Afterschool Advantage

Powerful New Learning Opportunities

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Chapter 4

Science in Afterschool: *Undisputed Advantage*

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Introduction

Across the country, students in afterschool programs are engaged in exciting, high-quality, hands-on science experiences offered by a wide variety of youth, community, and education organizations. Informal science education organizations such as museums, science centers, zoos, and aquariums have long been heralded for introducing children and adults to science in ways that are engaging and non-threatening. In recent years, however, educators and policymakers have come to realize that increasing student science achievement and literacy will require a partnership of sorts between schools and other educational organizations. Afterschool programs provide valuable ways to increase access to science content, especially in schools that cannot extend instruction time.

A look at the science pipeline – the flow of learning that students follow from early childhood to careers – offers some helpful insights into the status of science in schools. Unfortunately, most U.S. students are

not demonstrating proficiency in science, with students in underserved communities consistently performing at even lower levels. According to the 2000 *National Survey of Science and Mathematics Education*, on average, K–3 teachers spend only twenty-three minutes per day on science instruction. At the middle school level, students may have few options for science courses, and more rigorous advanced courses are not always available for high school students.

Limited science instruction in the classroom is just one issue. While the numbers of students who earn science and engineering degrees at the undergraduate and graduate level have increased in recent years, it is likely that even more will be needed to replace those who are retiring from science careers. Additionally, blacks and Hispanics earn fewer college degrees overall, fewer degrees in science and engineering, and are underrepresented in the science and engineering workforce. More must be done to attract and retain young people from all backgrounds in science.

Why Science Is a Fit with Afterschool

There is no better place than afterschool programs, with their smaller group sizes and less formal settings, for kids to begin to dig into hands-on science and technology adventures. Kids "learn by stealth" while they have a wonderful time planting gardens, building toothpick bridges (that's physics), or mixing corn starch and water into "oobleck," a slimy cross between a liquid and a solid.

If you ask Nobel Prize winners and other prominent scientists where they developed their fascination for science and technology, few will say it happened in class. Most found their career inspiration outside of school. The visionary behind Apple computers, Steve Jobs, caught the technology bug as a teenager attending afterschool programs. In afterschool, students can learn informally without the pressures of grades and tests.

Scientific inquiry – forming an idea, testing it, drawing a conclusion – takes time. Kids don't have to work in fifty-minute blocks but can spend hours on child-centered explorations. They have time to go out to museums or to visit a pond where they check the water quality each day. They have time to discover the wildlife that lives in their neighborhoods or to predict the weather by reading cloud formations.

Kids from every ethnic group and income level go to afterschool programs. This makes afterschool an important venue for highlighting science. Kids carry in their heads the stereotype of a scientist as someone who is old, white, male, and probably balding, with a funny fringe of hair like Albert Einstein. People from low-income and ethnic minority groups are under-represented in well-paid science and engineering jobs, as are women and disabled people.

A Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology concluded that high quality, out-of-school time (OST) science programs can provide "academic enrichment in mathematics and science to pre-college students, as well as informal science programs that help students see mathematics and science as interesting and fun." In afterschool, kids learn through experience that anyone can do science.

What Kind of Science Can You Do After School?

Science offerings in the afterschool environment have several advantages over the classroom setting. As the Coalition for Science After School has noted, afterschool settings "are particularly conducive to project-based activities where a wide variety of children can participate in design, construction, investigation, sense-making, and communication of science projects."

Program providers must consider the subject matter, delivery approaches, and resources that they will need to offer science in afterschool. Content

for afterschool science should align with local and national standards. Both nationally recognized sets of standards (National Research Council and American Association for the Advancement of Science) provide guidelines for developmentally appropriate content and instruction. Providers must be realistic about the amount of content that can be covered in an afterschool setting and align their programs with the development goals of afterschool as well, which include helping kids develop socially and emotionally as well as academically. Processes, such as science inquiry or innovation through design, can be a bridge between the science standards and youth development.

Programs may take an explicit or embedded approach to science content. For example, programs that have staff with science expertise may elect to focus exclusively on robotics, biotechnology, or environmental science. Partnerships with universities, businesses, and community organizations can help to provide laboratory resources and additional staff expertise. In other instances, if funding or expert staff is unavailable, it may be better to embed science and math content in interdisciplinary activities. Afterschool programs are ideal for authentic science learning that makes connections to real-world experiences. Authentic learning is experiential in nature, validates prior knowledge, and engages students with topics that are relevant to their daily lives (Rahm, 2002). Cooking, gardening, and environmental science are great ways to integrate measurement, observation, and classification.

In afterschool it is important to have activities that are stand-alone and can be adaptable to varying schedules. Afterschool activities should be developed specifically for an informal learning environment, and modified to support an interactive, student-focused approach to learning.

Afterschool Science Helps Kids Succeed

Schools alone cannot teach all kids all the science that they will need to become informed and productive adults. Afterschool programs can reinforce

school-day learning by helping kids learn specific content and by blending in math and reading.

