STEM READY AMERICA

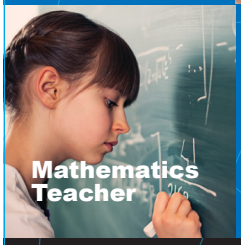
Inspiring and Preparing Students for Success With Afterschool and Summer Learning

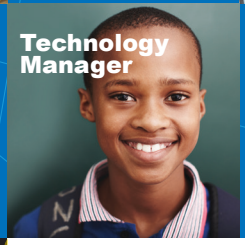
This collection of articles is excerpted from a new resource, *STEM Ready America: Inspiring and Preparing Students for Success with Afterschool and Summer Learning.* In this volume, Executive Editor Ron Ottinger and Contributing Editors Cary Sneider and Ian Hickox have collected expert perspectives on the state of the field of STEM learning—especially in afterschool and summer learning opportunities.

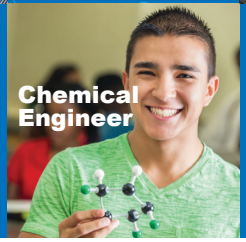
Collectively, these writings from more than 40 thought leaders highlight how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow.

The articles provide persuasive evidence and real-world examples to inform effective partnerships, policies, and actions to bring quality STEM learning to children and youth across the nation. This volume is focused in three key sections:

- **The Evidence for STEM**
- **Partnerships for STEM Learning**
- **Ensuring Access to Quality STEM Learning**







Developed by STEM Next with support from the Charles Stewart Mott Foundation, *STEM Ready America* builds on the award-winning 2013 publication *Expanding Minds and Opportunities: Leveraging the Power of Afterschool and Summer Learning for Student Success* edited by Terry K. Peterson, Ph.D., which made the definitive case for the power and effectiveness of afterschool programs and summer learning.

For more information about STEM Ready America and to download articles visit: www.stemreadyamerica.org.

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www.STEMReadyAmerica.org

Scientific Partnerships at the Core

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STEM Next | Charles Stewart Mott Foundation

Just as many scientific discoveries rely on strong partnerships, so does good science education. In New York City, efforts to promote strong STEM learning in afterschool settings have evolved into a drive to cultivate collaboration among formal and informal STEM educators, enabling them to collectively ensure that students have the STEM skills necessary for life in the 21st century.

Cultivating Cross-Sector Partnerships to Deepen STEM Learning

Imagine Maria, a third-grade student learning about habitats and the features of organisms that allow them to survive in certain environments. She works in a team in her science class to prepare for and engage in a class discussion comparing and contrasting habitats. In her afterschool program, she and her classmates develop environmental engineering solutions to contain an oil spill that threatens the habitat of fish and plants in a river ecosystem. Her afterschool educator and her science teacher help Maria connect the two lessons, enabling her to develop a deep understanding of the core idea of organisms and how they interact in particular habitats.

In recent years, STEM leaders in New York City have turned their attention to building partnerships between STEM learning opportunities during the school day and those offered out of school, harnessing the time and talent of science teachers, afterschool workers, and STEM experts in science-rich institutions to create experiences that build upon one another and create opportunities for deep, connected learning. Strengthening partnerships among each of the educators that a child sees during her day ensures that scientific concepts and practices are reinforced. Core ideas can be brought to life in multiple ways throughout the day.

The process of learning science, technology, engineering, and math skills is a lot like learning a new language.

Educators in and outside of school have the same goals. Both groups want to help young people think creatively and innovate effectively. By encouraging collaboration among educators, communities can foster young people's critical-thinking, problem-solving, and collaboration skills and empower tomorrow's workforce to be effective leaders and passionate scientists. The process of learning science, technology, engineering, and math skills is a lot like learning a new language. In order to build their fluency, young people need opportunities to practice their STEM skills in immersive, hands-on ways both in and out of the classroom.

Cross-sector collaboration is now possible because of the growth in STEM programming outside of school. Private funders, as well as local, state, and federal funding streams—such as the U.S. Department of Education's 21st Century Community Learning Centers—encourage comprehensive afterschool providers to include robust STEM activities in their programs. As a result, a survey by the Afterschool Alliance (2014) found that 69 percent of afterschool programs report offered STEM learning opportunities.

New York's efforts to ensure all students have opportunities outside of school to hone STEM skills and boost engagement in STEM have been bolstered by strong local leadership from the city's youth services agency. The agency requires the school-based afterschool programs it funds to offer two hours of STEM or English language literacy each week. The agency also provides funding to underwrite STEM training for afterschool providers. As a result, more than 90 percent of afterschool programs in New York City now offer STEM to young people, according to a local survey (Kanter & Browhawn, 2015).

Efforts to build STEM in afterschool have had enormous impact in redefining where and when STEM happens—in science and math classes, on trips to the zoo or science center, and in community-based afterschool programs. It offers young people additional opportunities to spark their curiosity and immerse themselves in STEM learning, allowing them to remain engaged in STEM when many of their peers lose interest.

Professional Development Improves Outcomes

Creating opportunities for educators to bridge the various school-day and afterschool experiences enables them to add depth and relevance for young people. To create these kinds of experiences, New York City elementary and middle schools teachers, afterschool staff, and science-rich cultural institutions have partnered to create co-teaching teams made up of one classroom teacher and two afterschool community educators.

Over the summer, each team participates in the STEM Educators Academy, a weeklong professional learning experience at a science-rich institution—the New York Hall of Science, the Institute of Play, the Intrepid Sea, or the Air & Space Museum. Participating educators focus on the fundamentals of scientific inquiry and the engineering design process through the lens of maker design, gaming, and system mechanics. Together, they learn about and practice design projects that they can implement to fuel STEM interest and excitement. The design process is a key feature of new science and engineering standards and helps students understand the problem solving and rigorous testing that goes into all kinds of engineering, such as developing household appliances, mobile apps, or civic infrastructure projects.

