POLICY STUDIES ASSOCIATES, INC.

SUPPORTING STEM ACTIVITIES IN OUT-OF-SCHOOL TIME PROGRAMS

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Summary

Out-of-school time programs are well-positioned to enhance students' Science, Technology, Engineering, and Math (STEM) skills, increase their interest in STEM fields, and increase their engagement in learning overall. In its 2011 Request for Proposals (RFP) for Out-of-School Time (OST) programs for youth in the elementary and middle grades, the New York City Department of Youth and Community Development (DYCD) encouraged programs to incorporate STEM subjects into their activities. In addition, DYCD's RFP required OST programs to institute a system of continuous quality improvement (CQI), which includes an examination of the program's goals and intended participant outcomes, observations and data collection, and adjustments to program practices based on this information.

As part of its ongoing efforts to evaluate the implementation and effectiveness of the OST initiative, DYCD asked Policy Studies Associates, Inc. (PSA) to examine the ways in which OST programs implemented STEM activities, and to document their approaches to continuous quality improvement. In 2012-13, the first year in which STEM was part of DYCD's expectations for OST programs, PSA visited five programs to learn about their experiences with designing and supporting STEM programming. Programs were selected through discussions with DYCD and preliminary interviews, and purposefully represented a variety of program structures and STEM implementation strategies. Three of these programs were center-based and two were school-based; two of the programs served participants in grades K-5, one served grades 6-8, and two served both elementary- and middle-grades participants. This report is based on interviews with staff of these programs, as well as activity observations and document reviews.

This report describes the strategies and approaches used by five OST programs to implement STEM activities. The first section of the report looks across the programs to examine the rationale for STEM implementation, and highlights areas where further technical assistance or guidance could strengthen implementation. The second section of the report contains a profile of each of the five programs visited for this study. The central findings of this study include:

- Programs implemented STEM activities using one of two approaches: integrating STEM themes into existing program activities, or creating stand-alone STEM activities. While all of the study programs sought to expose participants to STEM concepts, programs varied in the intensity of that exposure.

- Programs fit STEM activities into their existing program structures by either creating their own lessons or using existing curricula as resources from which to develop lessons; they did not adopt curricula wholesale. In some programs, STEM activity content was connected to or interwoven with program themes that were also infused through other activities. All of the programs visited for this study reported incorporating some type of hands-on learning into their STEM activities.

- Programs recruited staff with varying levels of STEM experience. Based on observations at these five programs, staff with prior knowledge of STEM subjects and experience leading STEM activities were better able to design and implement

inquiry-based activities that allowed participants to develop STEM process skills, such as prediction, measurement, and observation. Observations of staff without STEM instructional expertise indicated that staff may need additional assistance in implementing such activities.

- Programs did not use resources above and beyond their normal resources in order to implement STEM activities. They relied on their current funding, DYCD-sponsored trainings, and external partnerships to support STEM activities and staff development. At the same time, programs did not have sufficient funding to pay staff for the time they spent planning activities, or the time spent in professional development outside their programs. Programs need guidance on strategies to support lesson planning and to cover time spent in training, within their budgetary and time constraints.

- Program staff relied on existing networks to establish partnerships with external organizations in order to support STEM activities. While some programs could tap into the networks of staff members, in the first year of STEM programming, many struggled to identify partner organizations. Staff need additional guidance early in the process of planning for the program year to identify, develop, and sustain relationships with partners.

- Programs used various strategies to enhance school partnerships, including maintaining ongoing communication between OST and school-day staff and cross-staffing to support instruction. These partnerships supported the alignment of OST activities and in-school instruction and helped program staff address participants' academic needs.

- While their methods for improving program quality varied, all programs had systems in place to plan and monitor instruction in their programs and provide feedback to staff, consistent with DYCD's expectations for continuous quality improvement. However, STEM staff need additional support to develop effective activity plans that concretely define the activity's learning goals, instructional strategies, and connections to past and future activities. For example, program directors and education specialists should review activity plans on a regular basis, observe activities and provide feedback, and facilitate ongoing reflection to help STEM staff improve their instructional strategies over time.

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Program Profiles

Introduction

Since 2005, the New York City Department of Youth and Community Development (DYCD) has funded Out-of-School Time (OST) programs for youth that are intended to provide young people with high-quality programming that supports their social-emotional and cognitive development, at no cost to their families. Operated by nonprofit provider organizations, OST programs are housed in schools and community centers throughout New York City.

To enhance the capacity of OST programs in helping participating youth build skills that will support their academic achievement, guidance established in the 2011 Request for Proposals (RFP)[1] issued by DYCD encouraged OST programs to offer Science, Technology, Engineering, and Math (STEM) enrichment activities. Elementary programs must provide at least two hours per week of either literacy or STEM-focused enrichment activities that are "structured and provide experiential learning opportunities, in addition to strengthening basic skills." Middle-grades programs must offer a minimum of two hours per week of enrichment activities, "designed to build basic literacy and math skills as well as '21st century skills' such as teamwork, problem-solving, and critical thinking." Activities can focus on literacy, the arts, STEM, or a combination of these subject areas, and must offer experiential learning and skill-building opportunities. In addition, middle-grades programs must provide participants with opportunities to explore their interests.

In addition, DYCD's RFP required OST programs to institute a system of continuous quality improvement (CQI) to "identify program strengths and weaknesses on an ongoing basis" and "raise quality through data-driven decision-making." The recommended CQI efforts included an examination of the program's goals and intended participant outcomes, observation of staff as they deliver activities, data collection on participants' progress, and reflections upon and adjustments to program practices based on this information.

As part of its ongoing efforts to evaluate the implementation and effectiveness of the OST initiative, DYCD asked Policy Studies Associates, Inc. (PSA) to document approaches to STEM activity implementation and continuous quality improvement occurring within OST programs. This report describes the strategies and approaches used by five OST programs. The first section of the report looks across the programs and examines how STEM activities were implemented, and highlights areas where further technical assistance or guidance could strengthen implementation. The second section of the report contains a profile of each of the five programs visited for this study. Each of these profiles describes the program's structure, the content and instructional approach of its STEM activities, its alignment with schools, staffing strategies, and continuous quality improvement strategies.

[1] Out-of-School Time Program for Elementary and Middle School Youth Request for Proposals: http://www.nyc.gov/html/dycd/html/resources/ostrfp.shtml

Study Methods

In collaboration with DYCD, PSA identified five OST programs from which to gather information about STEM implementation and quality improvement efforts during the 2012-13 school year, the first year in which STEM was part of DYCD's expectations for OST programs. To select these programs, DYCD first identified 13 possible programs for inclusion, based on program proposals and DYCD knowledge of program implementation. PSA reviewed the proposals for these programs, and conducted brief phone interviews with the 13 program directors. The goal of these phone interviews was to learn more about their STEM activities and to gauge interest in participating in the evaluation. Following these interviews, PSA recommended seven of these programs to DYCD for further consideration. The recommended programs represented a range of implementation strategies, especially as related to use of curricula, school partnerships, and CQI. Through discussions with DYCD, five programs were selected for the study, including two school-based programs and three center-based programs. Two of the programs served participants in grades K-5, one served grades 6-8, and two served both elementary- and middle-grades participants.[2]

Data collection took place in two phases. First, PSA conducted an initial set of in-depth telephone interviews with staff members from the five programs (January-February 2013) and reviewed documents that programs provided. Second, a team of PSA researchers conducted a one-day visit to each program in April or May 2013. Between the first and second phases of data collection, PSA prepared preliminary case study profiles for each of the programs and shared them with DYCD in order to identify emerging themes that were of greatest interest. While on site, PSA researchers observed STEM activities and conducted interviews with program directors, education specialists, STEM activity leaders, and (for school-based programs) school leaders. The research team drafted comprehensive site profiles following these visits; staff members from each of the programs were invited to review the profile of their program before its inclusion in this report.

Per agreement with the New York City Department of Education's Institutional Review Board (IRB), no names of schools or individuals are included in this report. Principals of school-based OST programs visited also approved the study prior to data collection, as required by the IRB. In addition, to further protect the confidentiality of the selected programs, PSA created pseudonyms rather than identify the nonprofit provider organizations operating the programs.

Approaches to STEM Implementation

There is growing consensus that out-of-school time programs are well-positioned to enhance participants' STEM-related skills, increase their interest in STEM fields, and increase their engagement in learning overall. With the additional, informal learning time available in OST programs, participants have the opportunity to explore STEM topics through in-depth, hands-on activities (Traphagen, 2011). In addition, because of the population of youth they

[2]One program had two DYCD contracts, one for elementary-grades and one for middle-grades; another program funded their middle-grades program through DYCD funds and funded fourth-and fifth-grade programming through other funding sources.

serve, DYCD OST programs have the opportunity to spark an interest in STEM in girls and in youth from racial and ethnic groups that are underrepresented in STEM fields. By igniting students' interest in STEM, OST programs like those funded by DYCD can increase the number of youth pursuing post-secondary education in STEM fields and pursuing STEM-related careers, and can also foster diversity within this STEM pipeline (Afterschool Alliance, 2010).

Program Structure

In response to DYCD's expectations, OST staff at the programs in the study worked with each other and with their nonprofit provider organizations to determine how to implement STEM in ways that were aligned with both their existing program structure and with priorities for participant outcomes. Building on these established structures led to variations in STEM approaches, as described below.

For some programs, STEM was a priority throughout the nonprofit provider organization. For two of the five programs in this study, the providers launched initiatives to promote STEM-related content in all of their programs (one provider did so before the release of the 2011 OST RFP, and the other did so after). Staff from both of these programs explained that their providers' emphasis on STEM reflected national priorities for teaching 21st century skills (such as teamwork, problem-solving, and critical thinking) and for supporting in-school science instruction. The importance of STEM was communicated to programs through a number of channels, including in staff meetings for all provider-affiliated OST programs and in program-specific meetings. Through these initiatives, providers identified STEM curricula and training opportunities. The new STEM priority also influenced structural decisions at both the program and provider levels, including decisions related to staffing.

Programs used two broad approaches to structure STEM activities. The OST programs in this study implemented STEM activities using one of two approaches: integrating STEM themes into existing program activities, or creating stand-alone STEM activities. Decisions about these approaches aligned with the overall vision of the programs and provider organizations, and also depended on whether STEM activities were intended for all students, or were part of a menu of enrichment offerings from which participants could choose. There was variation in how programs interpreted the expectations for STEM in OST. One program, for example, understood that they were required to include a weekly structured STEM block in the program, similar to activity blocks scheduled for other content areas. In contrast, another program viewed the new emphasis on STEM as an instructional approach, and developed strategies to integrate STEM themes into the program's existing arts activities rather than scheduling STEM-specific activities.

While all of the study programs sought to expose participants to STEM concepts, programs varied in the intensity of that exposure. Of the five programs visited, four engaged all program participants in STEM learning. One program allowed students to choose whether to participate in the dedicated STEM activity, but made efforts to weave STEM components throughout the program's other activity offerings, such as learning digital photography in the yearbook club and applying mathematics concepts in music, so that all participants received

some STEM instruction. One program offered a 30-minute science enrichment course twice a week for all participants as a way to support in-school test preparation. To give participants a meaningful choice about what they learn, the program also offered a longer, more intensive STEM activity that students could choose to sign up for; this activity was designed to excite and further engage participants with an established interest in science.

Programs did not allocate greater resources to STEM relative to other program offerings. Rather, programs supported STEM implementation as part of general program planning. All of the programs visited paid staff hourly, with staff earning between $10 and $35 per hour depending on their experience and qualifications in general; staff who instructed STEM activities were paid following the same standards as their colleagues instructing other activities.

Preparation and planning time with colleagues are important elements to ensure the quality of activities. All five of the programs were able to compensate all program staff for some time spent in program staff meetings; three of the programs compensated staff for time spent in professional development. One additional program, because of budget constraints, could not pay staff their normal rate to attend professional development, but instead offered incentives such as comp time and gift cards. Again, program staff meetings and professional development resources applied equally to all program planning and improvement efforts, not just STEM. Only two of the programs were able to compensate staff fully for planning time. At another program, staff were paid one hour a month for staff meetings and an hour a month for lesson planning; however, the staff spent additional time planning their activities, without pay. Staff members at the other two programs also reported that they volunteered their time to plan lessons and research STEM activities.

Without additional funding sources to implement STEM, programs often relied on donations from schools or used their creativity to secure materials for hands-on projects. STEM group leaders at one program explained that they often adjusted activities or found substitutes for materials to which their program did not have access. The program director stated, "We'll just use what we have to make the experiment come to life." Low-cost or free activities provided by partner organizations are also used to supplement STEM programming. For activities with an associated cost, one program director benefitted from a discretionary fund from the provider organization to cover costs.

STEM Curricula and Instructional Strategies

The five programs in this study developed their own STEM curricula or tailored existing materials to the teaching styles of staff, participants' interests, program and provider priorities for outcomes, and the materials and space available to them. Some programs also chose to organize materials around program-wide themes and emphasized hands-on learning opportunities to support content delivery.

