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Linkages between youth diversity and organizational and program characteristics of out-of-school-time science programs: A mixed-methods study

By Heather Thiry, Timothy Archie, Melissa Arreola-Pena and Sandra Laursen

Introduction

In the United States, African-American, Hispanic and Native American children make up 40% of the current enrollment in public K-12 schools (NCES, 2013), but just 18% of students earning bachelor's degrees in science and engineering, and only 10% of the science and engineering workforce (NSF, 2013). Minority youth underrepresented in STEM (principally African-Americans, Hispanics, and Native Americans) are more likely to attend schools with inadequate science teaching resources, unchallenging curricula, and teachers who are unprepared to teach STEM subjects (Haycock, 2001; Peske & Haycock, 2006; Singer, Hilton & Schweingruber, 2006). They see fewer role models of how to pursue science and have fewer learning opportunities outside school (The After-School Corporation (TASC), 2014). As a result, while many students from underrepresented groups have high interest in STEM fields (Riegle-Crumb & King, 2010), only 20% of such students complete college STEM degrees (President's Council of Advisors on Science & Technology (PCAST), 2012).

Women too remain underrepresented in many fields of science and engineering among both degree-earners and in the workforce (NSF, 2013). Yet the origins of this underrepresentation differ than for racial and ethnic minorities. Girls' interest in science careers is high (Modi, Schoenberg & Salmond, 2012), and while their college readiness in math and science is modestly lower than boys' (ACT, 2014), this readiness gap does not explain young women's lower rate of entry into science majors at the college level (Riegle-Crumb, King, Grodsky & Muller, 2012). Rather, a shortage of role models and gendered societal expectations affect girls' confidence and beliefs that they can do math and science (Brickhouse, Lowery & Schultz, 2000; Calabrese Barton & Brickhouse, 2006; Gunderson, Ramirez, Levine & Beilock, 2012; Riegle-Crumb et al., 2012). These beliefs in turn lead women to opt out of STEM majors and careers (Correll, 2001, 2004).

Out-of-school-time (OST) science programs may address these gaps in opportunity by enriching young people's science learning experiences, providing venues in which to develop a science identity, interact with supportive adults, and gain exposure to science careers (Afterschool Alliance, 2011; Bell, Lewenstein, Shouse & Feder, 2009; National Governors Association, 2012; PCAST, 2010; Siaca Curry, Traill & Rao, 2012). Because of their ability to deliver authentic and meaningful science experiences, OST programs hold particular promise for both girls and underrepresented minority students (Fadigan & Hammrich, 2004; Puvirajah, Verma, Li, & Martin-Hansen, 2014). Increased access to science pathways for both girls and minority youth would in turn contribute to achieving broad goals such as increasing the size and diversity of the STEM workforce.

Indeed, research offers evidence that well-designed OST science programs do hold promise in these respects (Afterschool Alliance, 2011; Krishnamurthi, Ballard & Noam, 2014; see also Chun & Harris, 2011). While several studies document short-term outcomes such as science learning, early development of a scientific identity, and increased interest in science careers (e.g. Diamond, St. John, Cleary & Librero, 1987; Fadigan & Hammrich, 2004; Kong, Dabney, & Tai, 2014; Richmond & Kurth, 1999), only a few have documented longer-term impacts on participants' life trajectories, such as greater likelihood of pursuing STEM undergraduate degrees and careers (Afterschool Alliance, 2011; Chi & Snow, 2010; Dabney et al., 2012; McCreedy & Dierking, 2013).

In this study, we sought to investigate not the outcomes for youth themselves, but the nature of the programs in which they may participate, drawing on a broad sample to sketch a picture of OST science-focused programming for young people in the United States. In this paper, we address the research question:

> *What organizational, program and geographic factors affect program participation by underrepresented groups, including girls and youth from racial and ethnic groups that are underrepresented in science and engineering?*

To answer this, we explore relationships among the participation of girls and of minority youth in specific OST science programs and these programs' organizational characteristics and program design. Currently, there is a lack of research on the characteristics of youth participants in OST SET and the types of learning environments that might benefit diverse youth (Dabney et al., 2012). By better understanding what factors influence programs' ability to recruit and serve youth from underrepresented groups, we can help practitioners select, incorporate and improve those characteristics most likely to increase participation from underserved populations.

Theoretical Framework

We turn to sociocultural theories of learning to explain and understand the relationship between program design and student participation in OST science. Sociocultural theories provide insight into how learners develop through socially and culturally situated interactions and practices, often with a focus on learners' trajectories and the environments that mediate these outcomes. Thus, learning is not simply a transfer of knowledge; instead, learning involves the interaction of people, places, and culture and the transfer or movement of knowledge, beliefs, attitudes, and skills across contexts (Gutiérrez & Rogoff, 2003; Lave & Wenger, 1991).

While our overall study explored many factors, this paper focuses on the programmatic elements of learning, relating the participation of girls and youth from underrepresented minority groups in out-of-school-time science experiences to the organizational, or "place-based," elements of sociocultural theory (Bell et al., 2009). Sociocultural research studies often examine the implicit social interactions and processes that occur within cultural contexts and that shape outcomes or learner identities; yet, sociocultural theorists also attend to the physical, organizational, and curricular features of learning environments. Organizational and programmatic design elements are important in the study of OST learning because these features, such as the physical space or location of the program, or the available expertise, resources and materials, will influence learning processes and outcomes (Bell et al., 2009). Indeed, these aspects of the learning environment often influence the scientific practices, tools and discourses that learners engage with, and, thus, the ways in which youth interact and learn. Therefore, learning environments—including the curricular and organizational characteristics of the learning experience—shape students' identities and trajectories (Bell et al., 2009; Gutiérrez & Rogoff, 2003). Out-of-school time learning environments exist outside of the confines and constraints of formal schooling and, therefore, may offer more variability, challenges, and opportunities than typical school environments in providing access to rich scientific tools and practices. In this paper, we explore how these characteristics of the learning environment may also influence *who* participates in OST SET programs.

We use the term "place-based" learning elements to refer to both the programmatic features and the organizational characteristics of the learning environment. Programmatic features refer to the educational design elements that shape students' experience of the program itself, such as the structure of the program, staffing, and curriculum. Organizational characteristics include the particular features of the organization housing or hosting the program, such as the location of the program, the organization's mission, funding, partner organizations, and other resources. In some cases, the program exists independently and does not have a host organization, and thus, the program and organization are the same entity.

We focus on place-based elements of learning because many out-of-school settings offer access to scientifically rich elements, including scientific tools, artifacts, and locations (e.g., in science museums or research settings), activities (e.g., research or investigation), and discourses (e.g., youth interaction with professional scientists) that are difficult to replicate in formal school environments (Bell et al., 2009). For instance, programs housed in museums and science centers, such as the American Museum of Natural History in New York City, offer access to working scientists employed through the institution and extensive collections of materials and artifacts for students to explore. Because of this access to scientific expertise and activities within the organization itself, the institution can offer different types of scientific activities than might be found in formal schooling or less scientifically rich locales. Other programs, such as Techbridge in Oakland, California or Project Exploration in Chicago, Illinois, provide students with engaging, inquiry or design-based SET curricula and scientific role models, despite working in school or community settings that do not offer abundant scientific resources on site. These varied examples suggest that there may be multiple paths by which OST SET programs can spark deep learning and increased interest in science for youth (Afterschool Alliance, 2011; Chi & Snow, 2010). To fully understand what learning contexts may promote the participation and engagement of diverse youth populations in OST science in the U.S., we must explore the place-based sociocultural features of the learning environments, including program design, learning activities, organizational mission, and program location. These elements will not only influence student learning outcomes, but may also influence who participates and has access to out-of-school opportunities.

Study Methods

The mixed-methods study incorporated multiple approaches, as detailed in (Laursen, Thiry, Archie & Crane, 2013; Thiry, Laursen & Archie, 2012). We chose a mixed-methods design to triangulate, or integrate, methodologies (e.g., qualitative and quantitative) to study the same phenomenon (Denzin, 1978). However, mixed-methods approaches have other strengths than simply employing multiple methodologies. Jick (1979) envisions mixed methods triangulation on a scale from simple to complex design, where multiple methodologies can “capture a more complete, holistic and contextual portrayal" of the topic at hand (p. 603). We use qualitative and quantitative methodologies to complement each other and to reach a deeper and more holistic understanding of OST SET than we would be able to do with a single method.

Semi-structured interviews

Interviews were conducted by telephone in 2010-2011 with 53 OST program providers and leaders in science, engineering and technology (SET), selected through snowball sampling (Heckathorn, 1997; Patton, 1987). We invited 85 people to participate; 53 accepted for a response rate of 62%. Digitally recorded interviews of 30-80 minutes were transcribed verbatim. Overall, 35 participants (65%) were program directors or staff, 13 (25%) were well-placed leaders in the OST SET field, two (4%) were researchers or evaluators, and three (6%) provided professional development or curriculum resources to practitioners. These interviews addressed program goals, outcomes, and youth demographics. Interviewees also discussed staffing, funding, resources, and evaluations. Leaders in OST science provided perspectives on policy and the larger field.

Questionnaire development

While the interviews sought a wealth of information about a few programs, the questionnaire sought basic information from a broader set of programs. Items were based on our research questions, findings from document and website reviews, and interview data. All items were then reviewed by several leaders in the OST SET community. The revised questionnaire was then piloted using think-aloud interviews with several program directors. Items were further refined based on their feedback, constructed in Filemaker Pro software (version 11) and implemented online.

The questionnaire distinguished between the host organization and the one or more programs it might run, with sections addressing:

- *the organization's location* (city, state, zip code)

- *the type of organization* (e.g,, non-profit, science museum or center, government lab)
- *the organization's connections*: partnering organizations, funding sources, involvement in national networks, and program evaluation
- *program audience*: grade level, special targets (e.g. girls, students with disabilities), application process, demographics of youth participants
- *program structure*: fee structure or stipends, scholarships, meeting schedule and frequency; arrangement of programs in sequences by age and ability
- *program staffing*: nature of staff, staff professional development and training
- *program content*: disciplinary focus, and self-reported nature of SET learning activities (e.g., extended research or design, inquiry-based, group work, presentation).

