

THE OPPORTUNITY EQUATION

Mobilizing for Excellence and Equity in Mathematics and Science Education

Out-of-School Time: Lessons and Inspiration from Science Programs

Many organizations are using the hours outside school to provide students with opportunities for exciting science learning, using experiential, hands-on learning models that can't always be replicated in the traditional school environment. The Opportunity Equation asked a number of innovators to tell us how they think K-12 educators can be inspired by and learn from out-of-school programs to help them produce better STEM outcomes in the classroom.

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Anita Krishnamurthi, PhD

Director of STEM Policy, The AfterSchool Alliance

www.afterschoolalliance.org

Nationwide, schools and communities are using the hours after school to get students excited about STEM learning, which is key to getting them into STEM careers. Afterschool programs allow students to further their science knowledge in a setting where they can experience it as a collaborative and creative process that has immense relevance to our daily lives.

The afterschool setting allows for hands-on longer-term project-based activities that build upon and reinforce concepts learned in school without feeling like more school time. In addition, it provides a venue in which children and youth can experiment and play with STEM concepts and projects without fear of failure. As we know, science and engineering projects do not follow a linear process and do not have pre-determined answers. It is very important that students learn to ask questions, learn how to apply the knowledge they gain in school, and be persistent when success is not immediately forthcoming.

The afterschool setting must be seen as an integral part of the learning experience that complements the learning that occurs during the formal school day. This needs to be reflected in legislative language and national initiatives that target STEM education. Increased collaboration between science teachers in school and afterschool program providers will also allow for even more effective STEM engagement that builds on what the student is learning during the school day.

Increased partnerships between the science and engineering community and the afterschool community will encourage more afterschool programs to offer STEM programming. STEM professionals serving as consultants and volunteers with afterschool providers will help to reduce some of the barriers in offering STEM programs that are exciting and challenging to the children and

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youth they serve.

In addition to improving attendance rates in school and inspiring aspirations to go to college, children participating in STEM afterschool programs consistently demonstrate increased interest in STEM careers and are more likely to consider science “fun.”

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Hillary Salmons

Executive Director, Providence After School Alliance, Inc.

www.mypasa.org



The question should be: “What can educators from schools and community institutions teach each other?” The traditional K-12 education system doesn’t allow enough time for intensive, in-depth focus on core subjects, and for cross-curricular, inquiry-based learning strategies that explore the rich STEM world beyond the classroom walls. Despite the fact that informal science learning has been shown to be a more likely predictor of future careers than grades, too few federal dollars are allocated to support hands-on, out-of-school learning. Schools are under tremendous pressure to meet test standards. Creating project-based learning models with local science museums, environmental organizations and higher education institutions is not usually a priority.

There is a talented pool of passionate STEM professionals who would jump at the chance to work more closely with schools or become school teachers if they were able to teach beyond the text book or in ways that integrated the STEM disciplines with real-world applications. Attracting expertise from the science community into the education community is critical and these barriers need to be broken down by encouraging professionals to continuously interact with schools. Until a premium is placed on informal inquiry-based learning, the formal system will not encourage interaction with the best local resources.

The Providence After School Alliance (PASA)’s mission is to expand and improve after-school opportunities for local youth by organizing a system to ensure that they have access to high-quality after school programs and learning opportunities. For after school science programming, PASA relies heavily on the expertise of its local STEM community, including environmental and sustainable living groups, zoos and museums. Many science-oriented and advocacy organizations have thoughtfully developed curricula, however they don’t always have access to schools or the ability to effectively engage them. When school teachers are afforded time to work with the STEM educators, the exchange of expertise and ideas can be a catalyst for building connections between classroom curriculum and community STEM projects. PASA serves as a bridge. We help community and traditional educators find time to co-design programs together that advance in-school curriculum and solve the real-world problems that young scientists, mathematicians and engineers confront in their own communities.

PASA is providing a community model for middle schools that many cities including Nashville, New Orleans, and Asheville are considering. Additionally, organizations such as the National League of Cities are closely monitoring the success of PASA,

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indicating that community leaders and educators are beginning to rethink informal learning. There is a lot more untapped potential and school systems need to embrace partners, create expanded learning time and close the gap between informal and formal learning.