Programs developed their own STEM curricula rather than implementing a packaged curriculum. Program staff felt that developing their own curricula or adapting existing materials allowed them to better meet program goals and respond to youth interests. For example, using

knowledge of host schools' curricula, staff in three of the study programs integrated concepts addressed during the school day as a way to support in-school instruction. Program staff also hoped to address participants' interests to increase their engagement in STEM. At two programs, staff created their own activities, explaining that they were hesitant about using published curricula or activity guides because they were similar to activities participants had already done. Instead, staff developed their own activities, "using a variety of tools to boost the kids' interests."

OST staff use a variety of strategies to differentiate in-school and afterschool STEM instruction. OST programs are uniquely situated to provide science instruction in such a way that complements but does not replicate in-school instruction. Indeed, several aspects of afterschool provide opportunities to learn science that supports academic success and engagement during the regular school day: increased opportunities for in-depth learning projects, informal learning environments that promote active participation, and flexibility for field trips and learning outside of the classroom (Afterschool Alliance, 2011).

One program director explained that science instruction in the OST program is inherently different because her staff is not composed of teachers. She explained, "Their lessons [are delivered] in a more fun way." While the director encouraged staff to align program content to learning standards, group leaders maintained autonomy to plan and implement activities that reflected their and the participants' interests. For example, in addition to teaching through hands-on projects, the science group leaders often supported instruction by finding short videos to teach content in a way that drew in participants' attention. At another program, staff viewed afterschool activities as a continuation of the school day and used the afterschool time to reinforce concepts learned during the school day through hands-on, participant-centered activities. A provider-level staff member explained, "If you're familiar with teaching, you have your textbook and on the right-hand side of every page are these wonderful enrichment activities that support the lesson. You never have time to do them. […] What we try to infuse [with the program staff is that] this is your fun time with the children."

Programs organized STEM activities around program-wide themes. In some programs, STEM activity content was connected to program themes that were also interwoven through other activities. One program, for example, connected STEM lessons to broad, program-wide month-long themes, such as dinosaurs and the universe. Program staff determined the focus of each theme, based on their own and participants' interests, and integrated the theme into all program activities. Another program used theme-based arts projects and sought to infuse STEM topics and STEM-related skills into those projects.

Programs differed in their approaches to developing activities that targeted STEM skills. Prior evaluations of the DYCD OST initiative found that programs that were effective in implementing skill-based programming communicated expectations for high-quality activities through intentional lesson planning and ongoing opportunities for staff reflection (Sinclair, B., Sanzone, J., Russell, C.A. & Reisner, E.R., 2012). All STEM activity staff in the programs visited for this study reported preparing for and researching their activities but varied in the extent to which they identified particular skills or knowledge targeted in each activity. For example, one program had established a strategic, intentional, and ongoing process for lesson planning. Staff developed lesson plans for six-week theme-based units that infused STEM

concepts into arts programming, addressing both content themes and specific STEM skills and terms that students would learn about in each unit. Staff used paid meeting and planning time to discuss activity plans with other staff members, including the program director and education specialist, and to revise these plans to ensure that they were successful in helping participants develop the targeted skills. Although other programs also required staff to develop lesson plans, they tended to focus more on the content and age-appropriateness of the activity and less on identifying concrete outcomes.

Hands-on, experiential learning opportunities supported content delivery. In the RFP for OST programs, DYCD stated that STEM enrichment activities should "provide experiential learning opportunities." All of the programs visited for this study reported incorporating some type of hands-on learning activity into their STEM activities. One program, for example, used a two-part instructional approach: the first half hour was typically a discussion and Q and A between adults and participants, and during the second half hour participants engaged in independent or group hands-on work. At another program, STEM activities built from a lecture/discussion on day one, to an activity such as a worksheet or mini-lab on day two to solidify participants' knowledge, to a more involved lab or activity on day three.

A growing body of research on features of informal science learning suggests that informal science learning that includes hands-on, investigation-based activities and opportunities to link content to the real world may improve youth content knowledge, process skills (e.g., experimentation, observation, and analysis), and engagement in STEM-related fields (Minner, Level, & Century, 2010; Peterson, 2007; Tai, 2006). Science process skills were evident in some program activities observed for this study. For example, in one activity, participants learned about the concept of density and practiced predictive analysis to determine which of five nuts would be hardest to crack and, therefore, had the greatest density. Program staff interviewed at two of the programs emphasized that the hands-on activity components helped reinforce STEM concepts and supported learning outcomes.

STEM Staff

DYCD encourages programs to select staff with appropriate qualifications and skills for their roles and with at least two years of experience relevant to their position. In addition, DYCD expects programs to have an education specialist with at least a four-year college degree, experience in curriculum development, and, if possible, teaching credentials; in some cases, the program director may assume the responsibilities of the education specialist. DYCD envisioned that these staffing patterns would strengthen and support the quality of implementation of program activities, including STEM. The OST programs visited for the study employed adults with a range of professional backgrounds to lead STEM activities, including teachers and other adults with STEM expertise, as well as some without prior STEM expertise. All five programs had designated an education specialist. For two sites, the education specialist supported all of the provider organization's OST programs; in only one program was the program director also the education specialist.

Programs recruited staff with varying levels of STEM experience. One of the program elements that DYCD identified as supporting STEM activities is that staff should have interest in STEM or be experienced with STEM. Research on promising 4-H Science programs has shown that staff members and advisors in informal science programs with a background in science can provide a focus on inquiry and real-world applications of science, knowledge about science topics, and connections to potential partners and resources to the programs they lead (Riley & Butler, 2012). In two of the programs visited, all STEM activity leaders had prior experience teaching STEM subjects and/or strong knowledge of STEM content, including a science teacher and a college student majoring in biology.

Although STEM experts can bring many benefits to informal science programs (Riley & Butler, 2012), with proper training and support, staff without STEM backgrounds can also lead activities (Donner & Wang, 2013). At one program in this study, the STEM activity leaders did not have any formal STEM content knowledge or training in STEM instruction. Rather, the program director emphasized that an ability to work with youth was an important criterion for hiring staff. To support STEM instruction, these staff relied on pre-made curricula such as *Wonderwise* and *After-School Science PLUS*, as well as the training offered through DYCD on implementing those curricula. Nonetheless, observations of these and other staff without STEM instructional expertise indicated that staff may need assistance in implementing inquiry-based activities that allow participants to develop STEM process skills. For example, an activity observed at this program, while hands-on, included few opportunities for inquiry-based learning. The group leader walked the students through the steps of building a circuit. On occasion, he took control and built parts of the circuits for youth rather than let them discover how to connect the pathways on their own. In a different program in which the STEM activity leader had knowledge of STEM subjects but little training in STEM instruction, PSA researchers observed a lecture-style session in which participants learned about cellular respiration and responded to basic questions about the concept as preparation for an in-program quiz. In contrast, in an activity led by an experienced science educator, youth learned about science concepts through group discussions and experiments in which they practiced predicting outcomes and analyzing results.

Education specialists supported STEM instruction by providing feedback to staff, identifying curricula, and supporting instruction. Among the programs included in the study, education specialists had relevant qualifications to carry out their responsibilities: all of the education specialists had teaching expertise or experience working with youth in non-school settings. At the study sites, education specialists supported activity planning – sometimes exclusively for STEM and sometimes for all activities – and served as a resource for staff as they implemented their activity plans; they observed STEM instruction and gave staff feedback on ways to improve their teaching techniques.

Two of the programs prioritized hiring an education specialist with STEM experience. For one program, staff from a partner school recommended that the program hire a science teacher from the school to serve as the education specialist. This education specialist focused only on STEM-related activities at the program. At another program, hiring an education specialist with STEM experience reflected the provider's priority for STEM in programs. A staff member at this program explained, "I'm a licensed teacher and qualified to direct and develop appropriate

afterschool curricula. However, STEM truly requires skills outside of the normal educational arena. […] For hands-on, project-based STEM activities, staff must be comfortable with tools, applications, problem solving and have a broad understanding of components of STEM."

Programs participated in trainings provided by DYCD-affiliated technical assistance organizations or their provider organizations to support STEM and CQI. All programs visited for this study sent staff members – or education specialists and directors – to trainings related to STEM, including DYCD-sponsored training opportunities facilitated by The After School Corporation (TASC). TASC offered several opportunities for staff to participate in a "STEM 101" session from October to February, which was designed to help staff learn about STEM practices, curricula, and how to implement STEM in programs. In addition, a series of "peer network" trainings offered in the spring were intended to help staff engage families in STEM activities, learn about the Next Generation Science Standards, build partnerships, and identify resources available to support STEM. Additionally, multi-session trainings in fall, winter, and spring focused on implementing specific STEM curricula (staff were required to commit to attending all three four-hour sessions for these curricula workshops).

Staff from the study programs reported attending trainings on specific STEM curricula. For example, activity leaders from one program participated in trainings on *Wonderwise* and *After-School Science PLUS* curricula and found these trainings useful in planning and delivering activities to participants. Staff from another program also participated in *After-School Science PLUS* training. However, not all STEM program staff participated in all of the available DYCD-sponsored trainings. Also, some training opportunities (such as those that help programs build partnerships to support STEM) may have been more useful before the school year began. In addition, based on staff comments and activity observations, attending a training workshop does not guarantee that activity leaders will then have the capacity to implement curricula or practices addressed in the session.

Ongoing training, perhaps delivered by education specialists, or through site-based trainings, could help STEM activity leaders better apply and implement approaches they learn. Some program staff did highlight the STEM trainings provided by their own organizations, program directors, or education specialists as particularly helpful. Programs hosted trainings for staff, usually during weekly or monthly staff meetings. At sites with only one or two STEM activity leaders, only those leaders attended STEM trainings; there were no program- or provider-wide STEM trainings that all staff attended. The two programs that incorporated STEM into their activity plans (either by infusing it into arts activities, or creating STEM activities for all students based on monthly themes) held in-house trainings specifically about how to do so. At these sites, all program staff were involved in the trainings, since all staff were expected to implement STEM.

For one program, training focused more on the program director rather than on the staff who delivered activities, primarily because the provider hired teachers from host schools to lead its activities and these teachers already had extensive experience. The program directors from across this providers' programs met weekly to discuss the provider's emphasis on STEM, curriculum selection, and implementation. Program directors then shared that information with the activity leaders at their respective sites.

Partnerships

External partners can support STEM implementation in OST programs by drawing human resources, including networks of volunteers, and offering science expertise; often, services provided by external partners are available at a low cost to programs. All but one of the programs in this study used external partners to some degree to support programming. Most often, partner organizations provided mentors to programs to guide STEM implementation, volunteers to lead activities, and resources to support programming.

Program staff used existing networks to establish partnerships with external organizations. Two of the programs included in the study benefited from having staff who were already connected to the STEM-related nonprofit network in New York City. In both cases, these staff members reached out to their contacts to coordinate supplemental activities for OST participants. For example, these opportunities included presentations by adults who work in STEM-related industries, nature hikes, and workshops for participants. The education specialist at one of the sites thought that programs without a staff member connected to these networks might struggle to find such organizations and build partnerships with them.

Programs took advantage of DYCD-affiliated partners but would benefit from additional support to establish connections. Two of the programs applied for partnerships with the New York Academy of Sciences, an organization that has an established relationship with DYCD. Both programs were assigned a mentor who implemented two science units in the OST program during the school year. One program director felt that this partnership helped integrate high-quality hard science into activities. Some programs, however, struggled to establish partners. Time constraints to identify and contact partners may be a hindrance to programs. One program director, for example, explained, "I'm focused on programming. So, if [DYCD] brings to my attention somebody that wanted to partner with an afterschool program, then I'll take the initiative." Other program directors suggested that DYCD provide additional guidance to programs as they reach out to potential partners.[3]

Alignment with Schools

Research on OST programs has found that aligning OST program content with school-day curricula and instruction can support student learning and offer supports that complement and reinforce learning tasks that occur during the school day (Afterschool Alliance, 2011). The DYCD OST initiative aims to establish effective collaborations between OST providers and the schools which participants attend. The RFP for programs highlighted the importance of partnerships that support alignment between OST program content and school learning goals, calling for partnerships "founded on a common vision and involving collaborative planning, frequent and ongoing communication, and coordination" between OST programs and schools. All five of the programs in the study made some effort to support collaboration and coordination

[3] Although DYCD's technical assistance provider (TASC) held one training on partnerships and the resources available to support STEM in afterschool, this training session was held in May (after most of this evaluation's visits were completed). Program staff did not report reaching out to TASC for help in forming partnerships.

between the OST program and in-school instruction, including maintaining ongoing communication with school staff and connecting activity content to learning standards.

Program staff supported open communication with school-day teachers and administrators. At all five of the programs, the OST program made efforts to communicate with teachers and administrators of the schools attended by participants. Conversations with school-day staff addressed participants' academic needs and topics addressed in participants' classes. Programs used varying strategies to support communication between OST and school staff. One program, for example, partnered with its feeder school to institute an open-door policy, where OST staff were welcome to visit the classrooms of OST participants during the school day, and teachers were encouraged to visit the OST program. Another program had an established process for staff to communicate and coordinate with staff, including weekly check-ins that allowed staff to learn how participants are doing in their classes and areas in which they struggle.