Altogether, the questionnaire 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. Respondents could enter data on multiple programs offered by their organization.

Questionnaire sampling

We established six criteria to bound our questionnaire sample to include programs that:

- focused on science, engineering and/or technology (self-defined by user),
- included youth in (or entering) grade 6 or higher,
- engaged youth with their peers and/or the public,
- involved youth for multiple sessions,
- had existed for one year or longer, and
- took place outside of school time.

These sampling criteria were based on markers of program quality identified in the literature. We focused on the middle and high school years, when students' science interests may decline or strengthen, and when they begin to make decisions about their future careers (Tai, Liu, Maltese & Fan, 2006). We use the term “science” broadly and interchangeably with the acronym SET, including technology and engineering as well as life, physical, Earth and space sciences. We excluded mathematics-focused programs based on our interest in hands-on investigation, collaboration, and design experiences as methods of engaging youth.

The questionnaire was launched in late 2011 and closed in mid-2012. We distributed invitations widely, through e-mail distribution lists and newsletters of national alliances, networks and funders; direct e-mail invitations to programs identified through web sites, membership lists and directories; business cards distributed at meetings and conferences; social media; and our own professional and personal networks of educators, scientists and engineers. Out of nearly 2300 email invitations, over 1900 were sent to specific OST SET-focused programs, and 300 more reached well-connected individuals working in informal, afterschool, K12 and higher education and in diversity initiatives, across engineering and science disciplines. However, because we also sent broadcast invitations, we have no way to assess how many people or programs received an invitation, and cannot compute a response rate. The final data set includes 712 programs from 45 states, of which 408 programs (57%) 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.

<u>Mission statements</u>

Mission statements were gathered separately from a web search of all organizations that provided an organization web site address and data on at least one program to the questionnaire. Of 396 programs providing a URL, we located mission statements for 326 programs from 285 unique organizations.

<u>Analysis methods</u>

Interview data were analyzed with *NVivo 10* using domain analysis (Spradley, 1980), in which transcripts are searched for units of meaning. Groups of codes that cluster around particular themes were assigned to domains and taxonomies constructed that link domains to coded examples. Matrix tables of frequencies for responses on particular topics or themes enable comparison across domains or among sample sub-groups, such as by organizational type.

Mission statements were coded similarly in Microsoft Excel, noting themes apparent in each statement, such as education, conservation or youth development. For example, 34% of programs had a mission statement identifying high quality education (in STEM or more generally) as a program or organizational goal. Other themes included positive youth development, workforce development, awareness or knowledge of nature, and community involvement. In all, 17% of programs had a mission statement that explicitly addressed inclusion and involvement of diverse and/or underserved populations.

Quantitative data from the questionnaire were exported into *SPSS* version 22. We used SPSS to calculate means and frequencies for the organization- and program-level data. We created dummy variables for categorical program-level and organizational-level variables, then used these to conduct an ordinary least squares (OLS) regression to analyze predictors of diversity of youth participation. To test for statistical significance, we used analysis of variance (ANOVA) and ordinary least squares (OLS) regression for continuous dependent variables; we report effect sizes (eta) for statistically significant results and also conducted post-hoc tests of statistically significant results. For categorical variables, we used crosstabs analyses and computed chi square statistics and effect sizes (Cramer's *V*). We used Bonferroni tests to identify individual differences and reported these if significance values were within 95% confidence intervals ($p \leq 0.05$) after Bonferroni correction.

To classify program locations, we used the US Census Bureau (2014) definition of "urban areas" as those with populations of 50,000 or greater and treated OST programs as "urban" based on the address of the host organization. All others were classified as "non-urban."

To describe the organizational and program characteristics of OST programs in relationship to underrepresented minority (URM) and female participation, we first classified OST programs into "high, medium or low" levels of URM, female, and combined URM and female participation. For each program, respondents reported the distribution of participants by ethnicity. The total percentage of underrepresented minority (URM) youth participants for each program includes all but Asian and White participants, who are not underrepresented in STEM overall. We then conducted a cluster analysis to divide programs (n=408) into three categories (high, medium, low) based on the percentage of participating URM youth. Similarly, we conducted a cluster analysis of programs by female participation and classified programs as female-only, high, medium, or low female participation levels. Lastly we classified programs by the combined proportions of URM and female participation, divided into three categories as shown in Table 1. These grouping strategies enabled us to describe program characteristics in relation to the proportion of URM youth or girls who participated.

Table 1. Underrepresented minority and female participation classification of OST programs

Youth audience	Participation level	Percentage of URM and/or female participants within participation level	Percentage and frequency of programs within participation level
Underrepresented minorities (n=314)	High-URM	67%-100%	33% (n=105)
	Medium-URM	30-66%	25% (n=78)
	Low-URM	0-29%	42% (n=131)
Female (n=338)	All-female	100%	15% (n=49)
	High-female	56%-99%	22% (n=75)
	Medium-female	36-55%	47% (n=159)
	Low-female	0-35%	16% (n=55)
Underrepresented minorities and female (n=311)	Diverse all-female	30% or greater URM and 100% female	8% (n=26)
	Diverse	30% or greater URM and 56-99% female	15% (n=47)
	Less diverse	29% or less URM and/or 55% or less female	77% (n=238)

In the following sections we examine organizational and programmatic characteristics by varying levels of participation by girls and underrepresented minority youth. For questionnaire data, we report frequencies (as percentages) of categorical variables and means of continuous variables and tests of statistical significance as discussed above. We then discuss related results from the interviews. Then, after examining certain characteristics separately, we examine the collective influence of key characteristics using regression models.

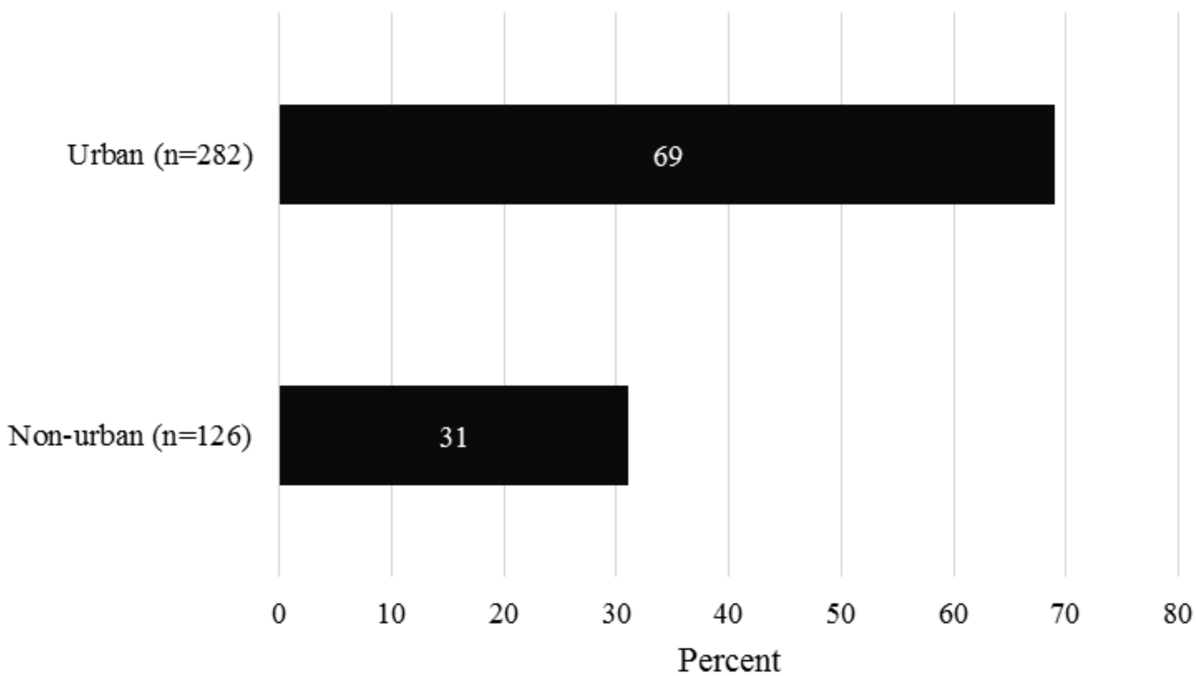
Results: Organizational Characteristics

We investigated the relationship of minority youth and girls' participation to several organizational characteristics, including the location of the host organization, its organization type and mission, and its connections to partners.

<u>Location of OST programs</u>

We reasoned that programs in urban locations would often have better access to minority youth and better success in recruiting and attracting them.

