Paper Copters and Potential

Leveraging Afterschool and Youth Development Trainers to Extend the Reach of STEM Programs

by Stephanie A. Lingwood and Jennifer B. Sorensen

October 6, 2012: 109 adults simultaneously threw their heads back and shouted "I discovered!" at the top of their lungs. Slightly mangled bright-green paper helicopters littered the floor. We were six minutes into a daylong journey of discovery, during which this group of volunteer trainers would learn to facilitate a curriculum that uses inquiry-based science to teach youth development concepts. Our first step, though, was to shout, squeal with joy, and send paper helicopters fluttering through the air. Why? Because no other way would have been appropriate.

What would it take to increase the number of youth-serving volunteers who can competently lead science, technology, engineering, and math (STEM) activities? This question has guided our work in the Inquiry in the Community project, launched in 2008. Along with Girl Scout staff colleagues and many dedicated volunteers, we have created a system for embedding inquiry-based science into a youth development organization. We achieved this goal by training staff and volunteers on inquiry facilitation techniques and then building support networks to reinforce these new skills. When co-author Stephanie was accepted into the National Afterschool Matters STEM Practitioner Fellowship, we decided to use the action research component of the fellowship to dive deeper into a facet of Inquiry of the Community we hadn't yet been able to investigate: the experience of volunteers participating in the project's train-the-trainer program. The lessons learned in the resulting action-research project can apply to other

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train-the-trainer efforts in afterschool and youth development.

Stephanie takes over the story from here to describe how she and co-author Jen Sorensen implemented the program and how Stephanie's action research examined the volunteers' experience.

Youth Development and Inquiry-Based Science Learning

Jen and I decided to use inquiry science as a tool to teach youth development because facilitating activities in both areas is similar. Youth development organizations seek to build the "abilities and competencies [of youth]…by increasing participants' exposure to supportive and empowering environments where activities create multiple opportunities for a range of skill-building and horizon-broadening experiences" (Roth & Brooks-Gunn, 2003, p. 94). In both youth development and inquiry-based science, learner choice, experiential learning, and cooperative learning strategies are key parts of the equation.

We knew that the Exploratorium's Institute for Inquiry had developed an excellent curriculum, the *Fundamentals of Inquiry* series (Exploratorium, 2006) to teach school teachers to facilitate hands-on, learner-led, and collaborative science learning. What's to stop us, we reasoned, from modifying this curriculum for use with volunteer Girl Scout troop leaders? This volunteer development would serve two purposes. It would increase the number of volunteers who could competently lead inquiry science activities, thus building new audiences for STEM education. It would also improve volunteers' skill in implementing core youth development strategies, in the process better equipping Girl Scouts (or any other youth development organization that implemented a similar project) to achieve its mission. It was a win-win.

Building the Foundation

Over time, Inquiry in the Community took shape. Funding from the National Science Foundation allowed us to adapt and test the *Fundamentals of Inquiry* curriculum with successive groups of Girl Scout volunteers. Our team integrated the curriculum into the standard slate of workshops for troop leaders and explored ways to embed further reinforcement on inquiry science into a volunteer's typical web of support. The team created activities, designed professional development for staff and senior volunteers who support troop leaders, and trained and provided assistance to numerous troop leaders.

An ongoing evaluation, conducted by Evaluation and Research Associates, helped us see our successes and navigate needed changes. Eventually, the research (Fitzhugh & Liston, 2013) yielded two key findings. The first was that two-thirds of troop leaders who received training and support subsequently implemented inquiry science activities with girls. The second was that large numbers of troop leaders were using inquiry science facilitation behaviors generally in working with their girls (Fitzhugh & Liston, 2013). Those who did not use inquiry tactics primarily cited time constraints, rather than lack of skill or comfort with inquiry science.

Jen and I then partnered with three other Girl Scout councils, from Maine, Oregon and southwest Washington, and California's central coast, to expand the project's reach and to explore replication in councils with different staff structures, membership profiles, and size. At the same time, we prepared to expand our project's inquiry science curriculum throughout Girl Scouts of Western Washington and with the front-line volunteers who serve more than 26,000 girls.