Programs sometimes used cross-staffing strategies to support OST and school-day content alignment. Two of the five provider organizations had deep roots in the communities served, having operated in their respective communities for 30 years or longer. In this time, the provider organizations had increased their visibility and gained recognition from community members, which, in turn, supported the credibility of the programs they operate. The two programs included in the study affiliated with these providers used these long-standing community relationships to involve school-day staff in OST activities. For one program, the provider's relationship with the host school's administrators helped in recruiting and hiring the program's STEM instructor. For the second program, many former activity leaders – often college students studying education – went on to become teachers at the program's feeder school and continued their support of the program. For both programs, involving school-day staff helped OST staff gain an understanding of participants' academic needs and schools' overall priorities for students.

Through its relationship with the host school, one OST program's staff worked alongside school-day teachers to help students during the school's extended-day program. During the extended-day periods, OST staff went into classrooms and supported writing and math instruction. They provided individual assistance to all students, as needed, regardless of their enrollment in the OST program. One benefit of this approach was that program staff could observe teachers as they modeled instructional strategies.

Continuous Quality Improvement

In order improve the quality of activities in OST programs, DYCD expects programs to develop systems for monitoring and reflecting upon their work throughout the year. Although few programs could articulate a "Continuous Quality Improvement" or CQI plan, the programs in this study had indeed set up a range of systems to monitor instruction and student learning in their programs.

All of the programs visited for this study used the same CQI methods to assess STEM activities and the staff that led them as they used for the rest of the program activities, although

one program reported exploring the use of a STEM-specific tool to supplement the evaluation tool currently in use (the NYSAN Program Quality Assessment tool). The CQI systems that programs set up had both formal and informal aspects. Formal aspects of CQI included weekly or monthly staff meetings, formal staff evaluations either once or twice a year, written reviews of lesson plans, and surveys of students and/or adults. Informally, directors reported observing programming on a regular (if not daily) basis, directors and staff reported conversing with students about their learning and the program in general, and staff reported giving one another feedback and support.

Program staff used CQI systems to examine and improve programming, especially as related to professional development. Directors and education specialists sought to improve the activities that staff delivered by reviewing and giving feedback on lesson plans, observing activities and giving feedback on techniques to engage students, and responding to staff questions and challenges on an ongoing basis. All but one of the programs held weekly staff meetings (the other program met monthly). During these meetings, program staff reported discussing both program content and logistics. Staff at multiple programs cited their regular meetings as a strong aspect of their program that helped their team solve problems and helped them develop stronger activities.

Program directors and education specialists also varied in the amount of review and oversight provided to staff as they developed activity plans. In one program, the review process included frequent rounds of director and education specialist feedback with staff revisions. At the other extreme, at the beginning of each semester the director of another program reviewed a list of topics to be covered on each day, but did not require or review lesson plans beyond that (although the activity leaders did spend unpaid time researching and preparing activities).

CQI systems helped program staff monitor participants' progress toward learning goals. Some programs set learning goals for their students that emphasized the development of 21st Century skills. Programs also set goals for the content that they wanted students to understand at the end of a unit. Programs monitored student learning by using quizzes, surveys, pre-and post-tests, and informal conversations with students during activities. All of these tools were used to check student understanding of topics covered during the year; some programs also used surveys at the beginning of the year to uncover student interests and modify activities according to those interests. OST staff sometimes used program-specific tools to monitor progress. One program, for example, reported that students created portfolios for each activity unit, and that program staff met with each student at the end of the unit to discuss the student's progress towards learning goals. In addition to checking understanding verbally at the beginning of each class, the staff also checked portfolios throughout the unit, and used it to determine whether the activity was successful in helping students meet these goals.

Summary of Findings and Recommendations

DYCD's focus on promoting STEM in OST programs reflects the current national focus on engaging youth in STEM in both formal and informal settings. Based on the five programs visited for this evaluation, in the first year of DYCD's emphasis on STEM, OST programs took steps to implement STEM activities using strategies similar to those used for other subject areas. Programs also incorporated continuous quality improvement systems into their management structures, consistent with DYCD's expectations. Findings from the experiences of these five programs are summarized below, followed by recommendations of ways to further strengthen efforts to improve program quality and impact, and STEM programming in particular. In general, patterns of implementation showed that:

- Programs did not use resources above and beyond their normal resources to implement STEM activities. They figured out ways to implement STEM activities within their current levels of funding, and by relying on DYCD-sponsored trainings and existing partnerships.

- Programs integrated STEM activities into their program philosophies and goals. They did not change their program to introduce STEM, but rather fit STEM activities into their existing program structures. In this vein, programs typically did not adopt outside curricula wholesale, but either used curricula as resources from which to develop lessons, or created their own lessons altogether. Programs often implemented theme-based and project-based STEM activities.

- Programs used the same continuous quality improvement methods for STEM as for other activities. Some programs used more formal tools for observing activities and providing feedback to staff than others, but all had systems in place for program directors and education specialists to monitor instruction and provide feedback to staff.

- Programs did not have sufficient funding to pay staff for all of the time they spent planning activities, or all of the time they spent in external training opportunities. However, programs did pay staff to attend staff meetings, which served as opportunities for coaching and troubleshooting.

OST programs would benefit from the following supports to further strengthen their implementation of high-quality STEM learning opportunities:

- ***Offer guidance on resource allocation to support STEM.*** STEM activities require adequate planning, materials, and trained staff. However, program budgets and the part-time nature of most OST program staff positions are unlikely to change. Programs need more guidance on strategies to support ongoing, reflective lesson planning, within budgetary and time constraints.

- ***Facilitate participation in professional development activities.*** DYCD and its technical assistance providers offered trainings on STEM curricula. Although

staff reported that attending external trainings was helpful, programs noted challenges fitting trainings into staff schedules and paying staff to attend trainings. Helping programs identify funding sources to cover time spent at trainings could increase participation and build staff capacity.

- ***Provide additional guidance on STEM-related pedagogical techniques.*** Program staff were generally satisfied with trainings offered on curricula, but some expressed an interest in professional development focused on teaching higher-order science skills, without being tied to a specific curriculum. Additional, ongoing technical assistance addressing broader pedagogical techniques – such as developing inquiry-based activities – that engage participants and nurture their interests and curiosity would benefit both staff and participants. Offering this training to education specialists and program directors early in the year would enhance their capacity to better support staff throughout the year.

- ***Encourage programs to seek out leaders with STEM-related experience.*** Hiring an education specialist with specific expertise in STEM and an understanding of how STEM in OST can complement school-day STEM learning could help programs more successfully incorporate STEM. The education specialist could then provide support for strengthening instructional techniques to ensure that STEM activity leaders are incorporating best practices for informal science, such as inquiry and experiential learning.

- ***Help programs identify and approach partner organizations.*** While some programs tapped into the networks of staff members, others struggled to identify partner organizations that could support STEM programming. Programs need additional guidance early in the program year on strategies to identify, develop, and sustain relationships with partners.

- ***Promote an ongoing, reflective approach to activity planning.*** To support continuous improvement, STEM staff should not only be supported in writing activity plans, but program directors and educational specialists should review and discuss those plans with staff on a regular basis. This practice would help STEM instructors build their capacity to incorporate components of strong STEM activities into their plans, such as experimentation, observation, and analysis. Observation and feedback from program directors and education specialists could further help staff leading STEM activities improve their instructional strategies over time.

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Program Profiles

Amber Street Program

Program Context	
Years in operation	30
Grades served	K-5
Center- or school-based program	Center-based
Program operation	Monday-Friday, 3:30 PM – 6:00 PM
Number of participants	120
Number of participants in STEM	120
STEM enrollment	All participants, grouped by grade
STEM activity frequency/duration	1 hour/week for grades K-4, 2 hours/week for grade 5

This center-based program has served its community for 30 years and currently provides OST programming to 120 participants enrolled in a local elementary school. Although the nonprofit organization operating the program has established a cultural and youth development focus for all its OST programs, program directors have flexibility in supervising and building staff capacity to meet the unique needs of each site. This program has a full-time on-site program director and is staffed by a team of 12 part-time OST staff members. Each month, teaching pairs for each grade-level cohort, composed of a head teacher and an assistant, develop theme-based lesson plans. The program's schedule is structured so that different subjects are addressed each day: participants engage in literacy on Mondays and Thursdays, enrichment (e.g., dance, art, or music) on Tuesdays, STEM on Wednesdays, and physical activities on Fridays. Through STEM activities, staff hope to expose youth to science at an early age and help them understand how STEM subjects are relevant in "the real world."

The program has established a system of continuous quality improvement that includes professional development, monthly staff meetings, annual parent-staff meetings, student progress reports, and informal observations and feedback for individual staff members. The program has also implemented a series of workshops for staff to discuss ways in which STEM concepts can be integrated into existing program activities.

Approaches to STEM Programming

School Alignment

Connections between OST and school staff

Although the program is located in a community center, it benefits from a close connection to its predominant feeder school. Before becoming a center-based program, the program was housed at the feeder school. Some program staff members were once teachers at the feeder school, and others have gone on to become teachers at the feeder school. As a result, program and school staff have established relationships and communicate regularly to address student needs. One program staff member commented, "Because the teachers are familiar with us, they will actually tell us, 'This kid is not doing too well in math. This kid is not doing too good in science. This one needs help in English. Or they're just not doing homework.'" The program staff can then ensure that they address participants' needs during program time; in one staff member's words, "Because the thing is, we want them to do well. We don't want them to get left back or not do as well."

A teacher from the feeder school serves as the education specialist for the program, working five paid hours per week. In his dual role, he collects curricula from the teachers at the feeder school and shares these curricula with program staff in order to support lesson planning. He also meets with teachers and administrative staff at the school to discuss individual participants' or grade-level needs and relays that information to program staff. The education specialist noted the importance of purposeful communication with the school's teachers and principals. To facilitate communication, the program and the school recently instituted an open-door policy, such that program staff are welcome to visit and observe activities in participants' classrooms during the school day, and school staff and teachers are encouraged to visit the OST program. One program staff member explained that she was encouraged to visit classrooms once or twice a month, but she went more often than that: "I used to go in every week. And actually, no, twice a week, even. It was my first time trying to speak to one of the teachers, so I thought we could build a relationship that way, and the kids would benefit from that."

The program director explained that at the beginning of the school year, the principal, assistant principal and school-day teachers receive a participant roster and a letter introducing the OST program and staff and welcoming them to visit the program. School-day teachers typically visit when the program holds special events such as performances, exhibitions, and fundraisers.

Although neither OST nor school staff are paid for the time they spend visiting one another's classrooms and activities, both the principal and the program director encourage their staff members to reach out to one another. The program director said, "I encouraged [the principal] to tell her teachers that we're not invading the classroom, but we are there to know what's happening in the daytime so that it makes a stronger connection." The partnership with the school encourages relationship building among the staff and participants and supports STEM curriculum planning and additional support for participants in the STEM content areas.

Using STEM to supplement school-day learning

The staff member responsible for first-grade participants said she does not directly align the OST lessons to school-day lessons because participants become disinterested and say, "I've learned this already." She tries not to repeat lessons, but instead approaches the material in a fresh way. For STEM, she aims to provide participants with new experiences, especially because first-graders do not receive science instruction during the regular school day.

Program staff members in charge of older participants use the school-day curricula to develop lessons that supplement in-school lessons. The program director explained, "We hope to bring in more hands-on experiences for the kids, because in public schools they only have science once a week, or they have it once a week for one semester and then the next semester they have another extracurricular activity such as art or gym or something. So we want to let them know that science is still there – math, technology, and engineering. They only have computers once a week too sometimes. So we try to provide, in addition to what they're learning in school, something else so that they're more aware of their surroundings."

STEM Curricula and Instructional Strategies

Participant-centered content

Approach to STEM curricula

STEM topic area(s) addressed	Physical and biological sciences, engineering
Curricula used	Developed by staff
Sources for activity plans	Staff, education specialist, program director, online resources

Teaching pairs lead activities for their grade cohorts every day, and are often supported by a high school volunteer. The three facilitators work together to develop and implement STEM activities that center around participants' interests. All cohorts receive one hour of STEM programming a week, except for the fifth-grade cohort which engages in STEM activities twice a week. This cohort's teaching pair includes a retired science teacher and a college engineering major. The program director explained that she scheduled more STEM time for this group in order to leverage the expertise of her program staff, and to enable students to create their own projects and learn more about math or engineering.

The retired science teacher who works with fifth-grade participants tailors programming to prepare these youth for middle school: "Because I'm teaching the fifth-grade kids, they're going away to a junior high school next year. I was a junior high school teacher. One of the things that I always like to do is try to prep them for junior high school. So we do things that are similar to junior high school. We try to give them some basis."

Thematic lesson planning

Program activities revolve around different themes each month; themes are thoughtfully selected according to participant and staff interests. Program staff connect activities to real-world concepts. The program director described, "Thematic instruction is the organization of a curriculum around macro-themes. Thematic instruction integrates basic disciplines like reading, math, and science with the exploration of a broad subject, such as communities, rain forests, river basins, the use of energy, and so on." OST staff implement thematic activities for a full month, which allows a topic to come to life across various content areas.