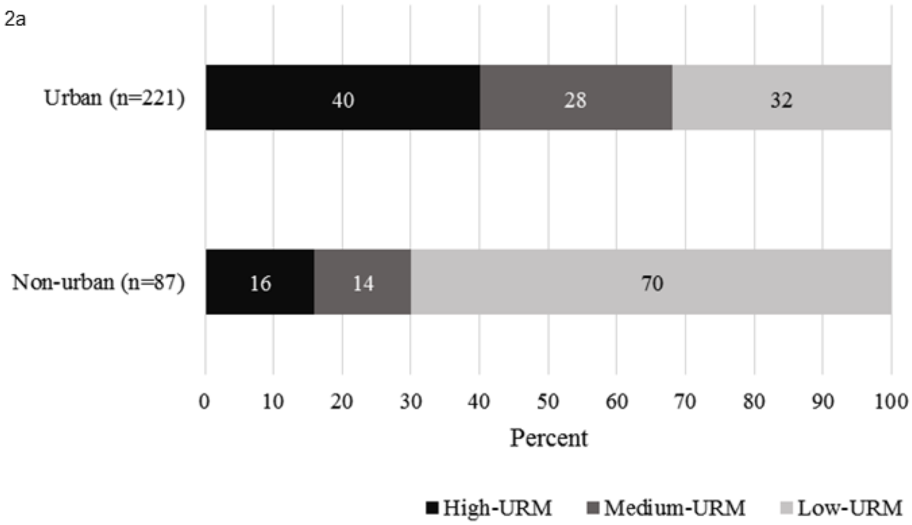
Figure 1. Percentage of urban and non-urban OST programs



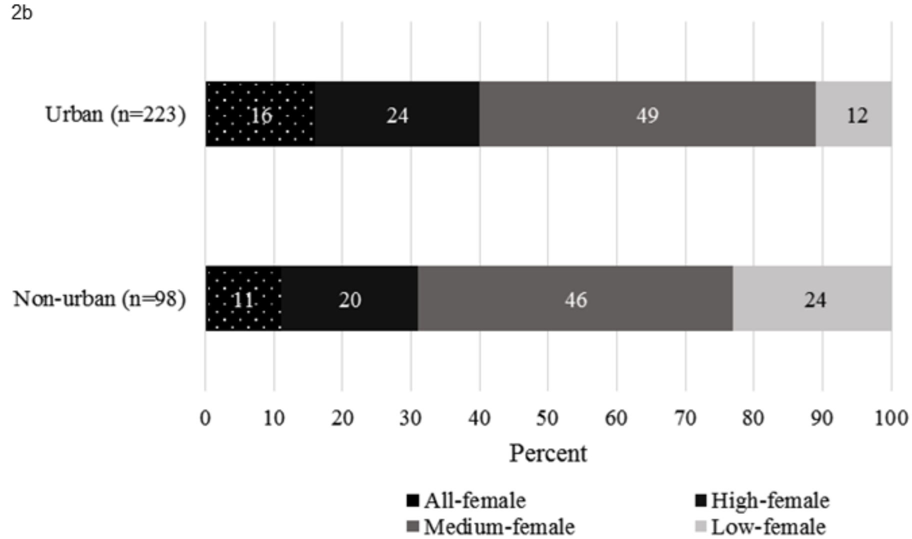
As shown in Figure 1, roughly two thirds of programs in our questionnaire sample were located in urban areas. Compared to non-urban programs, urban programs were statistically significantly (χ^2= 37.89, *df*=2, *p*< 0.001) more likely to have high- or medium-URM participation, and less likely to have low-URM participation (Figure 2a), and the medium effect size (Cramer's *V*=0.35) indicates that this difference is also substantive. There were no statistically significant differences in female participation levels by location (Figure 2b), but there was a statistically significant difference (χ^2= 12.42, *df*=2, *p*=0.002) in combined URM/female participation levels by location (Figure 2c). Urban programs accounted for more of the *diverse all-female* and *diverse* participation categories and fewer of the *less diverse* category, though with a small effect size (Cramer's *V*=0.20).

Figure 2abc. Demographic characteristics of urban and non-urban OST programs

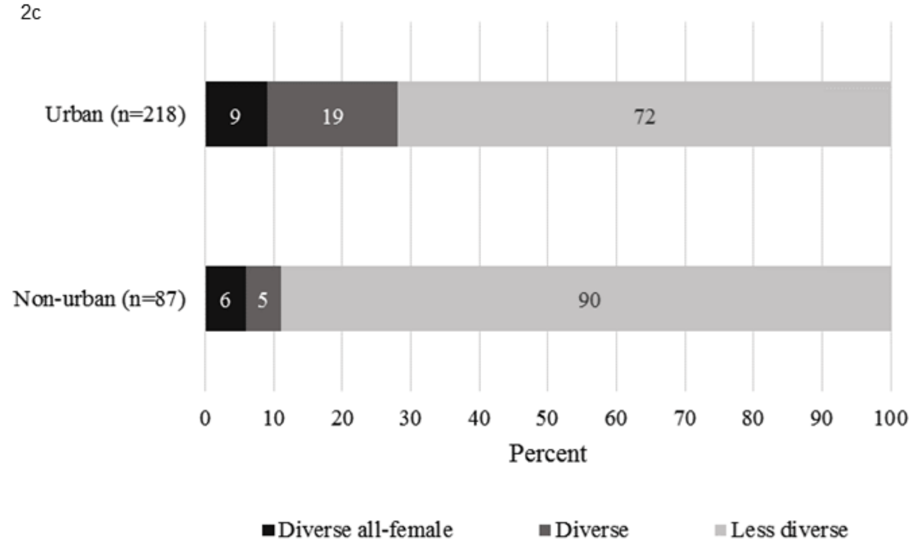
2a


Urban (n=221)
40
28
32
Non-urban (n=87)
16
14
70
0 10 20 30 40 50 60 70 80 90 100
Percent
High-URM
Medium-URM
Low-URM

2b


Urban (n=223)
16
24
49
12
Non-urban (n=98)
11
20
46
24
0 10 20 30 40 50 60 70 80 90 100
Percent
All-female
High-female
Medium-female
Low-female

2c


Urban (n=218)
9
19
72
Non-urban (n=87)
6
5
90
0 10 20 30 40 50 60 70 80 90 100
Percent
Diverse all-female
Diverse
Less diverse

Regional differences in the representation of minority youth, though not girls, were also evident in the interview data. The few rural program directors whom we interviewed were often able to attract underrepresented minority youth in larger proportions than their general representation in the surrounding area. For example, a 4-H leader in a rural and predominantly white area reported higher minority representation than seen in their local schools. He had taken eight students to a national 4-H conference, four of whom were African-American. This may not be typical of rural programs; for interviews we purposefully sought programs that were well designed and highly regarded in the OST science community.

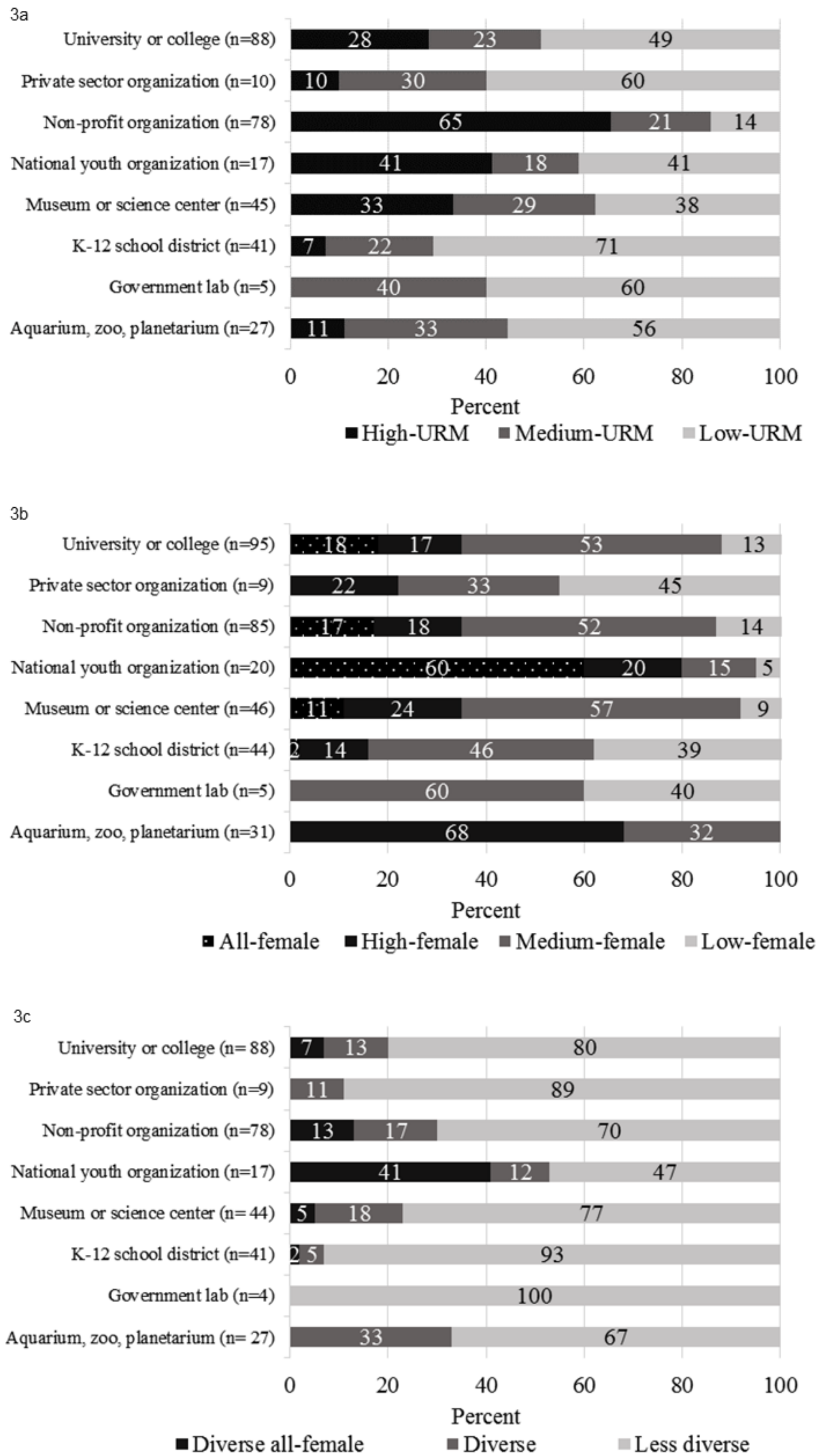
Likewise, many urban program directors sought to reflect the demographics of their local communities, which were often ethnically and culturally diverse—as exemplified by the comment below.

> I want to be reflective of the community. I would say that about 40% [of our youth] are African-American or Latino. And then everyone else is Asian; there are a lot of Filipinos, Pacific Islanders using the program, and 20% of the entire group is Chinese. And everyone else is Nepalese and Thai, and I have one Caucasian girl.

