot of issues, [we] really just need good parents.*

On the other end of the spectrum lay an urban science-rich museum, staffed with practicing research scientists and trained science educators. Teachers, scientists, and other qualified volunteers were often available to fill any staffing gaps in this already resource-rich organization. The director of youth afterschool and science internship programs described the staffing at her organization:

> *The day-to-day classes are taught by our staff and we also have to bring in outside teachers because there aren't enough. When we're fully functioning, we don't have enough staff to come in to teach all seven classes. So, in addition to our staff, we also bring in middle school and high school science teachers and some of the teachers are also Ph. D candidates or post-docs in science who are interested in education. Also every module has a scientist visiting and sharing their career trajectory with the kids, and they're exposed in every unit to what the working scientists at the museum are doing.*

Thus for the most part, the organizations in our sample appeared to be appropriately staffed and trained, with two exceptions: private sector organizations had far fewer full-time staff, and K-12 school districts offered fewer opportunities for ongoing training. Other factors, such as a reliance

on volunteers for staffing or a rural locale, impeded organizations' abilities to provide facilitators and role models with scientific backgrounds.

Content of Program Activities

To understand the specific learning activities in OST SET programs, we asked respondents to select from a list of activities that they might use in their programming. In Table 1, we examine differences in reported program activities according to organization type. Most organization types emphasized learning specific science content, but K-12 school districts and government labs (88%) reported this slightly more often than other types of organizations. Almost all non-profit organizations (96%) used inquiry-based learning activities, while these were used less often by government labs (75%) and by planetariums, zoos, and aquariums (74%). Extended research design was not a common program feature for most organization types, with the exception of government labs (63%).

Youth development features, such as personal and social-skill building, were common across all organization types, particularly national youth organizations (100%), most of which emphasize youth development in their mission. Youth development activities were less common in government labs (75%) and for-profit programs (75%). Variations in program activities most likely arise from differences in organizational mission and program goals, as well as access to scientific expertise and resources.

Table 1: *Frequency of specific learning content and activities by organization type (n=336)*

	Organization Type							
	Aquarium, zoo, planetarium	Non-profit org.	K-12 school district	Museum or science center	National youth org.	University or college	Government lab	Private sector org.
Learning specific science or engineering concepts	81%	87%	88%	83%	74%	86%	88%	75%
Inquiry-based learning activities	74%	96%	79%	85%	79%	84%	75%	88%
Extended research or design	39%	55%	49%	52%	32%	45%	63%	38%
Exposure to science, technology and/or engineering careers	81%	92%	65%	81%	84%	90%	75%	88%
Science content linked with local, state or national standards	26%	71%	35%	44%	47%	31%	38%	38%
Communication and presentation skill-building	71%	79%	74%	81%	89%	69%	75%	75%
Personal/social skill-building	94%	87%	81%	96%	100%	88%	75%	75%

Interview data paralleled our findings from the questionnaire. In interviews, the program activities discussed most frequently by program directors were the learning of specific science content or concepts (91%), youth development (86%), hands-on learning (80%), authentic or real-world content (77%), exposure to careers (74%), inquiry-based learning (69%), and field trips (66%). Many programs emphasized scientific role models and access to "real-world" science, thereby situating students' science learning experiences in the social and cultural context of professional scientific practice (Lave & Wenger, 1991).

It is not surprising that the two most common program elements, according to interviewees, were the introduction of specific science content and youth development. According to most program providers in our interview sample, the two go hand-in-hand and exemplify the mission of many programs in our sample.

> *It's important that we do all of this for science, but it's not just about science. But at the same time, I don't think we would get the same result in science, if we didn't have these other components, the personal and youth development components. I think we wouldn't be as exciting in the science component, and vice versa.*

Many OST SET programs in our interview sample also provided culturally relevant science programming, an opportunity that may not be present during the traditional school day. Many of the programs that targeted underrepresented youth sought to involve youth in extended duration scientific activities that were relevant to their lives or local community. For instance, a program provider commented on the program's focus on addressing community needs.