One staff member explained that she gathered ideas for her monthly themes by asking her participants at the beginning of the academic year what they wanted to learn. She said that participants often ask to learn about science-related themes. The first-graders, for example, wanted to learn about dinosaurs. In literacy, they read books about dinosaurs. In enrichment, they drew dinosaurs, and, on STEM days, they learned about fossils, dinosaur eating habits, and dinosaur life cycles. The fifth-grade cohort wanted to learn about animals, so staff members designed the monthly theme to explore exotic animals around the world. Students read about the habitats of animals on different continents, and each participant selected an animal to learn about for the month. Students learned to draw their animal and did research about it on computers. By the end of the month, students had created a world map of various exotic animals. Other themes chosen by participants included machines, gardening, and learning about the solar system.

Developing in-house curricula

In this program, the lead staff member for each teaching pair (the head teacher) is responsible for designing monthly lesson plans and receives input from their assistant as well as from the education specialist and program director. Staff members are paid for only one hour each month for lesson planning.

For this monthly lesson planning process, the education specialist recommends that staff ask participants what they want to learn, and then choose what to teach based on both staff and participant interests. He explained, "If the teacher's not interested and the kid's not interested, then it's going to be very hard to teach a lesson. And I guess they put more value into what they're teaching and do a lot more planning and looking for ideas [when they are interested]." He recommends that staff work with him, research the topic on their own, or ask other program staff members for ideas about how to incorporate monthly STEM lessons related to their topic.

The program director said that she seeks out STEM-related curricula trainings and workshops to obtain ideas for her staff, but often finds that many curricula are "very much what we have already done with the youth in our program." For example, the staff found that the *After-School Science PLUS* curriculum included lessons similar to those they had already completed with participants. One staff member said she prefers to write her own lesson plans because published curricula may have been designed for a different grade level or require materials to which the program does not have easy access. She explained, "I don't like using lesson plans that are done before, like by other people. I like to, if anything, just restructure the whole thing. So if the basic idea is to introduce [youth] to a topic, let's say plants, and they have this whole

lesson plan and how to go through it, that's not what I want. I would try to use whatever resources I have to introduce a subject to [my cohort]." For example, one previous STEM activity required plants and flowers. She planned ahead by having the participants draw flowers during an art enrichment activity the week before and then used the flower drawings during the STEM plant activity the following week.

Facilitating a workshop model

STEM activities follow a workshop model. During the first half of each one-hour lesson, the staff member instructs the whole class, and during the second half, participants work independently, in pairs, or in groups to apply what they learned. This independent or group work is typically a hands-on activity. Staff members found that the workshop model encouraged participants to hold discussions, ask questions, and engage in independent or group work. The workshop model fits into the thematic structure of the program since activities are each designed to build participants' skills and knowledge related to the theme. One staff member described activities in the workshop model as interconnected, saying: "Each of them is stand-alone, but they are like smaller portions of a big thing."

During a first-grade STEM activity about simple machines, participants gathered on the open rug of the room for an overview about the STEM lesson for the day. After a five-minute overview and a question- and-answer period, participants were split into two groups. Half went with the head teacher to gather around a computer in the back of the room, while the other half went with the assistant teacher who had a laptop. Participants watched a short animated video about simple machines on YouTube. The large group gathered again and the head teacher asked them to name and discuss the six machines described in the video. Participants then returned to their desks, copied definitions from an easel about simple machines, and drew three small pictures of a simple machine (e.g., a lever, a pulley, a wheel). They then completed a worksheet in which they matched images of machines to the concepts they had learned.

Approach to staffing

Total number of staff	14
Education specialist supports STEM	Yes
Number of staff who lead STEM activities	12
Professional development sources	CBO
External partners supporting STEM	NY Academy of Sciences; Cornell University; Lower East Side Ecology Center
Salary range for STEM staff	$10.50-$12/hr. support staff $14-$20/hr. head instructors
Staff paid for:	
Meetings	1 hr./month
Professional development	1 hr./month
Lesson planning time	1 hr./month

Although a workshop model fits well into a weekly hour STEM activity period, it is not conducive to in-depth project-based activities. As one staff member put it, "I really want to do a hands-on activity with the kids […]. But the thing is that sometimes – each day when we do a different category, like literacy, enrichment activity, STEM, and the physical activity, we have to drop everything and stop and then we have to come back like in the next two or three days.

Sometimes the kids will forget what we've done previously. And we have to recap everything what we did before they continue what they're doing."

STEM Staff

Hiring and retaining qualified staff

The program hires and retains educators with the experience and qualifications to develop lesson plans and skill-based activities. The average head teacher has worked at the program for seven years, and all six head teachers have or are currently working towards a master's degree in education. The program director said she is fortunate to have highly qualified staff, and explained that she recruits through word of mouth. She asks her staff if they know of anyone interested in the position, and her only requirement is that they enjoy working with kids.

The program also benefits from two long-term staff members with prior STEM-related experience. These staff members serve as the teaching pair for the fifth-grade cohort. Together, they develop STEM activity plans that address subjects such as building, engineering, and physical sciences. They also serve as a resource for the rest of the teaching staff in developing STEM activity ideas.

All staff volunteer additional time to make the program successful, including observing and supporting instruction at the feeder school without pay, writing curricula each month, writing individual student progress reports, and communicating with parents outside of regular program hours. Although staff members receive an hour of pay each month to plan activities, one staff member pointed out, "But as anybody that teaches knows, an hour to plan a month and write up lesson plans is never enough. You're just telling me to go home, get it done at home. And that is not – I don't think it's fair."

Using STEM partnerships strategically

The program has developed several partnerships that have provided staff with STEM-related experience and opportunities for field trips. With the encouragement of DYCD, the program applied to partner with the New York Academy of Sciences. A mentor from the academy was partnered with the program and teaches older participants (i.e., fourth- and fifth-graders) once per week for 10 weeks each semester. The STEM sessions provided by the New York Academy of Science are free, and all STEM-related materials are provided by the Academy.

The program director encourages staff members to learn from the staff from partner organizations. She said, "[The Academy has] curricula online that they use. So I just told [staff], see if we can replicate it in our center without really having a mentor." The program director prefers to use the science mentor for content areas her staff aren't qualified to teach. She admitted that, despite having a science teacher and engineering major on staff, engineering and hard sciences are more challenging for the rest of her staff to teach.

In the summertime, staff from the Cornell University Nutrition Program come to the program to teach participants a series on nutrition. Last summer, this activity ran for about one week. In the past, the program has also partnered with the Lower East Side Ecology Center. The program director has found that activities provided by partner organizations work best in the summer or on full days of programming so that the program can make the most out of field trips or guest visits.

Staff members also plan ahead and incorporate science guest presentations into the monthly themes. As one staff member explained, "Usually [the program director] is pretty good about letting me know ahead of time. She tells me this person will come in and do nutrition with you; would you be interested in that? [If] I say yes, I try to find a way to tie connections to the person who comes to do nutrition with the theme that we're doing."

Continuous Quality Improvement (CQI)

The program's CQI process includes the use of staff training tracking cards, monthly staff meetings, annual student progress reports, parent-staff meetings, and monthly informal observations and feedback by the program director and education specialist.

Staff members rely on one another for observations and feedback. One staff member worked closely with her assistant teacher for instructional and implementation feedback. She said, "I get feedback from her. I ask her what she thinks about my lesson, if it goes well or doesn't go as well, or maybe how we should change it a little bit. […] I also give her my feedback, what I think she could do better." Program staff are required to attend 30 hours of professional training every two years, and document hours.

Approach to CQI

Staff submit lesson plans for review	Yes
Frequency of staff meetings	Monthly
Program Assessment tools used	Student progress reports, Student/parent/staff meetings, Staff evaluation assessment
Frequency of staff evaluation	Annual; additional if necessary.
Use of feedback	Assess student progress and provide feedback to students, Refine program activities/implementation

Participant-parent-staff annual meetings

The program has created templates of student progress reports that staff use to summarize student outcomes. Staff use student progress reports every spring during parent-staff meetings. The progress report assesses a student in six developmental areas that align with the program's goals of focusing on the development of the whole child: (1) academic level/cognitive development; (2) social development; (3) physical development; (4) emotional development; (5) attitudes and behavior; and (6) work habits and class participation. Staff review the progress report with the participant and his or her parent. After the participant and parent create a goal for the upcoming year in one of the six developmental areas, the document is signed and then reviewed the following year. The conferences are scheduled during programming hours, so that one staff member supervises the class while the other meets with the parents. The program director explained, "We hope that

with the combination from both [this program meetings and regular parent-teacher meetings at the school], parents will gain a better understanding of their children." Discussing participants' academic and social development with an afterschool staff member may give parents additional information about their children's' progress.

One unexpected outcome of the parent-staff meetings is that the program staff now facilitate communication between the feeder school and participants' families. When asked what the feeder school valued most from the OST program, the program director said it was their communications with parents. Holding parent-staff conferences has also allowed program staff to learn more about the families they are serving and to better adjust programming to meet participants' needs. For example, one lead staff member said that many families did not have the resources to provide STEM-related activities at home, such as taking their children to the museum or enrolling them in a science camp. Instead, participants can enjoy such experiences through the program.

Informal observations and discussions

Staff use informal approaches to assess the program's effect. As one program staff member explained, "I hope that they understand the concepts that we're trying to teach them. That's what the discussions are for. So we try to talk to them as much as we can about what we did, instead of just telling them this is what we're going to do and that's it. Because they need to hear themselves or hear each other, what they all think. That's the learning experience." Staff members also bring content and questions from participants to the monthly staff meetings in which they receive support from each other related to implementation, activity content, and individual student concerns.

One head teacher uses the Know/Want to Know/Learned (KWL) Chart, a common teaching strategy designed to support the learning process. She explained how she uses the tool each month: "In the beginning we started with a KWL chart, what they know about dinosaurs. I want the kids to tell me what they already know about it and then we make a list. And then after the K chart, we did a W chart. They asked me questions and they were curious and wanted to know what dinosaurs are about. So we're making two different charts. And then the last chart [is the] learning chart. After we've studied all about dinosaurs, understand what they're about, the kids will tell me what they know – it's like an assessment of what they know about it, and then we have the kids write about it or maybe journal about the things they know about dinosaurs."

By using these approaches to support STEM implementation, the program engages participants in STEM learning opportunities. The education specialist said, "We make it fun here. It's not a place where there's so much pressure. The kids are here to learn, that's the main goal, to teach them as much as we can and teach them things that they wouldn't learn at school or at home, but open it up for them to ask and feel free to do whatever they need to do to learn something."

Arts Infusion Program

Program Context	
Years in operation	5
Grades served	K-5
Center- or school-based program	School-based
Program operation	Monday-Friday, 2:30 PM – 6:00 PM
Number of participants	120
Number of participants in STEM	120
STEM enrollment	All participants, grouped by grade
STEM activity frequency/duration	Infused throughout activities; Two six-week rotations per year focus on STEM

Overview

The program, located in a K-5 elementary school, serves approximately 120 participants, including some from a neighborhood school. In this program, experienced Teaching Artists develop project-based activities throughout the year that are implemented in six-week rotations, and two of these activities must be STEM-specific. In STEM-infused arts activities, participants have sketched the human brain, connected movement and geometry by making movement maps for a dance recital, and learned fractions through music composition. A director and education specialist from the nonprofit provider organization supervise and build staff capacity for all of the organization's youth programs. In addition, each program has a full-time program director and is staffed by a team of staff members who each have specific functions in implementing and supporting program activities.

This program's provider organization focuses on arts and literacy in all its OST programs. In responding to the most recent DYCD RFP, the provider organization worked with all program staff to identify the extent to which STEM concepts were already integrated into the arts-based activities, and to develop strategies to make STEM programming more intentional. Through the ongoing continuous quality improvement process, the education specialist and program directors continue to build staff capacity to implement STEM programming. Homework Warriors assist participants with their homework for an hour a day and coordinate closely with school-day teachers to ensure that participants' learning needs are met. Program Apprentices, who are high school or college students, support the Teaching Artists and Homework Warriors in activity implementation. The program has also established a multi-faceted system of continuous quality improvement that includes ongoing staff training, staff meetings, a lesson planning and review process, an assessment of student progress at the end of

each project unit, parents and teacher surveys, and observations of and feedback to individual staff members.

Approaches to STEM Programming

Program Structure

Theme-based programming

The program integrates STEM concepts through theme-based arts activities that are designed to help participants develop inquiry and analysis skills, consistent with the provider organization's model for all of its OST programs. To support this integration and respond to the DYCD expectation for STEM programming, the education specialist trained staff at the beginning of the year to identify ways in which they were already doing STEM in their arts-based activities. The education specialist explained, "Because if you can acknowledge that you're already doing something then it's easier to build on it. So how do we now make this more detailed, more highlighted or a bigger part of what we're doing?" One staff member noted, "When we first had the workshop about STEM, I was confused, like what is this, it's going to be so complicated. But then I realized we used this all along. [STEM] was always in our lesson plan, but we hadn't noticed. […] So it wasn't that hard to incorporate it, because we were already doing it, but weren't aware of it. Science is in a lot of our little projects and activities that you do when you build stuff, and math is everywhere."