Scaling up to reach all these volunteers, however, would require a small army. Luckily, Girl Scouts of Western Washington already had this structure in place, in the form of more than 100 "facilitators." These volunteers lead most of the organization's training workshops, facilitating hundreds of classes a year for other volunteers on topics ranging from basic group management to advanced leadership development. Like other afterschool trainers, our facilitators are a passionate bunch. They know they are capable of having a lasting effect by pre-

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paring front-line volunteers—troop leaders, camp volunteers, and others—to work effectively with youth. Some have been facilitating for just a few months; others, for a few decades. Some hold day jobs as educators, corporate trainers, or afterschool and youth development professionals. Others may be accountants, stay-at-home parents, or architects. All of them want to know that they're equipped with the best curricula for inspiring the next generation of Girl Scout volunteers and with the best strategies for implementing those curricula. To make sure that they could deliver the project's curriculum effectively (and happily), we needed to give them a first-hand experience that was engaging, relevant, thoughtful, and fun.

October 6, 2012, the day of the council's annual facilitators' conference, became the day to orient the facilitators to the new curriculum. Coincidentally, two weeks earlier, I had attended my first meeting of the National Afterschool Matters STEM Practitioner Fellowship. The fellowship, the result of a partnership between the National Institute on Out-of-School Time and the National Writing Project, was made possible by funding from the Robert Bowne Foundation and the Noyce Foundation. This fellowship engaged participants in extended action research and reflection on STEM-related topics of professional importance, in collaboration with a cohort of both afterschool professionals and school-time educators. Action research—a practice in which researchers are actively involved in the projects they study, using cycles of data collection and reflection to develop understanding—seemed a natural fit for the similarly cyclical work I was about to undertake with the facilitators.

During the first fellowship meeting, I gravitated toward a particular action research question: How would facilitators experience this switch from didactic, facilitator-centered curricula to an active, learner-centered, inquiry-based curriculum? I was interested not just in their initial experience at the conference, but also in their process of implementing the curriculum through the 2012–2013 school year. What obstacles would they perceive? What potential would they see? In the end, what advice would they give others who want to help afterschool and youth development trainers to facilitate inquiry science curricula?

Early on, my writings for the fellowship reminded me of a core professional development principle we've used in the Inquiry in the Community project: "fun first." Inquiry science activities are about active engagement and experience with a topic—the initial fun—followed by rounds of questioning, investigating, and reflecting. Professional development on inquiry should go through the same cycle. My work with the action research project would unfold similarly. And so, on October 6, 2012, I stepped onto the stage at the facilitators' conference, led 109 facilitators in enthusiastically making their first paper helicopter, and dove into my action research to see what I could find.

Initial Training

The scent of easel markers wafted up from the large sheet of paper. "Used open-ended questions" was scrawled on one side. "Gave us choices within the activity" was in the middle. "Sticker voting" was at the top, just above "Introduced the framework." Not too long ago, I had been leading the group of facilitators in a scientific inquiry about spinning tops. Now, they were deep in a discussion about the specific inquiry facilitation behaviors they had just seen from me and my co-facilitators—what we had said and done, what supplies we had provided, and how we had set up the room. In short, the volunteer facilitators were publicly dissecting every aspect of our facilitation skills—and I was loving it.

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Planning

Jen and I had been planning for months to introduce the project's curriculum at the facilitators' conference. From the beginning, we involved a small group of facilitators and staff in designing and developing the day's activities. While it might have been faster to plan the conference ourselves, we needed to bring the facilitators' voices and substantial insight into the conference planning. After all, it was as much their conference as ours, and we wanted to involve our audience in planning their experience—just as we would with any inquiry science activity.

First, the conference planning team, 10–15 people including council staff members and facilitators, experienced the project's curriculum as participants, complete with spinning tops. We had good discussions about how inquiry science relates to youth development in general and to their roles as volunteer facilitators in particular. Next, the planning team put together the framework of the day as a whole, decided on the flow of the sessions, and managed logistics and coordination. Even more im-

portantly, team members took an active role in designing ways to help other facilitators see how inquiry science and the Inquiry in the Community curriculum were relevant to their roles, the workshops they taught, and the organization as a whole. When the day of the conference came, they were right by our sides as workshop leaders and role models for their fellow facilitators.

Introducing the Curriculum

The resulting curriculum launch at the conference followed a simple progression. First, facilitators experienced core elements of the curriculum as participants. Then they explored how the curriculum's inquiry science concepts applied to their role as facilitators. Finally, they looked at the curriculum from a facilitator's point of view. Working in small groups, they anticipated the challenges they might encounter while facilitating the curriculum and devised strategies for addressing those challenges.