Most kids start out enjoying science inquiry, but many lose interest as they advance into middle and high school. The best predictor of whether someone will grow up to be an engineer, an astronaut, or a computer scientist is whether that child is still interested in science by the end of eighth grade, not whether or not the child is earning high marks in science. Afterschool can nurture kids' interest in science by drawing connections between facts on a page – water evaporates through heat – and what kids observe and experience in science activities, such as cooking classes. As they work through science exploration in groups or team up to build robots, kids learn the skills crucial to the new century: teamwork, thinking critically, and solving problems.

Many afterschool programs employ high school and college students to mentor younger kids and to model science methods. In New York, high school students have successfully led younger children through explorations of urban bird life and ecology.

Infusing science into afterschool programs also improves kids' attendance after school, and by extension, at school itself. In many districts, kids cannot attend afterschool unless they show up for school. Afterschool science is a draw, often among the most popular of all afterschool programs.

Best Practices

All high-quality programs share certain characteristics, including a mix of short-term and long-term experiences. In general the same characteristics that one would look for in any high-quality youth program should be present in programs that concentrate on science content.

Most afterschool programs are voluntary in nature, so participants will stop attending if they do not like the activities. One way to ensure buy-in is to

allow kids to have input in the program design and decision-making. Not only does this help to develop social, leadership, and problem-solving skills, but it also creates an environment of equity and trust. For example, the YouthALIVE! Program for middle and high school students in museums and science centers around the country included youth advisory councils (http://www.astc.org/profdev/youth.htm).

Science-based programs can achieve these goals by taking advantage of community partnerships that introduce students to real-world applications of science content through field trips to science labs, guest speakers from university research centers and environmental organizations, and even mini-internships. Students can learn about the scientific method by participating in citizen science projects such as the one offered by the Cornell Laboratory of Ornithology's Urban Bird Studies Program. This project invites the general public to observe birds in their backyard, or virtually via "bird cams" on the Cornell Web site (http://www.birds.cornell.edu/birdhouse/nestboxcam/cam_links/).

Making Scientists of Staff

Many adults are afraid of science and math. They think that they don't know enough to pass on knowledge to kids. The people who staff afterschool programs are no different. A diverse group of people including high school and college students, artists, musicians, paraprofessionals, and older adults can be afterschool teachers, even though many do not regularly teach science or math.

Afterschool staff members do not need deep scientific knowledge, but they need training to become comfortable with science activities and to sideline their science phobias. Through specially developed training programs, such as After School Science Plus, a program of the Educational Equity Center, staff members discover they know more science than they realize, and they grow more confident in their science abilities and interests.

Many schools have institutions in their communities, such as science or children's museums, with whom they can become partners. Afterschool and science institutions can flourish together when they partner to train afterschool staff to use well-designed science-enrichment curricula and simple materials that are low-cost or free. Because many afterschool staff members work part-time, and staff turnover is frequent, ongoing partnerships and frequent trainings are of particular value.

Program Examples

As indicated in the introduction, afterschool science programs are offered by a wide variety of organizations, including schools, science centers, museums, and community organizations. Below are several notable examples:

- **Community Science Workshops (CSW):** Located in schools and community centers, CSWs are small-scale science centers that promote inquiry-based science learning. Each CSW partners with museums, community organizations, and science centers to create a unique neighborhood setting that invites science exploration. http://www.scienceworkshops.org/site/csw/

- **Partnerships for Achieving Careers in Technology and Science (PACTS):** PACTS is based at The Franklin Institute and provides middle and high school students from the Philadelphia metro area with opportunities to participate in hands-on science activities in environmental science and robotics, in addition to field trips and training for positions in the museum as gallery explainers and peer tutors. http://www.fi.edu/tfi/programs/pacts/join.html

- **Kinetic City:Mission to Vearth:** Kinetic City, developed by the American Association for the Advancement of Science, enables children in grades 3–5 to learn standards-based science concepts using

a colorful, interactive video game format that is supplemented by collaborative hands-on activities. Students help the Super Crew battle the Deep Delete computer virus, while exploring topics such as the human body, animal diversity, and human learning. http://www.kcmtv.com/

- **Studio 3D:** At Studio 3D, the Walker Art Center, in partnership with the Science Museum of Minnesota, has created a drop-in afterschool art center that combines art, technology, and science. http://www.smm.org/studio3d/

Leaders in afterschool programming and science institutions are collaborating on ways to help staff introduce more science into afterschool. The National Partnership for Quality Afterschool Learning has developed a toolkit for staff development in science and a resource guide for afterschool staff members (http://www.sedl.org/afterschool/toolkits/science/). Afterschool programs can find materials and curricula they can use to support afterschool science no matter the size of their budgets, the science backgrounds of their staff members, or the grade levels of participants.

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