According to the education specialist, by incorporating STEM into activities, the program aims for STEM to become a "relatable experience" for participants by not only teaching them foundational skills to apply STEM concepts, but also giving them opportunities to practice these skills. For example, in a six-week thematic unit on superheroes, participants researched social issues that affected them. After they discussed these issues, they then created superheroes to combat their chosen social issue in a nonviolent way. Participants created posters about these superheroes while also analyzing different poster styles. According to the Teaching Artist who developed this activity, participants developed STEM skills throughout the process. "Social sciences, that's bringing STEM into it. With the research component, writing and typing is bringing technology into it. Engineering and math come into play when it comes to composition." The arts component of the activity incorporated geometry in understanding dimensions and space in figure drawing. The activity also incorporated the study of anatomy in having to draw a human body for the superhero.

STEM Curricula and Instructional Strategies

Program staff develop their own lesson plans that infuse STEM concepts. With support from the education specialist, staff use various resources to plan activities. Staff may build on prior experience, or search for new ideas online (for example, through the Incredible Art Department or PBS's Arts 21).

Approach to STEM curricula

STEM topic area(s) addressed	General science, Social science, Physical science
Curricula used	STEAM activities developed by staff
Sources for activity plans	Education specialist, Online resources

Arts-focused instruction

The school principal values the support that the program provides to participants through the arts-based opportunities that supplement the school day. The principal believes that the program should support the school through activities that the participants do not receive during the school day: "I believe that it should probably be a lot of extracurricular activities to make the children more at ease, because we're not able to provide that during the school day." To facilitate the alignment between these enrichment activities and school-day learning, information about the school-day curriculum is made available to program staff, and the calendar of units of studies is also available to the program for each month. In addition, by sitting on the School Leadership Team and being in frequent contact with the principal and with the teachers, the program director can relay information about the school-day curriculum to program staff.

Approach to staffing

Total number of staff	13
Education specialist supports STEM	Yes
Number of staff who lead STEM activities	3
Professional development sources	CBO
External partners supporting STEM	None
Salary range for STEM staff	
HW Warriors	$10/hour
Teaching Artists	$20/hour
Staff paid for:	
Meetings	Yes
Professional development	Yes
Lesson planning time	Yes

STEM Staff

The program is staffed by 13 individuals, including three part-time Teaching Artists, three part-time Homework Warriors, six volunteer program apprentices, and one full-time program director. Each staff member plays a specific role in the program:

- Teaching Artists are expected to "develop and facilitate a progressive, innovative arts-and literacy-based curriculum" (according to their job description). These staff members must possess a BA/BFA and have a minimum of four years of experience teaching art.

- Homework Warriors are responsible for running two homework periods each day. These staff members must be enrolled in college and have two years of experience working in an afterschool program.

- Program Apprentices are high school or college student volunteers who work with a grade-level group throughout the program activities, and support the Homework Warriors and Teaching Artists.

Staff members work together to support participants and program activities. At the start of the program, staff and participants meet in the cafeteria for a physical activity. Afterwards, half of the participants stay in the cafeteria to work on homework with the Homework Warriors, while the other half participates in activities with the Teaching Artists. Later, participants rotate.

Although staff members have previously attended trainings offered through DYCD's technical assistance providers, most STEM training is done in-house, either by the program director or the education specialist during the weekly whole-staff meetings. The education specialist explained that in a recent STEM training, discussion focused on the rationale for integrating STEM into the program. "It had a lot to do with the global economy and where we are with education and the global scale. It's not just about education in the inner city, right? It's about our economic future, if you will." She said getting staff to understand the reasoning behind the STEM initiative was vital to how they will implement STEM activities. She added that reviewing lesson plans, working across disciplines, and using STEM vocabulary has further supported intentional implementation of interdisciplinary STEAM (Science, Technology, Engineering, Arts, and Math) activities. "We do a lot of interdisciplinary work. A dance teacher might go to a visual artist and say, 'Hey, I'm working this dance choreography piece, and we're talking about geometry.' One teacher drew movement maps for a piece of choreography. So then you have this sort of linear plotting in space, and then the kids had to choose where their plot was and their paths couldn't cross at a certain time to avoid collision. So you have them using math to figure out how they can move through space efficiently."

Alignment with Schools

The Homework Warriors support participant success in STEM by helping with mathematics homework. The program has established mechanisms for staff to communicate and coordinate with school-day staff to ensure that they are knowledgeable about school-day learning and instructional techniques. First, the program uses a push-in model, in which the Homework Warriors assist school-day teachers in an extended day classroom three days a week. Second, Homework Warriors conduct weekly check-ins with school-day teachers about the needs of students, and finally, program leaders have established open communication with school administrators and teachers.

Pushing into the school day

Some program staff work alongside school-day teachers in supporting students during the school's extended-day program. These extended-day periods are intended to help students who are struggling in school, particularly in preparation for the state assessments. In this push-in model, Homework Warriors go to the classroom and help the school-day teachers as they provide additional instruction in writing and math. They help ensure that every child is on the same page and understands the material by providing individual assistance as needed. Through this approach, Homework Warriors can observe teachers as they model instructional strategies.

Communication with school-day staff

In addition, all Homework Warriors are expected to talk to teachers on a weekly basis about participants' school-day performance, introduce themselves at the beginning of the year, and schedule a regular check-in time. As that relationship develops, the teachers also approach the staff informally. The education specialist noted, "What's so great about the check-ins is that there is a relationship formed. […] Once the teacher knows that we're actually serious about helping the kids, then they're more interested, and they're like, 'I noticed this is going on, can you help with [this or that]." The program director noted, "It's important to come in and meet with those teachers and say, 'This is what we're doing, this is how we incorporate literacy and all these core curriculums that need to happen and this is how we do it.'"

These check-ins provide opportunities for the program staff to find out how participants are doing in school and identify the subjects participants are struggling with. The education specialist noted, "Recently, the fifth-graders took a math pretest and a lot of fractions were mentioned and problem words. So now we know we should be focusing on these things to build those skills and make them ready for the state test." One Homework Warrior commented, "I meet with [teachers] about once a week to talk to them about the children, like what does this child need help in, how is he behaving in class, what problems are there?" The Homework Warriors review participants' needs and progress with the participants themselves. For example, a Homework Warrior described what she might say to participants: "The last time I talked to the teacher, you weren't completing homework […] I talked to the teacher this time, she says you're doing wonderful, your math is improving and you're doing your homework." In order to communicate with the teachers of participants from a neighboring school (not the main host school), program staff ask parents to send notes to these teachers, or include notes in students' school folders. Staff members share what they learn about participants with one other during their weekly meetings.

Continuous Quality Improvement (CQI)

Ongoing lesson planning

The program has established a strategic and intentional process for lesson planning to ensure that activities are aligned with program's goals. In this process, staff:

- Brainstorm possible thematic ideas, and discuss them as a group
- Identify specific vocabulary terms participants will learn and outcomes they will achieve through each activity
- Develop a weekly lesson plan, which is then reviewed by the program director and education specialist
- Discuss lesson plans during weekly staff meetings
- Receive individual feedback on lesson plans

Approach to CQI

Staff submit lesson plans for review	Yes
Frequency of staff meetings	Weekly
Assessment tools used	Student portfolios, Parent and teacher surveys, Review of student report cards
Frequency of staff evaluation	Once per week
Use of feedback	Assess student progress and provide feedback to students, Refine program activities

Teaching Artists work closely with the education specialist, the program director, and each other to plan and refine their lessons for each six-week thematic unit. First, staff members submit an idea for a theme to the entire program staff during a weekly staff meeting. These ideas are often inspired by staff members' own artistic expertise or background, adapted to be age-appropriate and reflect the developmental needs of participants. Staff receive feedback from their colleagues on how to develop that theme throughout the six-week interval. During these feedback sessions, a Teaching Artist reported that staff are "looking at our lesson, looking at the wording, discussing the activities, any concerns that we may have individually as Teaching Artists, and collectively coming together to figure out a better solution or another alternative." Teaching Artists then write weekly lesson plans that are reviewed by the program director and the education specialist, who provide individual feedback to all the Teaching Artists involved. Each week the lesson plans are refined to meet the needs of participants. The education specialist described the lesson planning as "ongoing" and a result of "a lot of group discussion."

One Teaching Artist said, "Lesson planning for me is coming up with a project. I think of the big idea first and then I work my way backwards. That's how I was taught to lesson plan: Come up with the end result, the end product, and then work your way to figure out the steps that lead up to that." This Teaching Artist continued, "I think about how I'm going to incorporate technology and literacy, and then figure out the activity or the many activities that will give participants the skills that it will take to do the final project." The final projects are presented at the end of the lesson series on family nights, during which participants showcase their work.

These projects might be a choreographed dance, an artistic piece, or other form of artistic expression. As compensation for this extensive planning, program staff are paid for one hour a week of planning and for a two-hour staff meeting. In total, staff are paid 21 hours a week.

Monitoring student learning

For each theme rotation, program staff identify the essential vocabulary and skills that students are expected to learn by the end of the rotation. For example, one program rotation focused on animals and incorporated concepts of animal anatomy, movement, and skeletal structures. As one staff member explained, vocabulary was "anatomy-specific and then maybe science-specific about different animals, habitats, environments, things like that." Throughout the rotations, staff introduce vocabulary in various ways. For example, the dance instructor might develop an exercise in which students physically demonstrate the meaning of the word, in order to help them retain the information.

The program's CQI process includes reviews of participant portfolios, which contain works of art accompanied by a standard portfolio review document (completed for each program rotation). At the end of each program rotation, Teaching Artists and participants meet one-on-one to examine participants' portfolios. The portfolio review is aligned with the vocabulary words and the skill development goals that staff wrote into lesson plans. Program staff identify areas in which participants have successfully developed their skills, along with areas in which lesson planning should be strengthened in order to have a greater impact on students. According to the program director, through these portfolio reviews, staff can "see certain patterns and certain words that children couldn't retain, they can reflect on their own lesson, like maybe I didn't focus on it long enough or maybe they needed to try something different." Teaching Artists review portfolios with individual participants for about five minutes each. They ask participants what they think they learned in order to better understand if participants are understanding the lessons. According to a Teaching Artist, these portfolio reviews "hold [students] accountable, but also provides them with feedback. […] It gives them a sense of responsibility that they probably don't realize that they have."

Although program staff use portfolio reviews to determine if they were successful in meeting the goals of their activities, the Teaching Artists also described a more ongoing, informal system of assessing progress. One Teaching Artist said, "You never wait until the end, you're always assessing throughout." Staff review concepts in the beginning of each class to assess whether participants remember previous lessons and if they understood the main point of the lesson. The program also measures program effectiveness through annual end-of-year parent and teacher surveys. Parents are asked to describe their child's improvement in school subject areas, homework habits, and social behavior. Teachers are asked about participant successes, what they value most about the program, and for suggestions to improve communication with program staff. Both surveys also offer parents and teachers the opportunity to provide feedback about program content areas that can be improved. Starting next year, the program director reported that the program will survey parents about their children's academic and social skills before the program as well as after the program in order to detect potential changes in students' knowledge and behaviors.

Ed Connections

Program Context	
Years in operation	8
Grades served	6-8
Center- or school-based program	School-based
Program operation	Monday-Thursday, 2:00-4:00 PM
Number of participants	100
Number of participants in STEM	20-25 each three-month cycle
STEM enrollment	By interest
STEM activity frequency/duration	Three hours per week

Overview

In response to both the new DYCD priorities for OST programs and to the national focus on science education, the nonprofit provider organization operating this program initiated an emphasis on STEM-related content in all of its OST programs. The goals of the organization's STEM initiative are to increase participants' engagement and interest in science-related content and to encourage participants to develop problem solving and critical thinking skills.

This school-based OST program serves approximately 100 participants in grades 6-8. The program, which has operated for eight years, provides a mix of academic and recreation activities to participants. Participants explore their communities and local environments through field experiences, project-based activities, and independent research centered on environmental science and physics. A full-time program director, supported by staff from the provider organization and the agency's education specialist, oversees all program activities.

Participants engage in activities in three-month cycles. At the start of each cycle, participants choose the activities in which they would like to participate; they may rejoin the same activity for the next cycle. The science activity, which meets three hours each week, draws approximately 20 participants each cycle. While many of the participants who engage in the science activity re-enroll, staff said that they also encourage participants who might shy away from science activities to try them. One staff member said that the goal is to have all participants take science during at least one of the activity cycles. The program director does considerable outreach to participants who do not engage in science activities, encouraging them to attend the science group if they have not yet done so during the year.

The science activity addresses a range of STEM content, mostly centering on environmental science and physics. Staff members provide hands-on learning experiences to

support learning outcomes. Past activities have included making paper airplanes to demonstrate principles of aerodynamics and building simple bridges during an engineering lesson. In addition to the science activity, program staff incorporate STEM components into other activities (e.g., digital photography in the program's yearbook club, computer software in the newspaper club, mathematics in the music club) so that all program participants receive some type of STEM-related instruction while not participating in the science activity.