Organization type

In a previous analysis (Laursen, Thiry, Archie & Crane, 2013) we found that the OST programs in this sample differed in many aspects by organization type. Not surprisingly, we found the proportion of participation levels to be statistically significant across all three participation comparisons: URM (χ^2= 68.95, df=14, p<0.001) (Figure 3a), female (χ^2= 112.38, df=21, p<0.001) (Figure 3b), and combined URM/female (χ^2= 44.19, df=14, p<0.001) (Figure 3c), showing medium and small effect sizes respectively (Cramer's V= 0.33, 0.33, 0.27).

Figure 3abc. Demographic characteristics of programs by organization type

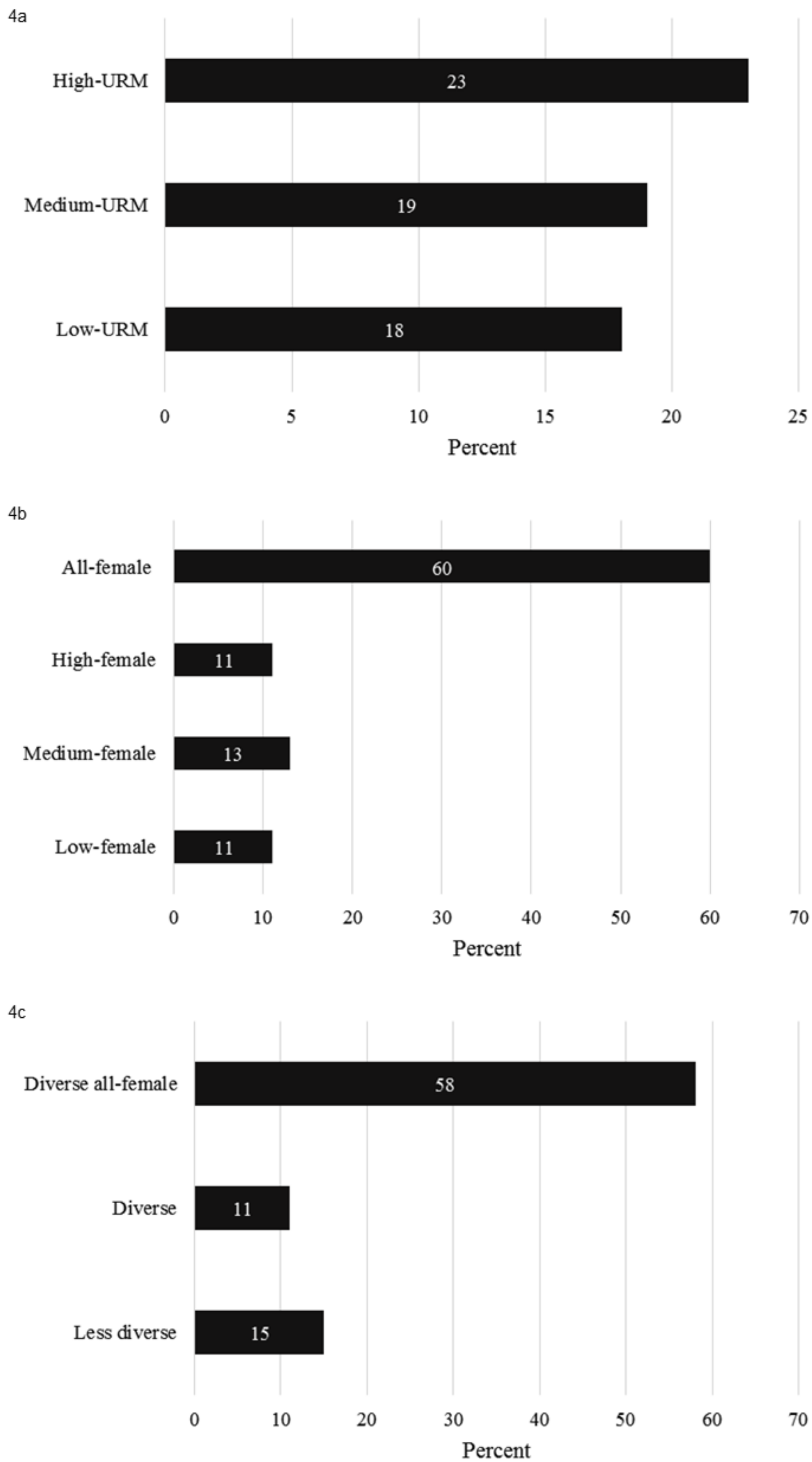

3a
University or college (n=88) 28 23 49
Private sector organization (n=10) 10 30 60
Non-profit organization (n=78) 65 21 14
National youth organization (n=17) 41 18 41
Museum or science center (n=45) 33 29 38
K-12 school district (n=41) 7 22 71
Government lab (n=5) 40 60
Aquarium, zoo, planetarium (n=27) 11 33 56
0 20 40 60 80 100
Percent
High-URM
Medium-URM
Low-URM
3b
University or college (n=95) 18 17 53 13
Private sector organization (n=9) 22 33 45
Non-profit organization (n=85) 17 18 52 14
National youth organization (n=20) 60 20 15 5
Museum or science center (n=46) 11 24 57 9
K-12 school district (n=44) 2 14 46 39
Government lab (n=5) 60 40
Aquarium, zoo, planetarium (n=31) 68 32
0 20 40 60 80 100
Percent
All-female
High-female
Medium-female
Low-female
3c
University or college (n= 88) 7 13 80
Private sector organization (n=9) 11 89
Non-profit organization (n=78) 13 17 70
National youth organization (n=17) 41 12 47
Museum or science center (n= 44) 5 18 77
K-12 school district (n=41) 2 5 93
Government lab (n=4) 100
Aquarium, zoo, planetarium (n= 27) 33 67
0 20 40 60 80 100
Percent
Diverse all-female
Diverse
Less diverse

The patterns were generally consistent: national youth organizations and nonprofit organizations reported high participation of URM youth, girls, or both. Government labs, school districts, and private-sector organizations were least likely to report high participation of under-served youth. Universities and colleges, museums and science centers, and aquariums, zoos and planetariums tended to fall mid-range. Yet while programs' success in recruiting girls and minority youth varied notably and consistently by location and organization type, these results alone do not help to explain why. We next examine specific organizational factors that may influence URM and female participation.

<u>Organizational Mission</u>

We considered the role of organizational mission in shaping youth programs and participation. We found (Figure 4a) that a greater proportion of programs with high URM participation had a diversity theme in their mission statement than did medium- and low-URM programs, although this difference was not statistically significant. A statistically significant (χ^2= 52.84, *df*=3, *p*<0.001) and substantially larger proportion (Cramer's *V*= 0.45) of *female-only* programs had diversity-themed mission statements than did other programs (Figure 4b). Likewise, in the combined URM/female comparison (Figure 4c), *diverse all-female* programs a statistically significant (χ^2= 25.48, *df*=2, p<0.001) and substantially larger (Cramer's *V*= 0.32) proportion of programs with diversity-themed mission statements than did *diverse* and *less diverse* programs.

Figure 4abc. Organizational mission statement and OST program diversity


4a
High-URM
23
Medium-URM
19
Low-URM
18
0
5
10
15
20
25
Percent
4b
All-female
60
High-female
11
Medium-female
13
Low-female
11
0
10
20
30
40
50
60
70
Percent
4c
Diverse all-female
58
Diverse
11
Less diverse
15
0
10
20
30
40
50
60
70
Percent

Organizational differences also emerged in interviewees' discussions of program mission and goals. For example, all of the university and college program directors discussed youth development as a goal, but none explicitly discussed diversity or increasing access to science. In contrast, museums and science centers often focused on diversity as part of their missions, particularly since many were located in diverse, urban areas. Even absent a formal organizational mission, many respondents discussed the importance of increasing access to science and providing opportunities that students might not otherwise have, as noted by an interviewee who stated that, "some [youth] might fall through the cracks and I try to grab them before they do that."

Consistent with the questionnaire findings, interviewees from non-profit organizations overwhelmingly stated that broadening participation in STEM for girls and or underrepresented minority youth was a primary part of their program mission and a reason they were founded, as demonstrated in the following comment from a program director from a large metropolitan area. She had earlier noted how many low-income and minority youth did not have access to the abundant scientific resources within her city.

> And so we kind of thought that there was a role for an organization in the life of the city to make sure that students that otherwise would not have an opportunity to do science had, in fact, those opportunities. That was the impetus for us to found the organization and for us to do these programs.

<u>Funding and affiliations</u>

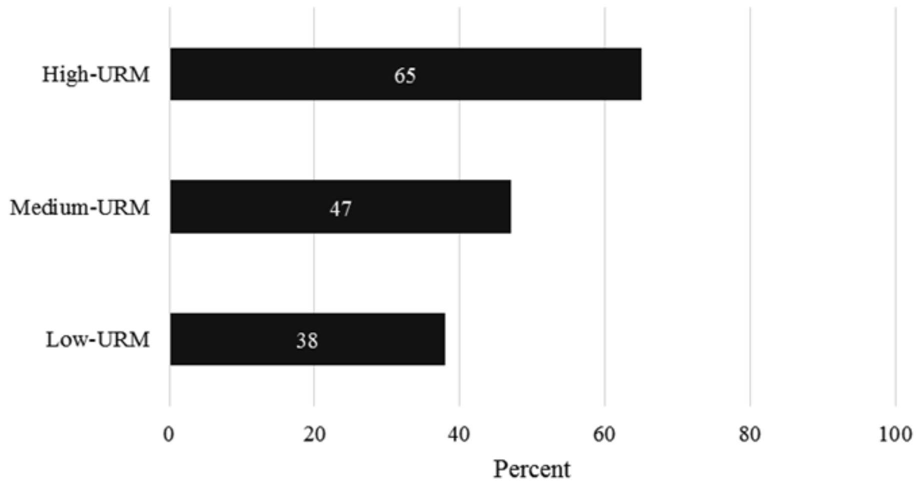
Overall, there were no statistically significant patterns in professional affiliations or funding sources for the OST programs in our sample. These organizations were generally well-connected to sources of support, which may be related to the networks through which we sampled.