Post-Launch Reflections

The Afterschool Matters fellowship gave me the opportunity to reflect on anticipated challenges the facilitators identified: managing logistics and supplies, making the curriculum relevant to their audience of troop leaders and others who work directly with girls, and supporting learners who have a wide range of prior experience.

It struck me that these anticipated challenges were similar to those voiced by other afterschool and youth development trainers, such as those engaging front-line staff with science and engineering activities in the National Partnerships for After School Science 2 (NPASS2) project (Manning, Stazesky, Lin, Houseman, & Goodman, 2011). This congruence meant two things: that I could use other afterschool train-the-trainer models as inspiration and that what we learned in this experience could inform best practices for other train-the-trainer models in afterschool and youth development.

I also took some time to reflect on the success of the conference as a whole and of the launch of the inquiry science curriculum. Involving a small group of facilitators in planning and executing the conference had been critical to our success. The planning team had indeed been able to foresee potential obstacles in the rollout of the curriculum. Team members also found ways to help participating facilitators see how inquiry science could be used to teach adults about broader youth development concepts.

I was also pleased that we had woven one of our key professional development practices—modeling—into all levels of the design and execution of the conference. Specifically, we had modeled our desired inquiry facilitation behaviors throughout the conference, from using the inquiry cycle to shape the day's activities to giving the facilitators time to identify their own questions and start finding their own answers. Modeling and talking about these facilitation behaviors gave our volunteer facilitators a common understanding of what inquiry science facilitation looks like in real life, plus practical tactics for using these facilitation behaviors in their own workshops.

Those workshops were beginning soon. Our facilitators now had a stockpile of inquiry facilitation behaviors

to draw on, as well as some potential solutions to the challenges they anticipated. It was time to move on to the next phase: providing ongoing support to our facilitators as they implemented the Inquiry in the Community workshop with hundreds of front-line volunteers.

Challenges, Opportunities, and Ongoing Support

In Girl Scouts of Western Washington, facilitators complete a standard self-evaluation survey after each workshop they lead. The questions invite reflection on the participants' experience, the facilitator's skills, and the structure of the workshop. I was impressed by our facilitators' honesty as I read their self-evaluations of their first attempts at inquiry science training. "[It was] more fun than I expected, but also more hectic," said one facilitator. "These participants really got it—that was encouraging," said another. I could tell they weren't quite comfortable with the curriculum yet when I read such comments as "I felt I messed up. Very stressed and nervous." Many facilitators were dealing with how to manage expectations, since their participants often expected lecture, not experiential learning. As one facilitator put it, "I'm thinking 'set-up, set-up, set-up.'… Setting up [the importance of experiential learning for adults] in participant's minds as they walk in the door."

The facilitators were a busy group between October 2012 and April 2013. During this time, they facilitated 56 Inquiry in the Community workshops, serving 435 front-line volunteers (Girl Scouts of Western Washington, 2013). That adds up to a lot of impact, when you consider that each front-line volunteer works with 8–15 girls. The number of volunteers receiving training on inquiry science and youth development practices was steadily increasing, and the number of girls affected by these volunteers was already in the thousands. In the council offices, there was a hum of activity to support volunteer facilitators as they led these workshops. Supply boxes were checked out, checked in, and restocked. Workshop sites were booked. Facilitators were scheduled so that they could co-facilitate in pairs. Through it all, we kept tabs on how our facilitators were doing and what support they needed.

This support occurred in several ways. First, we conducted quarterly check-in meetings, where regional groups of facilitators would share ideas, collaborate, and get updates. We used those meetings to discuss the new curriculum, find out what the challenges were, and collaboratively identify solutions. Similar work happened in individual conversations with facilitators before and after their workshops. We also could see their ideas and challenges in their post-workshop self-evaluations. A substantial amount of peer-to-peer support took place as co-facilitators debriefed the workshops together and gave each other feedback.

To gain a deeper understanding of the facilitators' experiences, I collected both survey and focus group data as part of my action research. The survey data were compiled from curriculum-related comments on the self-evaluations ($N = 27$). Focus groups were conducted during quarterly check-in meetings, where open-ended questions such as "How is the workshop going?" sparked free-ranging discussions. Asking these open-ended questions gave the facilitators the chance to name whatever challenges were on their minds.