On the day visited, participants completed a "Hard As a Nut" activity to explore the concept of density. After a brief overview led by the activity leader, participants practiced predictive analysis to determine which of five types of nuts would be hardest to crack and, therefore, possessed the greatest density. In groups of three or four, participants developed hypotheses about each nut's density and the number of pennies required to crack each nut. Then, using the procedure proposed in the activity guide, they tested their hypotheses. Each group designated a member to record observations and to present their findings to the entire class.

For all OST programs, the provider organization prioritizes hiring licensed teachers to lead activities, assisted by college students pursuing degrees in education or related areas. At this program, a science teacher employed by the host school leads STEM activities. According to the program's leadership, hiring a teacher who is knowledgeable and enthusiastic about science-related content has increased participants' excitement and engagement. Additionally, the program benefits from a strong relationship with its host school. Teachers and administrators regard the afterschool program as an extension of the school day, and lines of communication between OST program staff and faculty were described as a "cornerstone" of the program.

Approaches to STEM Programming

Program Structure

Nonprofit provider organization emphasis on STEM in OST programs

The provider organization has promoted an increased emphasis on STEM in all its OST programs. Although the provider organization had previously integrated science and math into many of its programs, the new emphasis was designed to bring STEM to the forefront and bolster their STEM efforts, especially as they relate to engineering and technology. At the provider level, staff now meet weekly to discuss STEM curricula selection and implementation at programs.

At school-based OST programs such as this one, the focus on STEM has been a natural fit for the provider. One staff member said that principals embrace the concept of STEM in afterschool programming as a strategy to help participants become critical thinkers and increase their confidence and self-efficacy related to science. She explained, "We want them to embrace [science], and it's only going to happen if they can practice with it and […] if there's that exposure." Principals have told program staff that integrating STEM content into the afterschool program has been beneficial because it has allowed participants to explore content in ways that they cannot during the school day due to the emphasis on standardized tests.

The provider organization's emphasis on STEM, as well as the host schools' priorities, is communicated through a number of channels. Program directors meet with provider-level staff at weekly staff meetings during which they discuss STEM implementation at each program. The weekly meetings allow program directors to share best practices and challenges as they relate to STEM activities. Although the program directors and provider-level staff work closely together, the program directors often take the initiative in deciding which aspects of science should be prioritized in their programs. At their respective programs, program directors share the information discussed with the front-line staff who carry out activities. At this program, OST science activities are led by a teacher from the host school. She is supported by the education specialist and the program director, who often provide curricular resources and materials to support instruction.

The programs also rely on a train-the-trainer model to transfer professional development information to the front-line staff. Related to STEM, the education specialist and program director have attended trainings organized by The After-School Corporation (TASC) and the Partnership of Afterschool Education (PASE). The education specialist also attended a training provided by the Youth Development Institute (YDI) related to Common Core; the education specialist mentioned that he has used this particular training to work with activity leaders across all the programs to ensure that, as they develop lesson plans, the content is aligned to the new standards.

STEM Curricula and Pedagogy

Approach to STEM Curricula

STEM topic areas(s) addressed	Environmental science/physics
Curricula used	Mix of published curricula (e.g., Design It) and activities developed by staff
Curricula source(s)	Provider organization, Online resources, Self-developed curricula

Engaging older participants in STEM

Program staff agreed that an initial challenge was developing high-quality STEM activities that would appeal to middle school-aged participants. Program staff discussed three strategies to maintain the interest of this age group: hiring knowledgeable staff, providing leadership opportunities for participants, and offering participant-centered content. Hiring staff with STEM expertise is especially important for programs that serve older youth. One staff member said, "These kids are at this age where they know [...] if someone doesn't know what they're talking about and they can sense that, and, as soon as they sense that, they start to drift away." The program's leadership and staff believe that hiring knowledgeable and enthusiastic staff has increased participant engagement in science and brought in those who otherwise may have not participated in STEM-related activities.

Program staff engage participants by giving them more ownership of the program: "You have to allow them to take on responsibility and feel like they are really important." One

participant, for example, heads the garden committee that maintains the school's outdoor garden. Her responsibilities include collecting materials for the compost bin.

To plan activities, the teacher who leads science activities explained that she often asks participants – many of whom are in her school-day classes – what they would like to learn. The teacher said that this approach has increased participants' engagement in science, especially among those who were considered "trouble kids" during the school day. For example, the teacher described a student who initially did not pay attention in science classes; however, because of his participation in afterschool science activities, he has become more interested in his school work. She described an activity during which students learned about the life cycle of worms: "Yesterday […] he got so excited to get in the soil and work with the soil. I said, 'Let's look for things, and the excitement and his behavior […] all of a sudden, you see him show interest and care.'" She attributed the student's engagement to the participant-centered focus of the afterschool activities. The teacher explained, "We're feeding into their interest; that's where we will get them."

Alignment with Schools

Fostering relationships with school faculty

The program benefits from a strong relationship with its host school. The provider organization has served the borough for more than 30 years, and it has long-standing relationships with several schools, many of which pre-date the DYCD OST initiative. Furthermore, the program director, who has served as a substitute teacher at the school, continues to be a presence during the school day.

The program's leadership makes a concerted effort to engage the school's teachers and administrators in supporting program activities. One staff member said, "The idea is all of these enrichment programs are supposed to be a safe haven first and foremost, but we're supposed to be elevating some degree of skills. So rather than us do it in isolation […] we need to work with [the school] to figure out what [the school needs] and how we can accomplish it." At this program, this collaborative philosophy led to the creation of the school's outdoor garden. The program director said that, at a meeting with the school's principal, he asked if there were any specific activities in which she wanted program participants to engage. The principal requested that the program use the school's outdoor terrain to create a community garden, which could also serve as a teaching device as part of the program's focus on environmental science.

In general, the school's faculty has been supportive of the STEM initiative, and the program's existing relationship with the host school brought the school's science teacher to the OST program. In a meeting with one of the school's assistant principals, the program director said that the program needed a staff member who could support the STEM initiative. He said, "Two seconds later, [the assistant principal] got on the phone and called the science teacher. […] We met, talked for 10 minutes, and, boom, she was hired." According to program staff, working directly with the school's administration yielded results more quickly than if they had posted a job opening. It not only demonstrated that administrators had bought into the

program, but also sent a message to the teachers about the program's value to the school. Furthermore, according to the program's leadership, hiring from within the school has been a powerful public relations tool that has helped the program gain recognition in the school; as a result, program and school-day staff have developed partnerships that bolster both afterschool and school-day learning.

The program's leadership and the science teacher make considerable efforts to differentiate afterschool and in-school instruction. A provider-level staff member said, "When I talk to a principal about coming on board with one of our programs, or if I'm speaking directly to the program staff, I always say to them, 'I want you to look at the afterschool as your opportunity to do all of those enrichment activities that are on the side of your textbook. […] So the principals understand and the teachers understand that this is their opportunity to do the enrichment – to bring the lesson to life." The science teacher said that what separates her in-school instruction from her afterschool instruction is the emphasis on learning concepts for standardized tests that occurs during the school day. In her afterschool instruction, activities are more hands-on and participant-centered, which the teacher believes is more effective at helping participants understand and remember scientific concepts.

The program staff is confident that the program's relationship with the host school has had a positive effect on participant learning. The science teacher stated that having additional time to explore science content is the greatest benefit of the relationship between the afterschool program and the school. She said, "It brings [science lessons] one step further in a way we cannot do in a classroom." By speaking to the school-day teachers and administrators, the program's staff has provided programming that is more academically rigorous than it has been in previous years. Aligning program content with the school's student learning objectives helps reinforce concepts and support learning. In turn, the program staff speculate that this will improve participants' self-efficacy as it relates to science: "When they're getting the reinforcement and the repetition and the enrichment, that they're becoming well-versed, more comfortable as students, more likely to pursue a higher education."

STEM Staff

Hiring staff with STEM and youth development expertise

A science teacher from the host school joined the OST program staff early in 2013 and is supported by the provider organization's education specialist, an experienced museum educator with a passion for environmental science. In the words of a staff member from the provider organization, "STEM can't be successful unless you have someone who's well-versed or enthusiastic about it. There is no comparison when you have someone who enjoys that field […] and is able to be responsive to the children."

The program has hired and compensated licensed teachers using the funding received from DYCD, which is possible because the program day is shorter than in a typical OST program. Currently, the program runs two hours a day, four days each week. The science teacher was approached by the school's assistant principal, who serves as a liaison between the program and the school. In hiring a science teacher from within the school, the program secured a staff member who knows participants from the school and who works well with youth. The science teacher's relationships with participants have supported participant-centered content delivery, since the science teacher knows where their interests lie and incorporates these interests into afterschool program content. Many of the participants who engage in STEM afterschool activities are students who attend the science teacher's school-day classes.

Approach to staffing

Total number of staff	11
Education specialist supports STEM	Yes
Number of staff who lead STEM activities	1
Professional development sources	PASE, TASC, YDI
External partners supporting STEM	Grow NYC, Compost NYC, NYC Parks Department, Friends of Blue Heron Park
Salary range for STEM staff	$35/hour
Staff paid for:	
Meetings	Yes
Professional development	Yes
Lesson planning time	No
Special resources needed for STEM programming	STEM-specific curricula, kits, and supplies

To plan activities for the afterschool session, the science teacher meets with participants to discuss which areas of science they would like to explore. Often, participants will describe experiments that they completed in class and pose questions about the design, which the teacher integrates into her afterschool lessons. One recent example of this occurred during a school-day lesson during which students learned about the life cycle of worms: at the end of the lesson, students had additional questions about worm habitats and life cycles, so the science teacher created an activity for the afterschool program in which the participants would build a habitat for the worms and observe their physical development.

Similarly, the provider organization hired an education specialist with experience working with youth and a background in environmental science. A provider-level staff member said, "It [was] imperative to find personnel who are passionate and knowledgeable about sciences and applicable mathematical concepts. […] This was a significant consideration in the recruitment of personnel." The education specialist supports staff at multiple programs as staff implement STEM-focused content. At this program, he and the science teacher have developed a symbiotic, information-sharing relationship wherein he provides her materials related to environmental science – a focus of the program at the school – while she provides school-day materials and lesson plans to use at the provider organization's other programs. The education specialist has also brought in several external partners to work with the program, many of whom are from his existing network of STEM-related organizations.

Establishing external partnerships

The program benefits from several partnerships with community organizations that support STEM programming, including Grow NYC, Compost NYC, the New York City Parks Department, and Friends of Blue Heron Park. Many of these partnerships were formed through the educational specialist's existing network, and he has engaged them to provide enrichment activities for participants. The educational specialist suggested that STEM programming across OST programs would benefit if DYCD and other provider organizations were also to establish institutional relationships that could be used across programs. He said that while he was already connected with the science-related nonprofit network prior to starting this position, he recognizes that others might struggle in connecting with potential partner organizations.

Staff members from these partner organizations have provided resources to support programming and, in some cases, led activities for participants. For example, Compost NYC has led composting workshops for participants, and rangers from the New York City Parks Department have hosted nature hikes and workshops for participants. The education specialist said that he is very active in the planning and delivery process when external partners work with the program: "I let them do their program, but I like to have my hands in the development. I'd want it to be tailored toward the goals that we have set here at [the school]." Most of the opportunities are provided free-of-charge to the program; when funding is required, the program director uses funds from his discretionary budget to cover costs.

The executive director explained that many of these relationships are new for the provider organization. "[The provider organization] has been around for more than 30 years, and we have linkages with many organizations [in the community] that provide activities. […] We're dealing more with agencies that have a mission but don't have a way to reach youth. We've opened our door to them and […] it's opened a broad horizon for additional resources." The program staff explained that, for the most part, they have had success in engaging community organizations but would like to engage a few additional partners, including the Museum of Natural History and the Bronx Zoo, which they would like to engage.

Continuous Quality Improvement (CQI)

Providing feedback to experienced staff members

The DYCD Program Quality Monitoring Tool and the NYSAN Program Quality Assessment Tool are used across all the nonprofit provider organization's programs to formally evaluate programs. Formal evaluations occur twice per year; the program director, education specialist, and provider-level staff are responsible for evaluation activities. Broadly, the evaluations focus on program capacity to provide engaging activities that help participants develop academically and socially. There is also a focus on whether staff support positive youth development. For STEM, the education specialist works with staff across all programs to help activity facilitators reflect on their activities and determine whether staff and participants are comfortable with the material. The program director is also exploring STEM-specific tools to supplement the evaluation tools currently in use.

Approach to CQI

Staff submit lesson plans for review	Yes
Frequency of staff meetings	Weekly
Program assessment tools used	NYSAN Program Quality Assessment, Staff self-reflection, Participant reflection
Frequency of evaluation	Twice per year
Use of evaluation feedback	Measure progress of participants outcomes, Staff development

Staff receive ongoing feedback from the education specialist and the program director. The education specialist said, "I think [the provider] is blessed with really engaging staff. […] They all seem to take what I say and use it, implement it, and grow. I think that's the idea." As noted above, the provider places a priority on hiring licensed teachers to lead program activities. The program's leadership believes that, despite these teachers' qualifications and experience, giving them feedback has not been a challenge because the feedback emphasizes youth development practices rather than instructional technique. A provider representative said, "Some of the things we're going to ask of [teachers] is vastly different than what [the principal] is going to ask."