<u>Partner organizations</u>

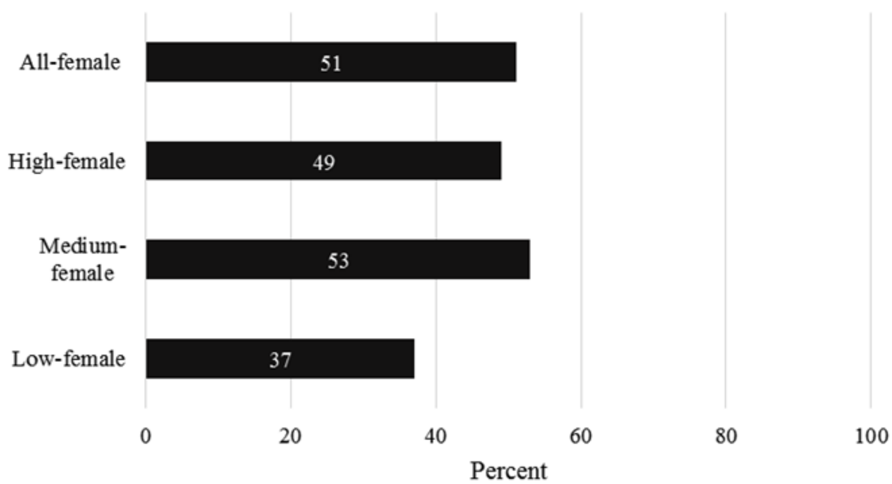
We asked questionnaire respondents to report whether or not their OST program partnered with one or more other organizations. We defined partners as active contributors that designed curriculum or content; helped deliver the program to youth; hosted or provided physical space; or contributed guest speakers, mentors, or other adult volunteers.

Figure 5abc. Partner organizations and diversity of OST programs

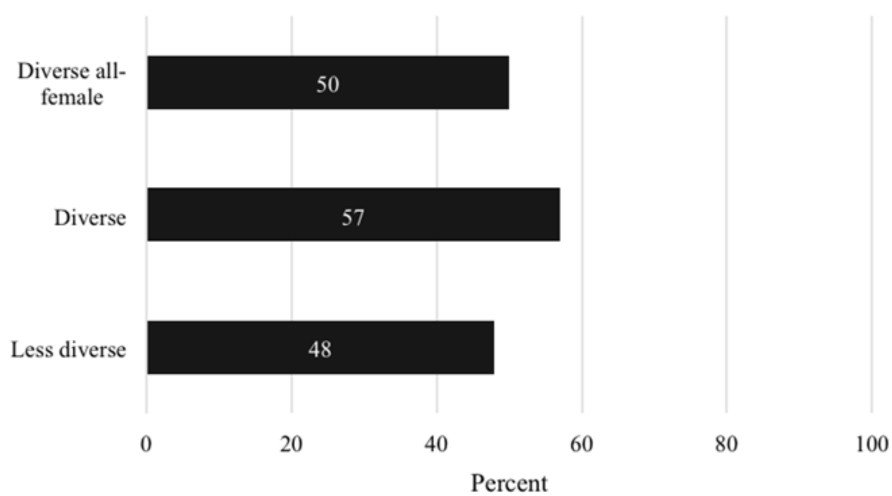
5a


High-URM
65
Medium-URM
47
Low-URM
38
0
20
40
60
80
100
Percent

5b


All-female
51
High-female
49
Medium-female
53
Low-female
37
0
20
40
60
80
100
Percent

5c


Diverse all-female
50
Diverse
57
Less diverse
48
0
20
40
60
80
100
Percent

When compared by URM participation (Figure 5a), we found that, generally, as URM participation increased, so did the proportion of partnered organizations. This difference in partnering was statistically significant ($\chi^2 = 17.28$, $df = 2$, $p<0.001$), but the effect size was small (Cramer's $V = 0.24$). As shown in Figure 5b, patterns in partnering among programs by female participation were not significant, nor were variations among programs in the combined URM/female comparison (Figure 5c).

In interviews, program directors emphasized the importance of partnerships for all aspects of program management and delivery: student recruitment, program content, funding, materials and supplies, facilities, and sustainability. Fully 42 of the 53 interviewees specifically talked about the value of partnerships to OST programming, especially for programs serving low-income or URM youth. One program director described partnerships that helped their low-income youth participants to prepare for college, providing access to resources otherwise not available.

> We've developed two really important partnerships—one is for Kaplan, and they give us 60 free SAT [Scholastic Aptitude Test] spots every year. And we also have a partnership with a local college counseling organization, which is one of the best in the city. They have a whole library of college stuff, financial aid workshops, and college counseling for students and their families. And they'll go through a FAFSA [Free Application for Federal Student Aid] and fill it out with the family.

Partnerships were also important for program sustainability, as strategic partnerships could fill gaps in services or expertise. A representative of a national youth organization discussed the importance of partners to provide volunteers who reflected the diversity of their youth participants.

> The art of sustainability is finding the volunteers…. We are working on developing national and state and local partnerships with organizations like the Society for Black

> Engineers, and all kinds of scientific associations that have come to us and said, "We have professionals—scientists or engineers who want to work with kids, and [we can] get you volunteers." And that's one of the things that we've been doing to help programs to become more sustainable.

Some programs developed partnerships with local schools or community organizations to better target and recruit local, low-income or minority youth. For example, a staff member from an organization that had struggled to recruit minority youth, despite a locally large Hispanic population, described strategies that had substantially increased the enrollment of minority youth in their sleep-away program. Identifying community and local leaders who could reach out to families contributed to the turn-around in their recruiting efforts.

> We go out into the community and we find 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 programs? We've developed a good network of formal and informal providers… they recruit the kids for us, and we work with them to make sure they have all the information they need. They're like our agents on the ground who are telling the parents it's okay, and helping to gather the paperwork. The experience of [this program] is definitely outside of the comfort zone of a lot of the families, …[so] it's a big step for them to let their child go for a week. A lot of these kids help with child care in their family, they have roles [such] that the family has to structure their lives differently for the week that they're up at camp. It's a lot of work from our recruiters and other community advocates that help with that.

These findings affirm the significance of partnerships in providing needed services or support and for identifying and recruiting youth from target audiences, as others have likewise found (Noam, 2001; Noam & Tillinger, 2004). While the partnerships created by programs in our study helped to support students, especially those from underserved communities, most existed at a basic, transactional level. Few of the partnerships reached the highest levels of partnership, interconnectedness or transformational partnerships, following the typology created by Noam & Tillinger, 2004. Instead, most of the partnerships described by OST SET program staff in this study operated on lower partnership levels, such as "functional" (serving overlapping interests) or "collaborative" (joining forces) (Noam & Tillinger, 2004). Many of these functional partnerships served youth or provided support in ways that the program could not accomplish alone, while also meeting the needs of the partnering organization.

Results: Program Characteristics

In this section we describe results that relate minority youth and girls' participation in OST science programming to specific characteristics of the program itself, including financial accessibility, contact hours, and curricular features.

<u>Program longevity</u>

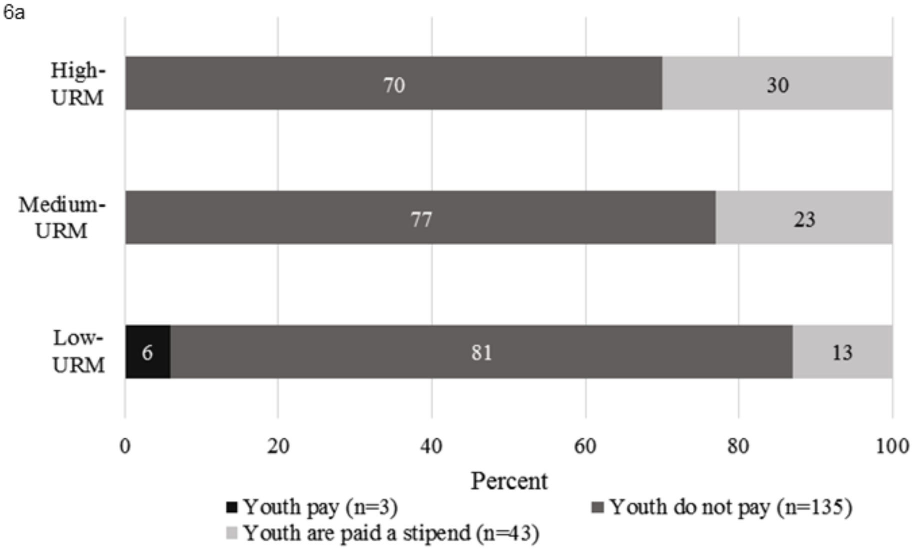
We surmised that a program's age would reflect its overall effectiveness in developing community support and recruiting URM youth. However, we found no meaningful or statistically significant differences in program longevity (in years) by URM participation level. Overall, the programs in this sample were well established and longevity was not a good indicator of their record of serving minority youth and girls.

