NYSAN
NEW YORK STATE AFTERSCHOOL NETWORK

TASC
THE AFTER-SCHOOL CORPORATION

Science Beyond the Classroom:
Critical to New York's Future

This brief argues that high-quality science[1] learning outside the traditional classroom is critical to young people's success, and outlines practical steps to make it accessible throughout New York State. New York's educators can draw on many resources to provide rigorous, interdisciplinary, hands-on science learning in schools, community centers, museums, parks and other venues. This brief will explore how to expand these opportunities for all students.

The economy and workplace of the 21st century demand that students leave school prepared for jobs that involve science, technology, engineering and mathematics (STEM). Today, a science-literate workforce is a critical indicator of whether a state or region can compete in a global marketplace. STEM enterprises hold tremendous potential for high-growth, well-paying jobs. For New York to ensure the state's economic vitality, it should prepare young people for success by delivering high-quality science learning experiences in and out of the classroom.

Expanded learning opportunities—before-school, after-school, weekend and summer programs—are prime venues for science learning from pre-school to high school. These programs typically offer a range of youth development, academic, social and recreational activities that support well-rounded learning and development. Expanded learning opportunities, or ELOs, may be offered by a school; a youth-serving community organization, such as a YMCA; a cultural institution, such as a science museum; a faith-based organization, such as a church youth group; or a public agency, such as the Department of Parks and Recreation. Schools and community organizations may also join forces to expand learning opportunities through longer learning days, as in ExpandED Schools[2].

This brief examines the role of ELOs in providing more young people with inspiring, transformative science learning. Together NYSAN and TASC propose policy recommendations for increasing the availability and quality of STEM learning outside the traditional classroom, and for creating a stronger system of funding, policy and practice. This brief is intended for professionals in STEM disciplines, after-school, youth development and education.

Why should we improve STEM learning experiences?

- Only 43% of graduating high school seniors are ready for college math.[i]
- Only 27% of graduating high school seniors are ready for college science.[ii]
- Only 16% of bachelor's degrees awarded in the United States are awarded in STEM fields, in stark contrast to corresponding statistics from countries such as South Korea (38%) and Germany (28%).[iii]
- Consistent with the national picture, fewer than 40% of New York State students in the 4th and 8th grades scored at or above proficiency in math and science.[iv]

[1] In this brief, science is broadly conceived to include a set of related but distinct disciplines including technology, engineering and mathematics.

[2] ExpandED Schools are public elementary and middle schools that partner with community organizations and work with TASC to expand the time and ways students learn.

Supporting Student Success through Science Outside the Classroom

By numerous measures, we know that large numbers of young people in the United States lack the experiences that build their interest and competence in STEM disciplines. Many are growing up unprepared to advance to the fastest growing and most lucrative industries and careers. This is particularly true among children who come from low-income or underserved communities and who are traditionally underrepresented in STEM fields, including people of color and women.[v] The demand for workers in STEM-related fields far outstrips the qualified supply.

Given this relationship between science education and student success, it is imperative to ensure that students have both formal and informal opportunities to develop STEM knowledge and skills. Diverse opportunities for ALL young people to engage in science outside the traditional classroom will:

1. Improve academic proficiency and school success, not only in STEM disciplines but in all areas of academic, cognitive and emotional development.

Studies show that students who participate in hands-on science experiences score higher than their peers on the National Assessment of Educational Progress (NAEP).[vi] ELOs are particularly conducive to activities in which students design, construct, investigate, analyze and communicate their work.[vii] In TASC's Frontiers in Urban Science Exploration initiative, participants increased their science motivation, confidence and knowledge as a result of participating in an after-school science program.[viii]

2. Build students' interest in high-demand STEM-focused disciplines in order to help meet the nation's long-term workforce demands.

Building a strong STEM workforce depends on igniting kids' passions and curiosity while they are young, and cultivating their belief that they can successfully pursue STEM careers. ELOs can play a critical role in prompting students' interest and motivation. They offer time and resources for hands-on STEM experiences. Students can apply, reinforce and extend skills and concepts taught in school. The National Academy of Sciences[ix] reported that "there is much overlap in the philosophies of after-school programs and informal science education." As Lucy N. Friedman of TASC and Jane Quinn of The Children's Aid Society wrote in Education Week:

After-school programs offer an ideal setting for nurturing the potential scientist in every student, as well as for reinforcing the science taught during the school hours. Compared to the school day, these programs' smaller groups, longer time slots, and less-formal settings provide opportunities for young people to visit museums, study neighborhood environments, cultivate gardens, perform laboratory experiments, and have their love of discovery awakened in countless other ways.[x]

3. Improve equity and access to science, particularly for groups that are historically underrepresented in the STEM fields.