After collecting these data, I conducted a thematic analysis, coded the data, analyzed these codes to find common themes, and then reviewed and defined these themes. The result was five themes that describe the facilitators' experiences.

Logistics. Facilitators discussed the management of workshop time, people, supplies, and resources. Some common challenges were covering the activities and content in the time allotted, ensuring enough set-up time, working with different-sized groups, and managing workshop supplies. The facilitators shared comments such as "We should have prepped more and set up our supplies ahead of time," and "We had a spreadsheet with times written out and had a cell phone on silent next to [the] spreadsheet with [the] time."

Facilitation skills. This theme is about how facilitators put the curriculum into action. Their comments suggested that the facilitators were, indeed, using inquiry facilitation behaviors such as asking open-ended questions, minimizing lecture, and helping participants find their own answers and apply them to their unique situations. When asked whether she had avoided telling her own stories in order to allow the participants to engage in dialogue, one facilitator noted, "Oh, yes! No time [to do otherwise] in this workshop."

Safe space. Many comments dealt with creating a safe space for the participants. The curriculum design relies heavily on having the facilitators model different facilitation styles, from very directed activities to more open inquiries. The facilitators noted the need to clarify with participants that they were, indeed, playing roles and modeling specific behaviors for a reason. Otherwise, they felt it was difficult to maintain the safe space needed for candid discussion. One facilitator, when describing her first experience of the curriculum as a participant,

echoed these concerns: "I wasn't aware that [the facilitator was] playing a role. I walked in and she took the top away. I thought it's just who she was. It wasn't until we discussed it that I got it."

Comfort. Facilitators expressed a range of levels of comfort with leading the workshops. Many of them mentioned feeling stressed and nervous, less prepared than usual, and not familiar with the material, especially the first time they facilitated the workshop. Facilitators who did the workshop more than once indicated that they felt more prepared and more comfortable. "[I] felt better doing it the second time," said one.

Expectations. Facilitators expressed the need to manage participants' expectations about the workshop and to help them understand why the curriculum takes an active, inquiry-based learning approach. Many volunteers are used to lecture-style learning environments. When they are instead presented with an inquiry-based workshop, they often need help to understand why this approach is valuable. If facilitators don't deal with this "why," the rest of the learning process can suffer. Many facilitators emphasized the importance of stating repeatedly why the curriculum uses inquiry science activities to teach about leadership concepts and why the workshops used inquiry-based learning processes. As one facilitator commented, "Once you let the participants know they'll be 'doing' instead of 'sitting,' then they have fun. Their expectation was that they'd come and we'd tell them stuff."

With my themes and analysis in hand, it was time to think about the bigger picture. How could my experience with this group of Girl Scout facilitators inform best practices in inquiry science train-the-trainer models in afterschool and youth development? To answer that question, I examined the afterschool science landscape and asked our facilitators to provide advice for other train-the-trainer efforts.

Broader Insights

Afterschool and youth development organizations represent an excellent opportunity for extending science education to more youth. They have extensive reach into a population critically in need of inspirational STEM experiences: children in grades K–8. One study showed that youth who expressed interest in science careers by eighth grade were three times more likely than those who did not to earn an undergraduate degree in science; this interest was a better predictor of STEM degree attainment than were test scores (Tai, Liu, Maltese, & Fan, 2006). With its ability to offer flexible, youth-centered programming, the afterschool community is uniquely positioned to create the inspirational, engaging STEM experiences that build children's interest in STEM fields. STEM-rich experiences are also an excellent tool for advancing other youth development outcomes. In a summary of evaluation reports from 19 afterschool STEM programs, the Afterschool Alliance found that, besides improving STEM learning outcomes, participants reported gains in skills such as communication, teamwork, and analytical thinking—skills often measured in afterschool program outcomes (Afterschool Alliance, 2011). Others have noted afterschool programs' ability to move beyond a simple STEM "pipeline" concept, focused exclusively on workforce development, to one that "supports youth development goals as well as STEM learning" (Lyon, Jafri, & St. Louis, 2012, p. 56).