On the Block Youth Program

Program Context	
Years in operation	10
Grades served	K-8
Center- or school-based program	Center-based
Program operation	Monday-Friday, 2:30 PM – 6:00 PM
Number of participants	160 (100 elementary-grades; 60 middle-grades)
Number of participants in STEM	160
STEM enrollment	By grade/age-group
STEM activity frequency/duration	One hour per week (rotating schedule)

Overview

This center-based OST program serves approximately 160 elementary and middle school-aged participants who reside in the neighborhood near the center. (It is funded by two separate DYCD contracts, one for elementary-grades and another for middle-grades participants.) The program, which has operated for 10 years, provides a mix of academic and enrichment activities. Math and science were previously incorporated into programming, but in response to the new expectations for OST programs, the provider organization has begun an agency-wide STEM initiative to bring science-related content to all its programs. By focusing on STEM, the provider organization aims to bring more deliberate structure to all its programs and help participants develop 21st century skills.

In line with the provider organization's priority, this program established two goals for its science activities: to expose participants to new content areas and to encourage participants to pursue higher education and careers in STEM-related fields. In the program director's words, the science initiative aims to "spark an interest in science and help [participants] build their knowledge." The program director and group leaders hope to expose participants to many of the educational and career opportunities available to them through science activities. This goal is a priority, especially for female participants. During the summer program, for example, the program director will invite as guest speakers women who work in STEM-related industries; moreover, the program director plans to focus on how female scientists are recruited as a program strategy to attract more female participants.

The combined elementary-grades and middle-grades program is led by one program director and is staffed by 14 group leaders who are responsible for implementing core activities and enrichment clubs. Currently, a high school graduate and a college graduate lead science activities for both elementary- and middle-grades students. Participants are divided by grade level into groups and engage in one-hour blocks of activities and clubs, including art, dance, technology, nutrition, cooking, and sports. While participants may choose their Friday club

activity, all other program activities are mandatory. Each week the program director creates a schedule for each grade group. Science group leaders aim to make activities "as enjoyable as possible" to keep participants engaged in each content area. To do so, most activities include a hands-on learning activity that differentiates the OST program instruction from the participants' school instruction.

At this program, participants engage in science activities each Thursday. Science activities address topics that are primarily drawn from published curricula, including *After-School Science PLUS* and *Wonderwise*. The program director also encourages the science group leaders to reference the Harcourt science curriculum, which is used by several of the feeder schools that the participants attend. In general, the curriculum is used as a supplement to activities; the program director explained that the science group leaders "are creative and use a variety of tools to boost the kids' interests."

Approaches to STEM Programming

Program Structure

Nonprofit provider organization emphasis on STEM in youth programs

The provider organization that oversees the program began a STEM initiative to promote STEM-related content in all its programming. In doing so, the provider organization seeks to enhance programming and help participants develop skills that will support their success in college and careers. The program director commented that the STEM initiative has made the program more structured; the addition of science activities, according to the program staff, has created an opportunity for students to develop and practice the necessary skills required to excel in education and careers. One group leader said, "A long time ago, we didn't even do science in afterschool – not at all. […] I think it makes the program better. It enhances it because we added on something that the kids need and could use in life."

While the provider organization has offered some guidance on STEM implementation, each program was given flexibility in designing and planning its science activities. Greater flexibility allows program leaders and staff to determine the subjects and instructional strategies that work best for the youth in their programs. All the program directors, for example, attend the same trainings provided either by the agency or by DYCD-affiliated technical assistance providers; however, they do not necessarily have to implement all the activities to which they are exposed in the trainings. The program director said, "We go to trainings and we see what works for our kids. Some programs do hydroponics. We don't do that here because […] it wouldn't work with these kids. It would be good for another site. You have to know who your kids are and how to address them to see what works."

STEM Curricula and Pedagogy

Youth-centered content

Approach to STEM curricula	
STEM topic area(s) addressed	General science
Curricula used	After-School Science PLUS, Wonderwise, Fruit Bowl
Sources for activity plans	Provider organization, Online resources; Published curricula

As part of the flexibility given to programs to implement the STEM initiative, the provider organization identified several research-based science curricula to be included in a menu of options from which programs can select. This program draws its science activities from the *After-School Science PLUS* and *Wonderwise* curricula. In addition, group leaders are encouraged to include concepts that are covered by the schools attended by participants. Besides having access to the Harcourt curriculum, which is used by the program's feeder schools, the program director shares information gleaned from conversations with school-day teachers during weekly staff meetings.

The program director and science group leaders aim to increase participant engagement by addressing their interests. As one group leader explained, "I think it's easier if you ask the kids what they would like to learn during science." The program director and group leader try to get to know all the participants in the program, including whether the content of the activities is something to which participants can relate and is age-appropriate. Often, one of the group leaders said, participants complain that they have already learned about a topic in school; in response, group leaders may adjust activities to supplement what was already learned in school or create new lessons based on participants' interests. When working on a lesson about plants, for example, younger participants demonstrated basic knowledge about pollination, which they had learned in school. However, when participants had more questions about pollination, the group leader found additional resources, including a film, to answer questions and introduce new information. In the program director's words, the efforts to center the activities on participants' interests have improved youth engagement: "You could have a wonderful lesson, but, if the kids aren't interested in it, you're talking to yourself. We definitely try to do a lot of things participant-centered so we can get their feedback."

Teaching through hands-on, project-based learning

The science group leaders incorporate hands-on learning experiences and visual aids into their lessons, both of which are intentional strategies used by the program to differentiate afterschool and in-school instruction. One science group leader said, "I try to make [the science activity] as welcoming as possible so they come to science and say, 'I want to be in this room.' The science group leaders explained that they try to distinguish in-school instruction from afterschool activities by incorporating educational games to reinforce the lessons participants learned in school. For example, one science group leader uses Jeopardy to teach science-related vocabulary. Project-based learning is also used to engage participants, and sometimes competition is incorporated into the projects to keep youth engaged. When the evaluation team

visited the program, older participants were learning how to create simple closed and open circuits. The participants, in groups, will use this knowledge over the next few weeks to design, build, and light model homes to be judged by program staff.

To make the science activities more "their own," the science group leaders are given flexibility when planning activities, and they often incorporate their own passions into the science activities. One group leader, for example, who described himself as an "artsy" person, often incorporates visual components into activities and projects. For a plant anatomy activity, the group leader planned for the participants to build models of plants to reinforce what they had learned.

STEM Staff

Training staff to implement STEM

When asked what she looks for when hiring staff, the program director said that an ability to work with youth is a must: "I don't care if you have a Master's in science, if you can't have a conversation with or don't like kids, then you can't be around them." Although neither science group leader has a formal STEM-related education, they both felt that their limited STEM educational experiences did not pose a challenge to their work. One group leader, for example, said that he fills in knowledge gaps by conducting independent research and by asking for support from the program director.

The provider organization and program director place a priority on staff training. The program director also serves as the education specialists for the program, and in that role supports activity planning and monitors activity implementation. The science group leaders explained that the program director shares information about relevant trainings and ensures that someone from the program attends. To implement STEM, both science group leaders have received training from TASC and PASE. The group leaders also attended training on the *Wonderwise* curriculum, one of the published curricula used by the program, and a content-related training on hydroponics, which is being implemented at another program.

Both science group leaders said that while the trainings had been useful, they struggle in securing supplies to conduct activities. To compensate for the absence of materials needed for activities, the staff adjusts activities or finds substitutes for materials to which the center does not have access. The program director said, "We'll just use what we have to make the experiment come to life. We have to be creative."

Alignment with Schools

Connecting material to schools while maintaining program priorities

The program serves participants who attend one of 10 feeder schools in the surrounding area. As an employee of one of the feeder schools, the program director connects with the science teachers at her school to discuss strategies to connect the afterschool program to student learning during school. While some efforts are made to align program content to school-day learning, primarily through the Harcourt science curriculum used by the feeder schools, the program director said that the science group leaders maintain flexibility when planning and implementing science activities. "We try to connect so the kids can achieve academically, but [the schools'] goals are not necessarily what ours are." One of the feeder schools, for example, is a health and wellness magnet school; program participants took part in a nutrition activity and explored food groups, based on curricula provided by City Harvest. While this is a strong theme at the feeder school, the program only occasionally integrates nutrition-based activities.

Approach to staffing

Total number of staff	14
Education specialist supports STEM	Yes (program director)
Number of staff who lead STEM activities	2
Professional development sources	PASE, TASC
External partners supporting STEM	City Harvest, New York Academy of Sciences, TransCanada
Salary range for STEM staff	$10-15/hour
Staff paid for:	
Meetings	Yes
Professional development	Yes
Lesson planning time	Yes
Special resources needed for STEM programming	Materials associated with curricula

The science group leaders differentiate in-school instruction from afterschool instruction. The program director explained that, by virtue of the group leaders not having formal education training, content delivery will always be different. "They're not teachers. They're not thinking of making that connection to statewide standards that you have to do in school. Their lessons [are delivered] in a more fun way." With respect to using the Harcourt curriculum, the program director said that she encourages the science group leaders to use the materials as a supplement to their activities. "We're not bound to any specific curriculum, but with the creativity of the instructors, they're able to do a lot of activities with the students."

Continuous Quality Improvement (CQI)

Providing feedback to staff

Approach to CQI

Staff submit lesson plans for review	Yes
Frequency of staff meetings	Weekly
Assessment tools used	NYSAN Program Quality Assessment, Youth surveys
Frequency of evaluation	Twice per year
Use of feedback	Measure student progress, Adjust program content, Make human resource decisions (provider)

All group leaders receive ongoing training and support from the program director. The program's staff meet weekly on Fridays to discuss activity planning, challenges experienced by group leaders, and strategies to lead effective sessions. Each staff member also submits lesson plans to the program director, who then provides them with written feedback of their plans. Lesson plans outline activities planned for the week. While the science group leaders draw the majority of the material they teach from published curricula, they are encouraged to adjust the curriculum to better serve participant interest.

The program director also observes activities and provides feedback to ensure that group leaders improve their instructional strategies. One science group leader said that he received feedback on how to keep his entire class engaged during activities; the group leader stated that this type of feedback has helped his development as an instructor: "I feel that I have improved a lot, especially in science. I wasn't really focused on science when I was hired, but, as time went on, […] I gradually grasped it and became interested. I think having me interested in [science] makes the kids more interested."

To support continuous quality improvement, the program director uses the NYSAN Program Quality Assessment Tool to assess and improve activities. Staff evaluations are done using an agency-developed tool. The tool examines several domains: instructional skills, commitment to program, practice, and relationships with youth. The program director conducts staff evaluations twice per year. The first evaluation occurs at the middle of the program year and simply checks staff to see how they are doing, and the second evaluation occurs at the end of the year. Staff evaluations are entered into an agency-wide database and the agency uses the results to determine staff compensation, promotions, and other employment decisions.

Using participant feedback to adjust activities

To determine the efficacy of all program activities, the program administers pre- and post-surveys to participants to provide insight into what they have learned during the program year. For STEM, participants complete the surveys in September and May; the goals of the survey are to assess participant knowledge and determine the extent of their interest in science. The program director said that she tries to make changes to the program based on the feedback from the student survey. She explained that she and the science group leaders pay attention to youth scores on knowledge-based items. When participants complete the May survey, staff members evaluate student progress. If participants did not improve in science-related content

areas, the science group leaders and program directors make new plans to strengthen the STEM program area for the following school year.

In addition, the program director and science group leaders engage participants in informal conversations to gain their input on science activities, particularly what they liked about a given activity, what they did not like, and what other types of science-related activities they would like to try. Next year, an evaluation specialist from the provider organization will begin participant focus groups; these focus group data will be used to improve the STEM initiative across all of the agency's programs.

STEM Majors

Program Context	
Years in operation	1
Grades served	4-8
Center- or school-based program	Center-based
Program operation	Monday-Friday, 3:00 PM- 6:00 PM
Number of participants	170
Number of participants in STEM	All sixth- and eighth-graders participate in STEM enrichment; 25 participants in grades 4-8 chose to "major" in STEM
STEM enrollment	Required and by interest
STEM activity frequency/duration	Required: twice per week for 30 minutes; By interest: three times a week for 1 hour

Overview

This center-based program opened during the 2012-13 school year and serves participants from about 16 schools. The program implements the nonprofit provider organization's afterschool model, which the program director created about five years ago and which is also incorporated in the organization's other programs. According to the program director, the goals of the model are to introduce participants to various options in school and in life, to give them choices in the activities they do, and to support and encourage participants as they explore these options. Essential elements of the model include individual coaching and enrichment activities, with a focus on performing arts and on STEM.

An integral part of the program is the major/minor model. At the beginning of each semester, participants in fourth grade and above select a major and a minor. (They can select different majors and minors each semester.) For their major, participants engage in three hours of programming per week, choosing STEM activities or others, such as creative writing, drama, dance, and art. Participants also choose a minor, in which they participate for two hours a week choosing either newspaper, robotics, athletics, cooking class, dance, or vocals.

Each major is led by an activity specialist with expertise in that subject area. For example, the STEM major and the robotics minor were both led by the STEM specialist, who is a pre-med college student majoring in biology.