<u>Financial accessibility</u>

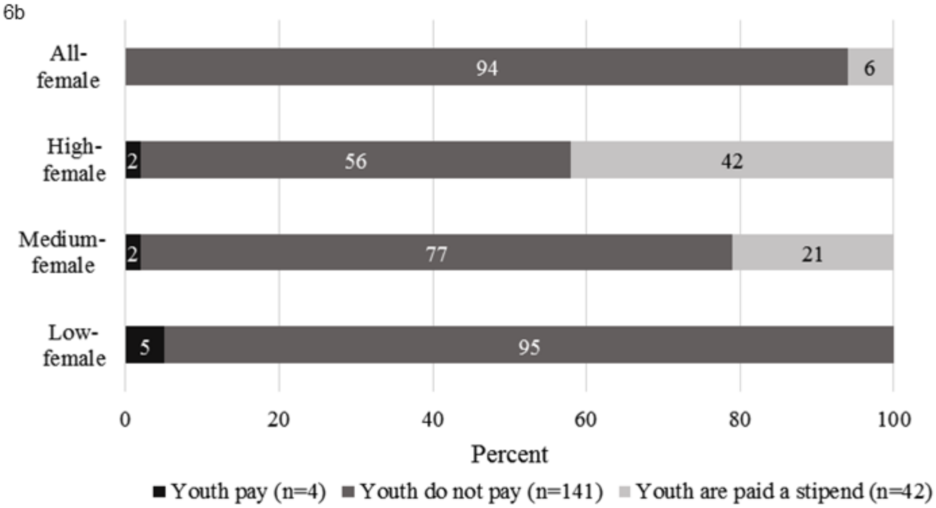
We probed the financial accessibility of OST science programs using two factors, fee structure and scholarship offerings. We expected that programs seeking to attract minority youth would minimize the cost to youth who may also be low-income, and that scholarships might be one way to do so in programs that also attracted paying youth.

Only a few (2%) of the programs in this sample required participants to pay. Overall, such programs had low-URM (Figure 6a), low-female (Figure 6b), and less diverse (combined URM/female) participation (Figure 6c). In contrast, programs with greater diversity were more likely to offer stipends to participants, across all three comparisons: URM (χ^2= 13.13, *df*=4, *p*=0.011); female participation (χ^2= 20.07, *df*=6, *p*=0.003); and combined URM/female (χ^2= 20.12, *df*=4, p<0.001). But all showed similar and small effect sizes (Cramer's *V*= 0.19, 0.23, 0.24, respectively), indicating that the differences in stipend payment by participation level were not large.

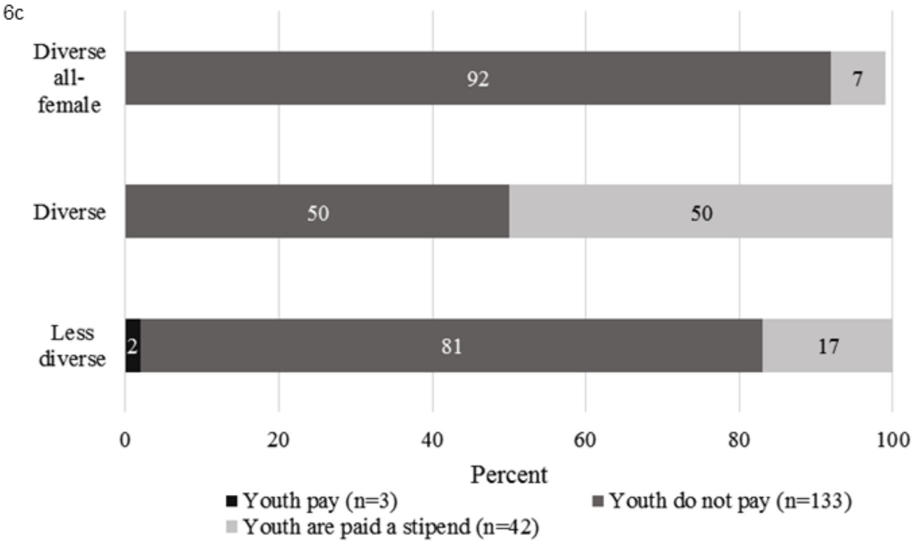
6a


High-URM
70
30
Medium-URM
77
23
Low-URM
6
81
13
0
20
40
60
80
100
Percent
Youth pay (n=3)
Youth do not pay (n=135)
Youth are paid a stipend (n=43)

6b


All-female
94
6
High-female
2
56
42
Medium-female
2
77
21
Low-female
5
95
0
20
40
60
80
100
Percent
Youth pay (n=4)
Youth do not pay (n=141)
Youth are paid a stipend (n=42)

6c


Diverse all-female
92
7
Diverse
50
50
Less diverse
2
81
17
0
20
40
60
80
100
Percent
Youth pay (n=3)
Youth do not pay (n=133)
Youth are paid a stipend (n=42)

Many of the programs represented in our interview sample were free to participants or offered stipends or employment opportunities, but a substantial minority charged youth to participate. Overall, 15 programs were free, 12 programs paid their participants wages or a stipend, and 10 charged a fee (of which six provided scholarships). Many of the no-cost or stipend-paying programs made decisions about program costs based on equity issues and the goal of increasing program access for low-income students. Especially for programs serving teenagers, providing a stipend or wages was crucial to recruit low-income youth who might otherwise need to work.

> We've been trying to reach out to the local high schools to get more students of color into the program. This is difficult is because a lot of the students need to work in the summer, so for them to spend eight weeks doing research and not actually having a job is very difficult for the families to afford that. When they finish the program, we give them $1000.

These financial factors are important in broadening participation. Often, targeted students join a program for the financial opportunity but in doing so gain access to youth development and science learning opportunities beyond what is provided in school, as noted by a program director.

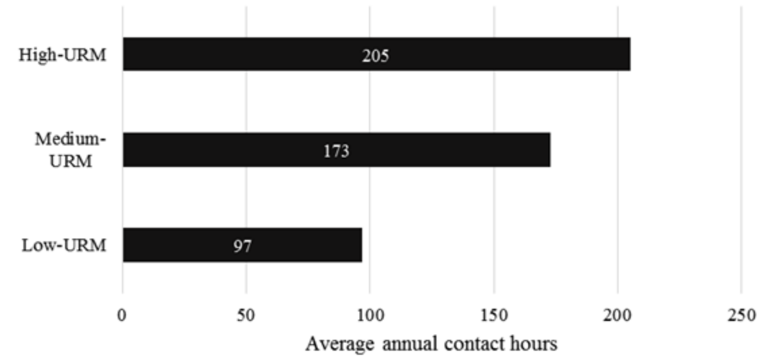
> We specify to recruit the kids who are most in need of support in making the transition into a healthy adulthood, which meant we were not looking for the kids most like ourselves, and we weren't looking for the kids most like the science teachers in school. Most of the kids did not communicate to us that they loved science or even had an interest in science. Most of them came because it was a job, you know? It met one of their fundamental needs in terms of a little bit of income and some independence.

<u>Annual contact hours</u>

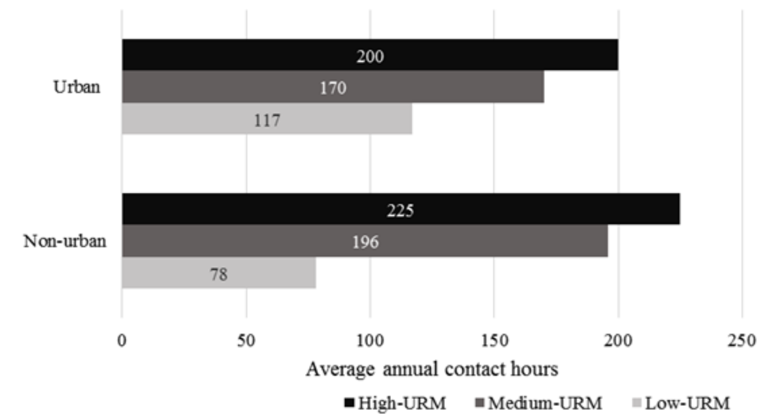
We asked organizations to report the average number of annual contact hours for a “typical” program participant. Comparing average contact hours, we found a statistically significant (*F*= 13.96, *p*< 0.001) and meaningful difference (Eta=0.33) by URM participation level (Figure 7a). On average, programs with high-URM participation reported statistically significantly more annual contact hours than did those with medium-URM participation, which in turn reported significantly more contact hours than did programs with low-URM participation.

Figure 7abc. Average contact hours and diversity of OST programs

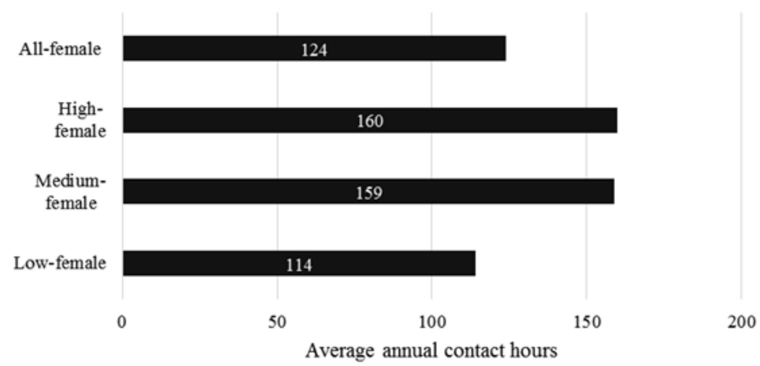
7a


High-URM
205
Medium-URM
173
Low-URM
97
0
50
100
150
200
250
Average annual contact hours

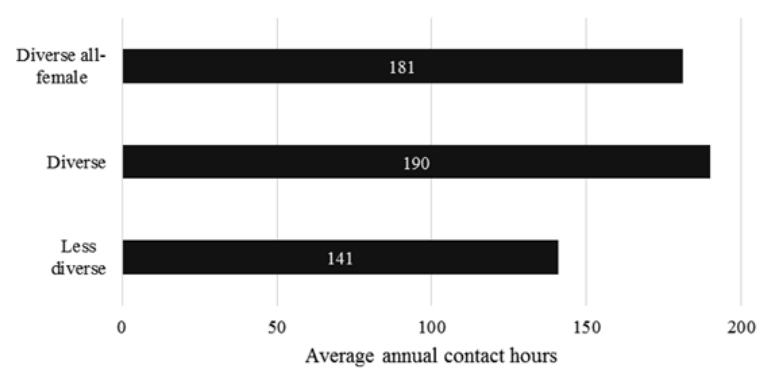
7b


Urban
200
170
117
Non-urban
225
196
78
0
50
100
150
200
250
Average annual contact hours
High-URM
Medium-URM
Low-URM

7c


All-female
124
High-female
160
Medium-female
159
Low-female
114
0
50
100
150
200
Average annual contact hours

7d


Diverse all-female
181
Diverse
190
Less diverse
141
0
50
100
150
200
Average annual contact hours

Because more programs with high URM participation were also located in urban areas, we wondered whether the increased number of annual contact hours was related indirectly to program location or directly to URM participation. Yet regardless of program location, as URM participation increased, so did average annual contact hours. Moreover, average annual contact hours varied little by location (Figure 7b). That is, both urban and non-urban programs that were successful in attracting minority youth offered high contact-hour programs.