Recognition of the power of out-of-school settings to effect science engagement is growing. According to Falk and Dierking (2010), "[A]verage Americans spend less than 5 percent of their life in classrooms, and an ever-growing body of evidence demonstrates that most science is learned outside of school" (p. 486). Against this backdrop, the President's Council of Advisors on Science and Technology (PCAST) has called for, among other things, development of "opportunities for inspiration through individual and group experiences outside the classroom" (Executive Office of the President, PCAST, 2010, p. 13) to "meet our needs for a STEM-capable citizenry, a STEM-proficient workforce, and future STEM experts" (p. 12). These opportunities would be realized through "high-quality STEM activities in afterschool and extended day programs, together with support for programs to train providers and develop high-quality instructional materials" (p. 102).

As PCAST says, training providers is an essential piece of creating STEM capacity in afterschool organizations. Luckily, many networks of trainers are already in place: Youth development organizations such as Girl Scouts, 4-H, and the YMCA typically maintain their own sizable cadres of trainers, and many afterschool interme-

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diary organizations have a network of trainers to serve the afterschool community. Even if these trainers have no STEM-specific training experience, they are often already doing training on topics that are in sync with inquiry-based science and STEM practices, such as cooperative learning, experiential learning cycles, and learner-led environments. With some focused professional development of their own on STEM practices and content, these trainers represent a resource that can easily be leveraged to train and support front-line volunteers and staff.

Advice from the Facilitators

The final piece of my action research was to ask Girl Scouts of Western Washington facilitators what advice they would give to other organizations who wish to engage their trainers in delivering inquiry science curricula. Using the themes that emerged in their previous comments, I developed a survey that asked facilitators open-ended questions about their experiences with learning and then implementing the inquiry science curriculum. The sample size was small ($N = 7$), but the insights these facilitators shared echoed many of the larger facilitator group's earlier comments.

These insights fell into three categories. First, the facilitators highlighted the importance of making logistics management as easy as possible. Clear curriculum guides, participant handouts, and organized supply kits (or instructions for quickly creating their own) were all important to the successful delivery of the curriculum. One facilitator summed it up: "GSWW staff and volunteers provided introductory training, provide[d] materials, [and] provide[d] curriculum that includes scripts and timing, and I have found all of this to be helpful."

Next, every single respondent mentioned that it was critical to have the facilitators first experience the curriculum as participants and then examine how to facilitate it. One facilitator's comment summarized this common refrain: "Last, but almost first, the . . . conference introductory session was very, very essential." Another facilitator said, "Be sure to demonstrate [inquiry-based science learning] by having your facilitators experience it. Then they will see it is *fun* . . . just as we did."

Finally, facilitators recognized the importance of creating and maintaining an ongoing culture of skill build-

ing and learning in their cohort. They had several specific suggestions related to this concept, such as promoting co-facilitation and supporting peer feedback, providing periodic opportunities to network and share ideas, encouraging and modeling a willingness to try new things, and creating a safe space where it's acceptable to take risks and make mistakes. As one facilitator noted:

Hearing staff say things like, "That exercise didn't go as we expected, so we are learning too" [was helpful]. I think having a sense of humor and fun is really important to create a safe space. If we can laugh at our mistakes, then it is easier for me to try new things because it feels like there is very little risk.

Moving Forward

Though my action research focused on the Inquiry in the Community project's efforts to engage a group of Girl Scout facilitators in delivering inquiry science curricula to front-line volunteers, the lessons learned can apply to other train-the-trainer efforts in afterschool and youth development. The structure of our facilitators' engagement with the new curriculum—an initial kickoff followed by continued support—allowed both for sustained focus on the curriculum and for ongoing, just-in-time learning.

Our facilitators identified the critical importance of allowing trainers first to experience inquiry science professional development as participants and to focus on why it is relevant to their role. Then they can explore the logistics of the curriculum, the required facilitation skills, and perceived challenges and potential solutions. I would add that involving a subgroup of trainers in the design and delivery of professional development ensures that the resulting efforts meet the unique needs of the trainer audience.

A final lesson is that the substantial networks of afterschool trainers that already exist can be leveraged to provide professional development on inquiry science and other STEM practices to front-line volunteers and staff. Using science facilitation curricula that have been specifically designed for the afterschool context, such as those developed by Inquiry in the Community, increases these trainers' chances of success. These trainers also provide access to their organizations' existing resources, such as training space, staff who support training, and access to potential audiences for the trainings. Using these resources can promote the sustainability of after-

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school science initiatives. Engaging these networks in building STEM capacity can create a world where sustainable, high-quality STEM experiences inspire millions of youth—and adults—to experience, investigate, and ultimately shout "I discovered!" at the top of their lungs.

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