Approaches to STEM Programming

STEM Curricula and Instructional Strategies

Differentiating STEM activities by participant interest

In this program, STEM is a priority for all participants – both those who explicitly express interest in it, and those who do not. All middle-grades participants in the program, regardless of their chosen major, participate in two 30-minute sessions of STEM activities per week. For participants with a STEM major, this time is in addition to the three hours of major programming each week (one hour a day, three days per week).

Approach to STEM Curricula

STEM topic areas(s) addressed	Chemistry, Biology, Earth science, Anatomy, Physiology
Curricula used	Activities developed by staff
Curricula source(s)	Online resources, Self-developed curricula

For the participants who declare an interest in STEM by majoring in it, the program seeks to "keep them interested in science" and gives them the opportunity to "explore different areas of science" such as advanced chemistry or dissection, according to the STEM specialist. She also hopes to get them to recognize the science that exists in everyday life. Some examples of topics that the STEM major group (called G-STEM) has covered include: advanced chemistry, dissection, cardiology, earth science, and ecology. According to the program schedule, the group spends about one week on each topic. For example, in the chemistry week, on the first day participants learned the difference between acids and bases (through a lecture/discussion led by the STEM activity specialist). On the second day, participants completed an activity to differentiate between acids and bases, and on the third and final day (the typical lab/activity day), they learned how to make pH sticks and how to balance out an acid.

In addition to selecting a major, participants in the program select a minor, which they participate in twice a week for one hour. For example, for the first semester, participants could minor in robotics: the STEM activity specialist attended a robotics training to learn how to lead the activities. During the second semester the program intentionally did not offer robotics, in order to expose participants to a greater variety of activities through their minors. to be exposed to a variety of activities in their minors.

The goals for the STEM enrichment class, which is mandatory for all participants, are to instruct participants so that they can do well in their science classes in school and in the state science tests. This STEM enrichment class consists of two 30-minute sessions each week. Participants receive a basic level of exposure to many different science topics that are aligned with the state science standards. The STEM enrichment class, which is taught by the STEM specialist, has covered such topics such as the respiratory system, environmental science, and the laws of energy and motion.

Participant input and feedback play a role in the selection of activity topics. For STEM enrichment, the STEM specialist determines if participants need help with science as she helps

them with their homework during the program's daily homework help period. That way, any science topic with which participants are struggling will be addressed in a future STEM enrichment class. For G-STEM, she talks to participants about their interests and, because she has had some of the same participants in G-STEM for a few semesters, she knows them well and knows what they are interested in.

Structuring STEM activities in order to engage participants

The STEM enrichment class period is limited to one half-hour and the STEM specialist has struggled to come up with engaging activities that will fit into the time frame. Although a longer time slot might help the STEM specialist go deeper into an activity and even incorporate some project-based and/or hands-on learning, both the project director and the STEM specialist said it would be harder to keep participants' attention for an hour's worth of STEM enrichment. The project director also mentioned that for middle school participants who are not explicitly interested in STEM, attending an hour-long "class" on STEM would be a hard sell, and those participants might instead skip the program altogether on that day. The class is therefore kept to a more manageable 30-minute "power lesson" instead of a longer session.

The former education specialist for this program (a science teacher) discouraged the STEM specialist from doing hands-on activities with STEM enrichment participants in 30-minute blocks, saying she would not have time nor space to do these types of activities with such a large group. The STEM specialist also said that the short time frame was not the only thing keeping her from doing hands-on activities with the STEM enrichment group; other factors included the lack of supplies and the logistical difficulty of conducting a large-group lab. The class has therefore turned into more of a lecture-style activity which the STEM specialist reported was "hard to make it not seem like school."

However, the new education specialist (who joined the program in the spring) said that he would like to reshape the structure of the STEM enrichment class so that it is possible to introduce hands-on activities; in fact, he thinks it is essential to do so in order to keep participants' attention. His goal is to reorganize the class into a workshop structure, much the same as in many school-day classes. The class would begin with a five-minute "do now" activity that would ideally build on the lesson learned in the previous session. Then, the STEM specialist would introduce the topic of the day in no more than 10 minutes, condensing the topic into two or three essential points. In the next 10 minutes, students would complete a hands-on activity, followed by five minutes of wrap-up (to be resumed in the next class). The education specialist described creating a plan for such a class: "What's the point you want to make in that 20 minutes? How can we do this? Also, managing classroom behavior; I think when you get into that workshop model when the students come in and there's a question on the board that they have to answer right away, that puts them in the focus right there and you have them. And then, I constantly rove [around the room]. […] I want to teach [the STEM specialist] a lot of the teaching techniques that I use as far as to get away from being in front of the class."

The education specialist would like to focus future lessons on fewer topics, such as anatomy and physiology, in which participants have expressed an interest. The STEM specialist

is also well versed in these topics, as she is a pre-med biology major in college and also an EMT. Because of strong participant interest and the STEM specialist's corresponding interest and expertise, the education specialist suggested that the STEM enrichment class and G-STEM activities could spend more time on these topics and use them as a starting point to explore other areas of science. He said: "If you're able to take a topical approach like anatomy and physiology, you can do one or two points a day and then you could take on a chemistry aspect, a physics aspect, a biology aspect, whatever it takes to fluctuate back and forth. And then I want to introduce careers. What are these jobs that this can lead to? And I think that's the biggest thing lacking in science."

In addition, the education specialist noted that STEM labs do not necessarily require a high level of resources. As a science teacher, he often has to create labs for the many students he has throughout the day and is experienced in designing labs that use inexpensive materials.

Creating STEM activity plans

The STEM specialist was leery of adopting an entire curriculum wholesale because she thought it would not be adapted to participants' interests and would be too much like school. While the STEM specialist did not use any outside curricula, she sometimes incorporated lesson plans that she found online. For both G-STEM and STEM enrichment class, the STEM specialist drew on the websites Biology for Kids and Chemistry for Kids. She liked these sites because she felt that they used child-appropriate language to explain science concepts. They helped her translate her own science knowledge into a format that was easier to teach to her fourth- through eighth-grade participants. She also searched the internet for sample labs and activities for the topics she had chosen. She spent a considerable amount of time each week planning lessons from scratch and tended toward lecture-style instruction for the STEM enrichment class. She knew the material and had read online how to adapt the vocabulary for middle-school participants, so she could deliver lectures to participants based on her own prior knowledge. She then created or found labs to incorporate into the activity for G-STEM. She also created her own quizzes for STEM enrichment classes, based on the information that they covered in class.

Comments from the STEM specialist highlighted the need to introduce staff to the myriad existing resources that are available to support STEM instruction in an afterschool setting. The STEM specialist valued the resources she received from the program's new education specialist at the end of the year to enhance her lessons. An awareness of these existing resources and activity ideas may have saved the STEM specialist time at the beginning of the year.

Incorporating participants' interests and needs is important to the STEM specialist. Before designing activities, she find outs what participants need and what they are interested in, "because it keeps them interested and it makes them feel more important. It makes them feel they have some sense of control rather than being controlled, rather than being told, sit here, learn this, write that. […] So that's how I feel it's better to know the kids that you have and the group that you have, what they're learning and what they need help in."

Alignment with School

To ensure that the content of the STEM enrichment activities is aligned with the New York State standards, the STEM specialist said that she spent the beginning of the year researching what participants should be learning between sixth and eighth grade. Since the program's goal in the STEM enrichment activity has been to introduce and revisit topics from participants' school-day science classes and prepare them for the state science tests, the STEM specialist briefly discussed these topics in an engaging way in the time allotted to the activity.

At the beginning of each semester, all the program's activity specialists (including the STEM specialist) submit a list of the daily activity plans to the director and the education specialist. While the G-STEM activity is not intentionally connected to school topics, it does cover a broad range of STEM topics, and delves more deeply into topics in which G-STEM participants have expressed interest. The STEM specialist described how the former education specialist gave her feedback on her STEM enrichment activities, which she had originally drafted as a shorter version of her G-STEM activity plans. The education specialist explained to her that the STEM enrichment class "is supposed to help [participants] connect what they're learning in school right now, what's going to help them right now or maybe in the near future, but nothing too advanced." So she revised her daily activity plans for the enrichment class to connect with the school topics.

All program staff agreed that hands-on activities are an important element of OST STEM programming, and that the STEM specialist had successfully integrated them into her smaller STEM major class. The education specialist believed that it was possible–and essential–to also do so in the shorter STEM enrichment class, and that such activities went to the heart of what STEM programming in afterschool could accomplish:

> "*[STEM in afterschool] goes back to variety of experience and I think a lot of times students are taught to the test as far as the fourth-grade test and also the eighth-grade test. So I think [this program] can add something so special to it by actually making it about the kids, about the labs, about the hands-on activities as opposed to just content that doesn't touch upon the heart of science and doesn't touch upon inquiry. And I think it can add to that level and do things that are not done in school*."

To the education specialist, STEM in OST represents an opportunity to go in-depth on science topics and provide hands-on opportunities in a way that school lessons might not be able to do.

STEM Staff

Staff training

The STEM specialist is a pre-med college student majoring in biology. According to the program's education specialist, if you're passionate about the topic you are teaching, as the STEM specialist is, participants will benefit: "If you have an interest, that's great because that's what you can bring to the table and kids can see that, they reflect it."

The STEM specialist attended a half-day training on robotics in which she learned teaching methods for robotics and brought back activities to use and on which to base her own curriculum. The provider organization hired an outside consultant to conduct the training because robotics was to be implemented in many of their program. The robotics minor activity took place during the fall semester.

The STEM specialist said that the program conducts a staff training in-house at the beginning of the year, "and then sometimes if [the director] feels that it's something that we may need to touch base on or something we need to be reminded of, he'll have a mini-training in the beginning of the day before we start the program."

Approach to staffing

Total number of staff	7
Education specialist supports STEM	Yes
Number of staff who lead STEM activities	1
Professional development sources	Robotics training
External partners supporting STEM	Local farmer's market
Salary range for STEM staff	$12/hour
Staff paid for:	
Meetings	Yes
Professional development	No
Lesson planning time	No
Special resources needed for STEM programming	Lab materials

Continuous Quality Improvement (CQI)

STEM activity planning

Before the semester begins, the STEM specialist comes up with a list of topics that she will teach each week. The STEM specialist arrives at the program early, about noon or 1 p.m., and prepares for the day until study hall begins at 3:30 p.m. The STEM specialist's lesson planning time is not paid. She noted that she spends more time planning this year than she did last year, even though this year is her second year teaching the program: while last year's topics were somewhat disconnected, this year she is trying to connect topics with one another, which requires more advanced planning.

The STEM specialist does change the planned activities if participants have not yet mastered a topic: "If they still don't understand what I taught them, I'm not going to switch over. So it's about staying committed to whatever you're teaching them until they understand and then also keeping it interesting at the same time." The STEM specialist checks for participant understanding through periodic quizzes and reviews, as well as through frequent discussion throughout the activities.

Communication between OST staff to encourage program improvement

The quality of program activities is checked through daily emails that staff are required to send to the director and by the director's frequent, informal program observations. All staff must send the daily email reports to the director detailing what happened that day in the activities they led, their challenges, and any suggestions they have. The STEM specialist described writing to the director about classroom management challenges she was having in the STEM enrichment course; he gave her strategies to improve her skills. The director said he responds to these staff emails either verbally or via email, and he includes the program coordinator in the overall conversation. (The program coordinator assists the director in the day-to-day operations of the program.) The director reported that the emails help him keep track of everything that happened at the program.

Approach to CQI

Staff submit lesson plans for review	No
Frequency of staff meetings	Weekly meetings, Daily email reports
Program assessment tools used	End of year surveys of stakeholders, Attendance analysis
Frequency of evaluation	Monthly
Use of evaluation feedback	Staff development

The director visits all the activities at the center every day for at least five minutes. He usually refrains from giving feedback during these visits unless he sees something out of the ordinary. Every month, the director sits down with each staff member and gives them feedback based on what he has seen in their activities over the past month, related to both instructional strategies and to content. He explained, "Depending on the staff member, I may give them specific things that I want to see. [For example,] in your next curriculum, I want to see more diversity in the genre of music that you use for dance." Since the program ends each semester with a performance, the director and the staff member also assess how far along participants are in preparing for the performance. The STEM activity specialist said that she frequently gets feedback from the director "because he's always in the class, and he sees how much my curricula have changed and [how] my teaching styles have changed, [from] when I first started working with him."

At the end of the year, the program planned to survey participants, parents, and such stakeholders as principals and community members in order to gauge the success of various aspects of the program. The director reported also planned to analyze participant attendance at the program to determine "what were the best things we did, […] which majors were attended the most, which were attended least, which days were attended the most."

Finally, the program holds a weekly hour-long paid staff meeting, in which staff discuss and attempt to resolve any problems in the program as they arise. The director leads the meetings with a rundown of the past week, using the acronym WWDR for "what we did right" to describe something a staff person did well during the previous week. The staff members then share any concerns that they may have. The STEM specialist said that if something is not working well in the program, staff work together to devise solutions: "We look at how to adequately make those changes that will suit all of us that work here and also the students that we serve. So it's a trial-and-error type of thing. We learn. We try things. If it doesn't work, we look for solutions."