Lucy Friedman

President, The After-School Corporation

www.tascorp.org

After-school informal science education (ISE) offers more time and opportunity to do science. The intense focus on math and reading in many schools contributes to a loss of time for science education. Even when schools offer science labs or project-based learning, a 45-minute period is not enough time to develop an idea, conduct an experiment, and follow up on the emerging results.

For example The After-School Corporation (TASC)'s Frontiers in Urban Science Exploration (FUSE) initiative delivers hands-on, after-school science instruction which takes the educator and student on a journey together, so that the adult isn't always the one with right answers. FUSE offers kids both the time and the right environment in which to explore and experience outcomes that they may only read about in the classroom.

One of the most critical lessons from ISE is the recognition of the importance of affective outcomes—engagement, interest, and self-efficacy—in addition to skills and knowledge. Giving kids access to experiential, hands-on instruction in an informal setting makes science less intimidating. For many kids, being unencumbered by the anxiety induced by right or wrong answers and test results creates a whole new attitude towards science. ISE may lead the way in developing assessments of these affective outcomes. And research by Robert Tai and others has shown that interest in and comfort with science are more important indicators for a science career than test scores or grades.

Well-delivered ISE can also transform the notions of who can deliver high quality science instruction. The after-school workforce can be a tremendous asset and we have to both develop the skills of these instructors and build confidence in their ability to lead science inquiry. ISE can also help to engage those working in science-related industries to interact with students, serving as role models and mentors.

ISE is a place for teacher development. Aspiring teachers learn to engage kids in science and bring ISE instructional practices into their school-day classrooms. All of TASC's programs are based in schools, allowing for close cooperation with the principals and teachers and integration with classroom curriculum. School-day teachers at some TASC sites have adopted the basic practices of ISE such as smaller groups, extended hours, and an inquiry-driven approach. We also bring science majors into after-school programs and give them experience working with children. Some are inspired to become science teachers, while others accurately assess an interest in working with children.

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Youth-serving organizations can offer a place for science institutions to reach students and their formal education. Currently, science institutions do not fully recognize organizations that serve youth and families as natural places to infuse science into everyday life. To instill the notion that science is not separate and apart, it is important to find ways to integrate with other activities. Youth-serving organization can help bridge the connection between rigorous science activities, formal learning, and community.

Over time, as a shared recognition grows that science learning and literacy depend on knowledge, skills, and affect, the terms "formal" and "informal" may become

meaningless. Already, in models of expanded learning time, where hands-on science experiences led by youth development experts become part of the school day, these lines are blurred beyond separate categories.



Why Do Science After School? from The After-School Corporation on Vimeo.



Science Training for After-School Educators from The After-School Corporation on Vimeo.



Who Does Science? from The After-School Corporation on Vimeo.



90 Minutes : Building a Telescope from The After-School Corporation on Vimeo.

Ron Ottinger
Executive Director, The Noyce Foundation

www.noycefdn.org

Out-of-school activities can lead to more engagement in school science curriculum. We need to offer more options for kids to engage with science in ways that are hands-on, interesting, and fun with a goal of hopefully changing attitudes and behaviors through these offerings. The 2007 Public Agenda study of Kansas and Missouri students, *Important, But Not for Me*, is very telling. It pinpointed the complacency that parents and kids have about science and highlighted the prevailing belief that most youth aren't likely to identify themselves as science-capable. That's more of a mindset than reality, and I think we can address this through a wide array of enrichment activities that afterschool, summer, and youth development programming can provide.

One of the organizations we fund is the National 4-H Council. They have the research and development capability to offer quality, informal science education at scale and can reach a very broad range of students—their network touches over six million young people. Many people think that they are still entirely focused on agriculture but their curriculum encompasses the environment, alternative energy sources, robotics, and so much more. And they are increasing the organization's capacity across the country to develop curricula, provide training to staff and volunteers, offer multi-media web resources, and engage in research and data collection. A good example is their partnership with U.S. First Robotics, which includes instruction and competition.

We also fund The After-School Corporation (TASC)'s Frontiers in Urban Science Exploration program which is much more integrated with schools, offering science and technology programming on school grounds. Their requirement that all 8th graders complete a science project in New York City really engages kids with curriculum, ensuring that they have the opportunity to take advantage of the afterschool and informal science venues to conduct rich science projects.

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