Analyzing by female participation level (Figure 7c) and by combined URM/female participation (Figure 7d), we found that low-female, female-only and *less diverse* programs tended to offer lower contact hours, but none of these differences were statistically significant.

Likewise, in our interview sample, programs targeting underrepresented youth tended to be extended in scope and duration, compared to less-intensive afterschool programs or one-day workshops for the general youth population. More intensive programs, including internships or research experiences, often required summer-long or year-long commitments and provided mentoring, career development, skill development, and scaffolded learning by which students gained deeper scientific content knowledge and took on more responsibility over time.

The director of a research program described the deep science learning to which youth were exposed, and the commitment required of them.

> At the moment we only take 20 students. The aim was 100% under-resourced kids. And it's a learning progression that works in modules by subject. The students are here for over 165 hours a year. The students do their own research starting in the summer, and then they also have all these other modules that they work on, that always have very intensive science content as well as a heavy emphasis on the process of science, and there's always a career piece where a scientist comes and talks about their career trajectory.

By design, many programs targeting underrepresented youth—whether minority, low-income, or female students—provided expanded contact hours. Not only did this foster deeper learning and greater opportunities for professional and personal development, but it also provided an avenue to pay students to work and learn. Requiring such time commitments from youth helped programs to meet their educational, financial, and equity goals.

Curricular elements

To understand what educational design features were associated with high minority youth and girls' participation, we asked organizations to report the educational elements of the OST programs they provided. Survey respondents selected the design features of their program from a list, generated from earlier interviews and literature reviews identifying markers of high-quality programs, which included curricular options such as extended research or design, inquiry-based learning, exposure to STEM careers, and opportunity to share knowledge with the local community. Respondents were instructed to select all of the curricular elements that applied to their program. We found several key differences in OST program elements by level of URM participation (Figure 8a). A statistically greater (χ^2= 6.87, *df*= 2, *p*=0.032) proportion of high-URM programs featured "exposure to STEM careers," but this difference was modest (Cramer's *V*= 0.15).

Examining programs by female participation (Figure 8b), a significantly smaller proportion of programs with low-female participation reported "exposure to STEM careers" as a program element compared to programs with medium, high, and all-female participation(χ^2= 17.54, *df*= 3, p=0.032, Cramer's *V*= 0.23) . There were no differences in program elements among the combined URM/female participation groups (Figure 8c).

As a means of understanding how program providers categorized their learning activities, survey respondents were also asked to provide an example of a SET-focused activity from their program. Many programs described extended research or design activities, inquiry-based activities, scientific presentation opportunities, and/or exposure to careers through role models or field trips. For example, a staff member from an after-school program for girls described an extended engineering design activity:

> The girls worked with therapists from the Children's Hospital to design and build simple toys or devices for developmentally challenged kids. Activities often take place whenever the girls on the team (5 different teams/schools, 2-5 girls on each team) can meet with their Society for Women Engineers mentor. Most projects involve girls working in teams. We give an open-ended challenge that they can complete and then share with the rest of the group and family at the end of the program.

Often such programs were strongly connected to their local communities. For example, a staff member of an after-school science program described an inquiry-based activity in a local natural area:

> One activity involves a macro invertebrate stream study where youth learn about how organisms in the water can be an indicator of the health of the stream. They work in groups to collect and identify specimens and then use that information to determine the health of the stream.

Other extended research-based projects offered students the opportunity to evaluate and present information in a process that replicated real-life decision making:

> Students work in groups to conduct a research project. For example, last year students examined different beetle kill treatment sites [in a forest], evaluated the habitat and determined how the different treatments would affect a bird species in the present, in 20 years, and in 40 years. The campers worked in groups to collect data, create scientific posters and present their posters to wildlife biologists at the end of the camp.

Affirming our finding that programs serving URM youth and girls had more markers of quality, interviewees involved with programs targeting underrepresented groups were more likely than others to discuss real-world scientific content and efforts to create a community of learners. Role models and exposure to career paths were other essential learning elements, especially for programs targeting girls. These elements were often combined to create rich learning experiences for youth. For example, a program director described a learning environment in which undergraduate science majors led inquiry-based science activities for elementary girls.

> We emphasize hands-on learning and asking questions, inquiry learning, and our activities are usually problem-oriented. They follow an activity and [look at] what do they find out, and what questions do they have now, how would they pursue those, what new questions do they have as a result of having done this activity. And the mentors, their role is to encourage and facilitate, but not to provide answers—to get the girls to ask questions—so it's oriented towards problem-solving.

The inclusion of practicing scientists acting as role models, in particular, seems to be well suited for programs targeting underrepresented groups. Role models of the same gender or ethnic group as youth can share their personal stories of challenge, struggle, and success and provide valuable insight into the practice and culture of science. One director described how role models interacted with girls to provide a well-balanced picture of what it means to be a woman in science.

> They share a personal story through a PowerPoint presentation, so we encourage the role model to include lots of pictures, stuff from when they were kids: How did they get to where they are now? Were they always interested in science? Really let the girls see who they are inside and out, and what led them to this career. [We let] the role models know it's okay to tell the girls that you were bad at math, and that one bad grade in math doesn't mean you're bad at math altogether, and that you may not have not always liked science, and there may been this one thing or this one person that really inspired you or

> encouraged you. Or you flunked your first semester of college in these science classes, but you tried again, and it wasn't easy—and to share all those things. And also what they love about their career, and about their current personal life to show that you can have a demanding career that also allows you to have a personal life, and be a mom, and travel, and have hobbies.

Additionally, role models provided exposure to career paths that students might not otherwise encounter, as described below by an interviewee working with a regional Girl Scout council.

> So we had a girl on one of our robotics teams who wanted to be a lawyer. And her mentors happened to be roboticists from the Jet Propulsion Laboratory, and she realized she could be a patent lawyer, and combine the two things she loved.

Thus many programs serving underrepresented youth drew on a common repertoire of learning practices, such as hands-on activities, exposure to science careers, and the inclusion of mentors or role models.

Results: Modeling relationships among organizational characteristics and participation of diverse youth in OST programs

The analyses discussed so far have examined minority youth and girls' participation in OST programs as a function of discrete organizational and program characteristics, but these characteristics may also be related. To understand these inter-relationships, we conducted an ordinary least squares regression to determine which characteristics were most strongly related to reported URM and female participation rates. Roughly half of respondents did not complete all the relevant questions, thus we limited the model to a small number of variables to maximize the number of observations that were complete and included only those characteristics that showed statistically significant differences by URM and/or girls' participation level in prior analyses. And, despite the strong statistical differences by organization type, we chose to omit this variable from the model, reasoning that organization type does not directly influence participation, but rather relates to other organizational attributes such as mission statement.

Underrepresented minority participation

The regression model (Table 2) was statistically significant and explained roughly 13% of the variability in URM participation. Of all the variables included in the model, location and partnership status (in bold in Table 2) were the only variables that were statistically significantly and strongly associated with URM participation rates. The unstandardized coefficients indicate that programs at an urban organization had on average 18% more underrepresented minority participants than did programs at a non-urban organization. And programs that partnered with one or more other organizations had, on average, 16% more underrepresented minority participants than did those that did not.

Table 2. Results of OLS regression for underrepresented minority participation in OST programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	34.16	8.17		4.18	0.000
Location	18.43	7.79	0.23	2.37	0.020
Partner organization	16.12	5.99	0.26	2.69	0.008
Mission statement	12.97	9.78	0.13	1.33	0.188
Fee structure	2.90	7.00	0.04	0.42	0.679
Public funders	1.85	1.81	0.10	1.02	0.310

Overall model F= 11.99, p< 0.001, r^2= 0.13

Because of the clear and strong linkage between URM program participation and location of organizations, we elected to perform separate regression analyses by location. We sought to determine the extent to which characteristics associated with URM participation were similar for programs located in urban and non-urban areas despite likely differences in their local densities of underrepresented minorities.

Urban sample

A regression limited to urban organizations (Table 3) was statistically significant and explained 7% of the variability in URM participation. In this model, an organization's partnership status was the strongest and only statistically significant predictor (in bold) of URM participation. Partnered programs had, on average, 19% more underrepresented minority participants than did programs that were not partnered.

Table 3. Results of OLS regression of underrepresented minority participation for urban programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	54.74	7.36		7.43	0.000
Partner organization	19.03	6.70	0.31	2.84	0.006
Mission statement	3.90	10.93	0.04	0.36	0.722
Fee structure	-0.07	7.46	0.00	-0.01	0.993
Public funders	1.12	1.95	0.06	0.57	0.568

Overall model F= 4.30, p= 0.015, r^2= 0.07

Non-urban sample

The regression model limited to programs located in non-urban areas (Table 4) was statistically significant and explained 26% of the variability in URM participation. In this sample, organizational mission statement was the only statistically significant predictor (in bold) and the most strongly associated with URM participation of any variable included in the model. The unstandardized effect size indicates that programs based at organizations whose mission statement included a diversity theme had, on average, 58% more underrepresented minority participants in their programs than did those that did not.