ELOs can have positive impacts on groups that are historically underrepresented in STEM fields, including: students of color, girls, students with disabilities and students from low-income, rural and underserved communities. Expanded learning programs—with their diverse staffing and low student-to-staff ratios, activities that promote hands-on inquiry and opportunities to create unique mentor-apprentice relationships– are ideal environments for offering equitable learning opportunities to a diverse student population.

4. Prepare young people for a world in which experience and expertise in science will provide a comparative advantage.

Successful preparation for an inter-connected world requires skilled and critical application of complex thinking, use of technology and an interdisciplinary approach to college, career and citizenship. The framework for global competence developed by Asia Society suggests that in order for young people to succeed in the 21st century, they must (a) investigate their world; (b) recognize diverse perspectives; (c) communicate their ideas with diverse audiences; and (d) translate their ideas and findings into action. These skills can be well-developed through STEM experiences, thus building global competence and increasing readiness for adulthood.

Science Learning in New York State

The vast majority of New York State's students do not have access to high-quality STEM experiences outside the traditional classroom. Science professionals, educators and leaders of youth-serving organizations in New York State need to make purposeful investments of resources—time, money, people and will—to fully realize the value and impact of STEM learning before school, after school, during weekends and summers.

New York State would benefit from a stronger system that supports expanded STEM learning. The Coalition for Science After-School[xi] developed system drivers for expanded science learning opportunities. Leaders should focus on ensuring these drivers are in place throughout the state. The drivers encourage high-quality programming through building on best practices and promoting up-to-date content and tools; community involvement; professional development and pathways; equity; and evaluation.[xii] When New York State youth development and STEM leaders were asked what system elements they find important, respondents indicated that the state needs to: raise awareness of the value of science education, increase access to curricular resources and professional development and secure additional funding to support informal STEM learning opportunities.[xiii] These ideas, as well as existing promising practices in New York, shape the policy recommendations in this brief.

Promising STEM Initiatives Throughout New York State

Schuyler County 4-H partners with the Greater Southern Tier BOCES 21st Century Learning Community Centers to offer a 4-H after-school program, Explore Science, Engineering and Technology, for middle school students. The 4-H program works with several local school districts to lead inquiry-based, hands-on science activities that complement classroom learning. In the program, students may build robots, learn about horticulture and plant gardens or test hypotheses about science questions. Survey data suggests that the programs have increased participants' interest and engagement in the STEM disciplines.

Beginning in 2012, all programs funded through the **New York City Department of Youth and Community Development (DYCD)** Out-of-School Time initiative are required to offer a minimum of two hours of literacy or STEM-focused enrichment activities per week. This shift in the agency's requirements is expected to increase the amount of STEM learning opportunities offered throughout the City's after-school programs. DYCD has also partnered with the New York Academy of Sciences, which offered postdoctoral fellows and graduate students in the STEM disciplines training in instruction and working with youth, and subsequently with mentorship placements at out-of-school time programs.[xiv] In its first year, the program served more than 2,100 children throughout New York City and dedicated more than 3,120 volunteer hours to high-need students.

The After-School Corporation (TASC) set out to create a culture shift among New York City's out-of-school time community to increase the demand for and delivery of high-quality STEM learning opportunities through the Frontiers in Urban Science Education initiative. This initiative employs a two-fold approach: a "grass-tops" strategy engages educators, OST leaders, government agencies, science organizations, policymakers and funders by raising their awareness of, and support for, STEM learning during the out-of-school hours. A "grass-roots" strategy builds the capacity of front-line program staff to deliver STEM content using engaging instruction methods. As a result, participating staff members are more confident in their abilities to teach science activities and students report higher levels of science motivation, confidence and knowledge as a result of participating in their out-of-school time science programs.[xv]

United Way of Greater Rochester requires the after-school and summer enrichment providers supported by its Community Fund to incorporate STEM into their programming. The United Way created a curriculum to help programs focus on making science fun. Programs now engage kids in activities such as gardening and building computers. Program staff members attend monthly learning circles to share experiences, gather knowledge from each other and participate in training by local experts. As a result of the United Way's leadership and investments in programs, professional learning and networking, Rochester's informal STEM opportunities have reached new levels of quality and availability.

Policy Recommendations

These recommendations promote a systemic approach to improving science learning in and outside the classroom. Policymaking and/or funding entities should:

Expand and/or deepen investments in expanded learning opportunities that encourage high-quality science learning and professional development.