> *The program has cohorts of kids who usually stay with it for three or four years, and those kids are doing actual scientific research. Usually it's water quality testing or things like that…. They discovered that there was some illegal dumping in a local stream and they've been working with the EPA to try to get the violator brought to justice…. And it's definitely targeting kids from underrepresented neighborhoods and getting them engaged in scientific research, in their neighborhood, that's specifically relevant.*

Finally, the involvement of role models and scientific career content was another important feature in OST SET programming. Scientists provided youth with exposure to the norms, practices, tools, and discourse of science. Programs in locations with more scientific and technological industries had greater access to practicing scientists to work with youth. A program director described his partnerships with industry:

> *We're finding a lot of engineers who want to explain to young people, in particular, what engineers actually do, so we do a lot of work and partner with many of the local companies. So there's the African-American network [of engineers] that we sometimes work with to reach out to engineers and have them participate. Some of our bigger companies like Dow Chemical and Dow Corning have even developed classes to expose young people to chemistry and science as one of their outreach engagement activities.*

Demographics of Youth Participants

We asked respondents to report the average demographics of their youth participants. On average, programs served a high proportion of girls (56%). National youth organizations reported the highest proportion of girls (82%), while private sector, K-12 school districts, and government labs reported the lowest proportions, near 40%. All other organization types reported significant proportions of girl participants, indicating that many programs focus on engaging girls in science, engineering and technology.

Averages for each ethnic group, by organization type, are shown in Table 2. Because we describe average rather than actual program proportions, the percentages of ethnicities do not total to 100% by organization type. Overall, programs by nonprofit organizations served the most ethnically diverse populations, while programs by K-12 school districts and by government labs served the least ethnically diverse populations. Outside of non-profit organizations and national youth organizations, Latino youth do not seem to be served in proportion to their representation in the U.S. population, estimated to be 25% of youth under the age of 18 in the U.S. (US Census, 2011).

Table 2: *Average Percentage of Youth Participants by Gender and by Ethnicity*
for Programs 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
Non-profit 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 reported by respondents are presented in this table and do not total 100%

Target Youth Audience

We sought to understand whether and how organizations targeted specific youth audiences to their programs (Figure 3). Respondents reported on whether or not their program targeted any of several groups of interest, including 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 success of its outreach and recruiting, and its choice to include non-targeted groups or not.

In general, girls were most commonly targeted, followed by underrepresented minorities, gifted and talented youth, and, least often, youth with disabilities. National youth organizations most frequently targeted girls, with 67% of programs thus directed. This 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 non-profit organizations targeting minority youth at the highest rates (49% of programs). Youth with disabilities were targeted less than any other group. They were not reported as targeted by any government labs, and were targeted most by private sector organizations (27%) and K-12 school districts (23%).

Overall, national youth organizations appear to more often identify girls as a target audience. Government labs and aquariums, zoos, and planetariums had generally less defined target audiences, with no group targeted over 20%. In ongoing analyses, we are examining these characteristics in relation to the organization's scope and mission, considering issues such as expectations of publicly funded institutions and the ability of organizations to target specific local needs.

Program Elements that Predict the Diversity of Youth Participants

We tested the association between various organization-level and program-level variables and the percentage of youth served by programs who are ethnic minorities (Table 3). Not surprisingly, the strongest predictor of underrepresented minority participation was the purposeful targeting of these populations. Fee structure was also significantly positively associated with serving underrepresented minority populations; that is, programs that did not have fees, or that paid youth to participate, yielded higher rates of ethnic minority participation than programs that had fees. Purposeful targeting of minorities and fee structure explained roughly 50% of the variability in minority participation, indicating that these factors contribute substantially to minority participation in OST SET programs.