Table 4. Results of OLS regression for underrepresented minority participation in non-urban OST programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	31.92	11.94		2.67	0.018
Partner organizations	-2.86	12.58	-0.05	-0.23	0.824
Mission statement	58.83	20.58	0.62	2.86	0.013
Fee structure	16.19	19.52	0.17	0.83	0.421
Public funders	5.41	4.59	0.24	1.18	0.258

Overall model $F = 10.25$, $p < 0.001$, $r^2 = 0.26$

Female participation

A regression model (Table 5) was statistically significant and explained 13% of the variability in female participation. Similar to the non-urban sample, organizational mission statement was the only statistically significant predictor and the most strongly associated with female participation of any of the variables included in the model. The unstandardized effect size indicates that programs whose host organizations included a diversity theme in their mission statement had, on average, 15% more underrepresented minority girls than did others.

Table 5. Results of OLS regression for female participation in OST science programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	46.90	9.70		4.84	0.000
Location	9.36	8.70	0.14	1.08	0.286
Mission statement	15.22	5.67	0.36	2.69	0.010

Private funders	-0.83	1.18	-0.09	-0.70	0.485
Fee structure	6.97	5.40	0.17	1.29	0.202

Overall model F= 11.05, p< 0.001, r^2= 0.13

The results of these regression analyses showed that URM and female participation rates were strongly related to a single factor in each analysis accounting for location. Urban-based organizations who partnered with another organization were much more likely to have greater proportions of URM participants, while organizations with a diversity-themed mission statement were much more likely to have greater proportions of URM participants when located in non-urban locations, and greater proportions of female participants regardless of location.

Limitations of the study

The ill-defined nature of our target population of programs posed many logistical and methodological challenges, especially in identifying a representative sample. There is no single network of OST SET programs in the U.S. or a well-bounded population of programs from which to sample. Thus we conducted extensive website and literature reviews, employed snowball sampling methods, and drew from a handful of existing networks. But we had no reliable way to locate the multitude of small programs that may operate in isolation, for example, at K-12 schools, community centers, or parks and recreation districts. By default, the programs in our sample are more likely to be well-connected than the typical OST SET program in the United States that may be operating in isolation.

Moreover, we purposefully excluded newer programs that offered short-term or one-off events. Thus, our sample of programs most likely displays more markers of program quality than the typical OST SET program in the US. The sample is limited by logistical constraints and methodological and theoretical choices made for study inclusion. Our ability to analyze the data for some types of patterns was constrained. The qualitative data helped to fill gaps where we did not have the statistical power to capture quantitative differences and provided insight into domains that cannot easily be quantified.

Discussion

Because many out-of-school programs in general serve high proportions of girls and underrepresented minority students, they hold potential to broaden access to SET learning experiences to populations that have not participated in these fields at high rates (CSAS Summit, 2014). Yet do OST SET programs fulfill this promise? Our findings suggest that well-connected programs that exhibit some markers of quality are indeed providing high-quality programming and serving under-resourced communities. Encouragingly, programs serving URM youth and girls often showed the most numerous indicators of high quality learning experiences, such as extended design experiences and access to role models. Design elements are important because learning environments will shape the social and cultural interactions and scientific practices that students experience in the program. Our findings demonstrate that many OST SET programs were exposing students to the tools, discourses, and sociocultural practices of science (Bell et al, 2009). While many programs seemed to provide rich scientific learning environments, their ability to deliver on far-reaching promises of equity and access varied by organizational and programmatic design elements that influenced not only *what* students experience in OST SET programs, but *who* participates.

For the most part, youth demographics reported overall reflected the racial and ethnic diversity of youth in the U.S. (US Census, 2012), though the participation of minority youth varied substantially by location and organizational type. While urban areas attracted more diverse student audiences, some non-urban programs also served highly diverse youth. Importantly, urban and non-urban programs that successfully recruited diverse youth differed only slightly on design or organizational features.

Yet location alone did not predict the prevalence of girls or underrepresented minority youth as OST science participants. Differences in participation often reflected the host organization's mission: for instance, national youth organizations may set out to serve girls or low-income or urban youth. Science centers, national youth organizations and non-profits were more likely than programs based at national labs or K-12 schools to explicitly include diversity in their mission, and this was a significant predictor of minority youth participation in non-urban locations and for girls in all locations. Programs serving diverse youth also had a greater number of partners and were more likely to pay youth a stipend. Thus, several sociocultural, place-based features of programs or host organizations, such as location, partnerships within the local community, and organizational identity or mission, were directly related to the diversity of youth participants. While curriculum and other educational design features mattered for retaining students, these other organizational features were key to recruiting diverse youth.

Collectively, these features reflect the intentionality and commitment needed to effectively recruit and retain URM youth and girls into OST SET programs. Leaders of effective programs were deeply aware of their local context, community, and youth population. They formed partnerships with community organizations, identified local leaders and champions, and reached out to families and schools to identify and recruit youth who could benefit from their programs. Programs also used partnerships to fill gaps in their programming and better serve youth from non-dominant communities.

In short, high numbers of underrepresented minority youth or girls did not show up in OST SET programs simply by happy accident. An urban location and a diversity-oriented mission statement helped to enhance URM youth participation, but were not sufficient to ensure diversity. Rather, successful programs *enacted* their mission statement through their recruitment practices and program design. They provided extended duration, engaging programming so that they could develop long-term relationships with youth. To deliver on the promise of engaging youth populations who have not fully participated in SET education and careers, local ecosystems that connect OST programs, families, schools, communities, and local leaders must be created and sustained (Traphagen & Traill, 2014). Policymakers must do more to fund and promote the development of these broad ecosystems of support for out-of-school science programming to ensure access to opportunity for under-resourced youth.

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Table 1. Underrepresented minority and female participation classification of OST programs

Youth audience	Participation level	Percentage of URM and/or female participants within participation level	Percentage and frequency of programs within participation level
Underrepresented minorities (n=314)	High-URM	67%-100%	33% (n=105)
	Medium-URM	30-66%	25% (n=78)
	Low-URM	0-29%	42% (n=131)
Female (n=338)	All-female	100%	15% (n=49)
	High-female	56%-99%	22% (n=75)
	Medium-female	36-55%	47% (n=159)
	Low-female	0-35%	16% (n=55)
Underrepresented minorities and female (n=311)	Diverse all-female	30% or greater URM and 100% female	8% (n=26)
	Diverse	30% or greater URM and 56-99% female	15% (n=47)
	Less diverse	29% or less URM and/or 55% or less female	77% (n=238)

Table 2. Results of OLS regression for underrepresented minority participation in OST programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	34.16	8.17		4.18	0.000
Location	18.43	7.79	0.23	2.37	0.020
Partner organization	16.12	5.99	0.26	2.69	0.008
Mission statement	12.97	9.78	0.13	1.33	0.188
Fee structure	2.90	7.00	0.04	0.42	0.679
Public funders	1.85	1.81	0.10	1.02	0.310

Overall model $F= 11.99$, $p< 0.001$, $r^2= 0.13$

Table 3. Results of OLS regression of underrepresented minority participation for urban programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	54.74	7.36		7.43	0.000
Partner organization	19.03	6.70	0.31	2.84	0.006
Mission statement	3.90	10.93	0.04	0.36	0.722
Fee structure	-0.07	7.46	0.00	-0.01	0.993
Public funders	1.12	1.95	0.06	0.57	0.568

Overall model $F= 4.30$, $p= 0.015$, $r^2= 0.07$

Table 3. Results of OLS regression for underrepresented minority participation in non-urban OST programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	31.92	11.94		2.67	0.018
Partner organizations	-2.86	12.58	-0.05	-0.23	0.824
Mission statement	58.83	20.58	0.62	2.86	0.013
Fee structure	16.19	19.52	0.17	0.83	0.421
Public funders	5.41	4.59	0.24	1.18	0.258

Overall model F= 10.25, p< 0.001, r^2= 0.26

Table 4. Results of OLS regression for female participation in OST science programs

Variable	β	*SE*	Std β	*t*	*p*
Constant	46.90	9.70		4.84	0.000
Location	9.36	8.70	0.14	1.08	0.286
Mission statement	15.22	5.67	0.36	2.69	0.010
Private funders	-0.83	1.18	-0.09	-0.70	0.485
Fee structure	6.97	5.40	0.17	1.29	0.202

Overall model F= 11.05, p< 0.001, r^2= 0.13

List of captions for Figures.

Figure 1. Location of OST programs (n=408).

Figure 2: Diversity of youth OST programs as a function of program location. (2a) URM participation level by program location (n=308). (2b) Female participation level by program location (n=305). (2c) Combined URM/female participation level by program location (n=327).

Figure 3: Diversity of youth OST programs as a function of organization type. (3a) Underrepresented minority participation level by organization type (n=311). (3b) Female participation level by organization type (n=335). (3c) Combined URM/female participation level by organization type (n=308).

Figure 4: Diversity of youth OST programs as a function of mission statement. (4a) Percentage of programs with diversity theme present in mission statement by URM participation level (n=244). (4b) Percentage of programs with diversity theme present in mission statement by female participation level (n=260). (4c) Percentage of programs with diversity theme present in mission statement by combined URM/female participation level (n=242).

Figure 5. Diversity of youth OST programs as a function of partnering. (5a) Percentage of programs partnered with one or more organizations by URM participation (n=311). (5b) Percentage of programs partnered with one or more organizations by female participation (n=334). (5c) Percentage of programs partnered with one or more organizations by combined URM/female participation (n=308).

Figure 6: Diversity of youth OST programs as a function of financial accessibility. (6a) Program fee structure by URM participation level (n=181). (6b) Program fee structure by female participation level (n=187). (6c) Program fee structure by combined URM/female participation level (n=178).

Figure 7: Diversity of youth OST programs as a function of annual contact hours. (7a) Average annual contact hours by UR minority participation level (n=225). (7b) Average annual contact

hours by URM participation level and location (n=225). (7c) Average annual contact hours by female participation level (n=239). (7d) Average annual contact hours by combined URM/female participation level (n=223).

Figure 8. Diversity of youth OST programs as a function of curricular elements. (8a) Program elements by URM participation level (n=298). (8b) Program elements by female participation level (n=320). (8c) Figure 8c. Program elements by combined URM/female participation level (n=296).