- Increase funding to support youth programs because the demand (and need) for programs is exceeded by the current supply, and many children and youth who want to participate are excluded.[xvi]
- Require that grantees offer high-quality STEM activities.
- Provide STEM-focused professional development and technical assistance to assist effective program implementation.

Encourage partnerships that link youth-serving organizations with science educators including collaborations between community partners and schools.

- Create incentives for partnerships between schools and community organizations that encourage collaborative program design, implementation and dissemination of successful practices.
- Leverage resources and expertise through public/private partnerships. Corporate partners may help secure expert volunteers, offer in-kind contributions or funding support.
- As policy and initiatives are developed and decisions are made about how to advance science learning in New York State, include ELO leaders and stakeholders in the discussion, planning and execution.

Develop and support a diverse workforce to offer science instruction in ELO settings.

- Recognize the potential and importance of community educators in STEM learning and train them to facilitate effective STEM experiences that lead to higher levels of student confidence and skills.[xvii]
- Create opportunities for STEM professionals to volunteer their time to work with young people outside of school.
- Expand and diversify pre-service training approaches to enable student-teachers to apply youth development and formal education strategies to STEM learning.
- Expand and diversify in-service training approaches to enable teachers to innovate and test new lesson plans and engaging, hands-on techniques, and to include certified teachers and community educators in blended professional development experiences.

Promote shared standards, learning objectives and outcome measures for science in ELO settings.

- Identify and adapt common standards in science, such as the National Science Education Standards, so that they are relevant for both informal and formal science educators.[xviii]

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About NYSAN

New York State Afterschool Network is a public-private partnership of statewide, regional and local groups dedicated to promoting young people's safety, learning and healthy development outside the traditional classroom. For more information, please contact Sanjiv Rao, Executive Director, at srao@nysan.org or (646) 943-8671.

About TASC

TASC's mission is to give all kids expanded learning opportunities that support, educate and inspire them. For more information, please contact Lucy N. Friedman, President, at lfriedman@tascorp.org or (646) 943-8700.

[i]Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. (2011). Expanding underrepresented minority participation: America's science and technology talent at the crossroads. The National Academies Press: Washington, D.C.

[ii]Ibid.

[iii]National Science Board Science and Engineering Indicators 2010, appendix table 2-35.

[iv]National Center for Education Statistics (NCES).(2009). NAEP. Data available at http://nces.ed.gov/nationsreportcard/science.

[v]Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. (2011). Expanding underrepresented minority participation: America's science and technology talent at the crossroads. The National Academies Press: Washington, D.C.

[vi]Ibid.

[vii]Coalition for After-School Science. (2007). Science in After-School: A Blueprint for Action. Retrieved from http://www.afterschoolscience.org/pdf/coalition_publications/Science%20in%20After-School%20blueprint.pdf

[viii]Smith, C. & Hoxie, A. (2010).Evaluation Findings from the Frontiers in Urban Science Exploration 2.5 Program.The After-School Corporation.Retrieved from http://tascorp.org/content/document/detail/3181/.

[ix]Schwartz, S.E.O., & Noam, G.G. (2007). Informal science learning in afterschool settings: A natural fit? Commissioned paper for the National Academy of Sciences Committee on Learning in Informal Environments.Retrieved from http://www7.nationalacademies.org/bose/Schwartz_abd_Noam_Commissioned_Paper.pdf.

[x]Friedman, L. & Quinn, J. (2006).Science by Stealth.Education Week. Volume 25, Issue 24, 2006-02-22 p 45,48,49

[xi]The Coalition for Science After School is a strategic alliance of individuals and organizations from STEM education, youth development and OST programs that aims to coordinate and mobilize community stakeholders to strengthen and expand opportunities that engage young people in science after school. For more information, see www.afterschoolscience.org.

[xii]Coalition for After-School Science. (March 2007). Science in After-School: A Blueprint for Action. Retrieved from http://www.afterschoolscience.org/pdf/coalition_publications/Science%20in%20After-School%20blueprint.pdf

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[xiv]Afterschool STEM Mentoring Program.New York Academy of Sciences. Retrieved from http://www.nyas.org/landing/afterschoolcredential.aspx

[xv]Collaborative for Building After-School Systems (2010) Frontiers in Urban Science Education (FUSE) Resource Guide/PDF

[xvi]Afterschool Alliance.(2009). America After 3PM. Retrieved from http://afterschoolalliance.org/documents/AA3PM_Key_Findings_2009.pdf.

[xvii]Smith, C. & Hoxie, A. (2010).Evaluation Findings from the Frontiers in Urban Science Exploration 2.5 Program.The After-School Corporation.Retrieved from http://tascorp.org/content/document/detail/3181/.

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