Table 3: *Regression Analysis for Numbers of Ethnic Minorities Served by OST Programs.*

Predictor	β	*SE*	*Standardized β*	*t*	*P*
Number of professional affiliations	-0.507	1.269	-0.047	-0.400	0.692
Programs with no fee*	7.035	2.745	0.306	2.563	0.015
Organization type	-1.402	1.473	-0.113	-0.952	0.347
Number of public funders	1.570	1.416	0.130	1.109	0.275
Number of private funders	-1.725	1.185	-0.181	-1.456	0.154
Programs with minorities as target audience**	31.390	5.248	0.780	5.981	0.000

β - unstandardized regression coefficient; *SE*- standard error; *standardized* β – standardized regression coefficient; *t*- test statistic; *p*- probability statistic. R^2= 0.47; *significant result, $p<0.05$, ** $p<0.01$

In interviews, program providers affirmed that targeted recruitment increased the diversity of their youth participants, particularly for underrepresented minority youth. For the most part, employing specific recruitment practices resulted in youth participation rates over 50% for the targeted groups. Interestingly, some respondents who described their program's general success in recruiting underrepresented minority youth often described difficulty in recruiting particular groups, such as Native Americans or African-Americans. Likewise, the data from the questionnaire indicate that some programs struggle to recruit underrepresented minority students, particularly Latino youth.

Programs with the greatest success in recruiting underrepresented minority youth had established relationships or partnerships with schools and community-based organizations in low-income or underserved neighborhoods. Many of these programs worked with local parents, teachers, or community leaders to reach out to the community and recruit youth. For instance, a program director described the community relationships that have helped increase Latino participation in their program.

> *We have a group of recruiters. We go out into the community, we find out who are those counselors in the school who are advocating for kids? Who are the migrant education leaders? Who are those teachers that are inspiring kids to look for different programs? We've developed a pretty good network of formal and informal providers that we work with directly. They will recruit the kids for us, and we work with them to make sure they have all the information they need, and they've got their parents for parent meetings.*

> *They're like our agents on the ground who are telling the parents it's okay, and helping to gather the paperwork.*

In conclusion, interviewees affirm the importance of specific targeting and recruitment practices, including community and family outreach, to recruit and retain underrepresented minority youth into OST SET programs. Fee structure and recruitment of targeted groups are also significantly associated with increased diversity of youth participants.

Scholarly Significance

This study takes the first steps in mapping the national landscape of youth OST SET programs by distinguishing key characteristics by organization type. Overall, our data suggest that OST SET programs are serving relatively diverse youth audiences. Some programs situate students' learning within the social and cultural context of science by engaging youth in extended scientific explorations with practicing scientists (Lave & Wenger, 1991). Thus, many SET-specific programs in our sample do not appear to merely extend or replicate the school day, but, instead, incorporate vital scientific learning elements, such as the use of scientific tools and data, and youth interactions with real scientists, that are not easily integrated into formal school environments (Bell et al., 2009). In this manner, OST SET programs seem to fulfill their promise of deepening youth engagement in scientific fields.

On the other hand, the data point to gaps in the OST SET landscape. For example, the regional distribution of OST SET programs varies substantially, with fewer opportunities in rural areas, and in the Rocky Mountain, North Central, and Southwestern regions of the country. The data from our sample of programs also suggest other unfilled niches for funders and practitioners to pursue, such as the lack of programs targeting youth with disabilities and the underrepresentation of Latino youth.

The data also highlight important commonalities among programs. Serving underrepresented groups is an oft-stated goal of OST SET programs. We find that programs that successfully engaged high numbers of underrepresented minority youth employed common practices. They specifically targeted underrepresented minority populations, often providing free programming or stipends to youth participants. Successful programs created relationships with communities and schools in underserved neighborhoods, and conducted outreach to families. Such approaches may be successful with other underserved populations, such as youth with disabilities. Data from the programs in our sample confirm the widespread view that the OST arena can be an important location for increasing access to science for underrepresented groups.

While OST SET programs were not without challenges, the programs in our sample did not encounter the same level of staffing, training, or structural difficulties faced by general afterschool programs in implementing science content and activities (Chi, Freeman & Lee, 2008; Noam et al., 2010; Means, House & Llorente, 2011). For the most part, OST SET programs reported greater access to staff with formal training in science and/or education than has been reported by general afterschool programs (Chi, Freeman & Lee, 2008). Additionally, many programs in our sample had the capacity and resources to provide deep science learning

opportunities for youth, although programs varied in their ability to provide high-quality programming. Collectively, these findings begin to elucidate key features of the national landscape of OST SET programs—a potentially powerful source of science learning and engagement for youth—and lay the groundwork for future, comparative studies of youth experiences across organizational types.

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