After the summer institutes, the educator teams meet weekly throughout the year back at their schools to plan and team-teach projects that support the curriculum. As a foundation for their lesson plans, educator teams use the NYC Science Scope and Sequence and the Science and Engineering Practices of the Next Generation Science Standards. Students in fourth and fifth grade, for example, learn about the hydrosphere

and water cycle by designing and constructing a water-filtration device using available materials. They're also exposed to the engineering design process as they build, test, and measure the performance of their devices.

Participating teachers report that working with the cultural partners has been the most action-oriented and engaging professional development of their careers, and community educators report that it has helped them create real relationships with science teachers. Importantly, school leaders say they have seen improvement both in terms of academic results and school culture as classroom teachers involved in the project are increasingly leading professional development for other teachers at the schools.

The impact of partnership is evident in external observations of the changes to educator's practice and educators' reports of their experience. Evaluators found that the quality of instruction improved over time. Using the nationally recognized Dimensions of Success observation tool developed at Harvard University by the Program in Education, Afterschool and Resiliency (PEAR), independent observers rated activities higher, on average, in all 12 dimensions of STEM program quality in the spring relative to the fall of the same academic year. Academy teams' STEM activities were, on average, above the national means for all 12 dimensions of STEM learning in the observation.

Educators participating in collaborative teaching increased their confidence in their ability to lead STEM learning activities. Educators reported their perceptions using the Science Teaching Efficacy Belief Instrument (STEBI). Over three-quarters of respondents, including both teachers and community educators, increased their confidence overall. The results were particularly striking for classroom teachers, 86 percent of whom reported increases in confidence. Interestingly, participating community educators with and without a STEM background significantly increased their confidence over the course of the program (Kanter, 2016).

Teachers reported that the STEM Educators Academy "impacted [their] teaching science during the day" because they "plan [their] activities and labs in a new way" and helped ensure that they are "connecting what students learn during the day with the science-related activities that students participate in during [expanded learning time]." Teachers also reported that the Academy inspired them to "create much more interesting science experiments and experiences for the students" and that the trainings "opened [their] eyes to how design can work in a classroom" (Kanter, 2016).

Students have the opportunity for more voice and choice, and more opportunities for design challenges that may take more than one lesson. These expanded efforts enable educators to immerse themselves in STEM and build their fluency, facilitate extension activities, and allow groups to explore new areas of curiosity.

Partnering organizations and city agencies are working together to strengthen and sustain the professional development models being used within the STEM Educators Academy. The partners were awarded an Investing in Innovation grant to further test the model and its impact on middle grades students. As an active partner in the national FUSE initiative, ExpandED Schools works with Every Hour Counts and its partners to deepen and expand STEM learning experiences in multiple cities, including Boston, Nashville, and Providence. The key component of the FUSE 3.0 model centers on fostering collaboration between formal educators and their informal educator counterparts and bringing models of collaboration from "niche to necessary." New York City STEM leaders are also active members of the national community of STEM learning ecosystems, enabling further opportunities to learn from others dedicated to collaboration and creating more opportunities for great science education.

Strategies for Building Cross-Sector Partnerships

Strong cross-sector collaboration inspires new ways of teaching, new partnerships among STEM educators, and greater opportunities for students to learn science and engineering practices that will enable them to solve problems in the future. How can communities foster this kind of collaboration? Below are strategies to create the conditions that enable joint professional development, changes in educator practice, and deeper learning for young people.

- **Focus on change in practice and policies.** Supportive policies, such as New York City's STEM Framework and the Department of Youth and Community Development's requirement that funded programs offer STEM or language literacy, encourage continued partnership and access to STEM opportunities (NYC Dept. of Education, 2015). Seizing those policy opportunities as they become available is critical to building long-term conditions for deeper STEM learning, but practitioners shouldn't wait for policy changes to test and implement practice changes.
- **Build systems support to facilitate collaboration.** In New York City, local funders have supported a NYC STEM Education Network since 2012. The Network brings together STEM-specific providers, STEM-rich cultural institutions, youth-serving organizations that offer school-based comprehensive afterschool programs, the New York City Department of Education, and the Department of Youth and Community Development. Network members discuss areas of mutual interest and develop cross-sector collaborations to fill gaps in services to young people.
- **Create authentic connections and ensure no one sector or leader dominates discussions.** Funders, city agencies, and intermediaries have to bring people together in ways that ensure that no one sector dominates the discussion. For example, in New York City, representatives from the original Network funder, the Pinkerton Foundation, attended every network meeting but sat at the side of the room. When discussions faltered, the Foundation representatives occasionally stepped in to offer strategic direction or to shape ideas but largely waited for members to resolve issues on their own. That process led to better buy-in and stronger, more authentic connections. An occasional reminder by the Foundation staff of the goals of the Network was useful to stay on point.
- **Give good ideas time to grow.** Developing two collaborative cross-sector proposals in New York City took a full 18 months. Funders and collaboration participants need patience and commitment to broad goals for STEM learning.
- **Use data about what is and isn't working to drive professional development.** Using observational data gathered from STEM observation tools, educator surveys, and student surveys, STEM-rich cultural partners were able to identify what was working and what wasn't. From this, they modified their professional development and training sessions and saw improvement in reflection and relevance, two areas that were relatively less strong than others.

- **Maintain strong afterschool and summer systems.** In New York City, strong STEM collaborations were made possible by a well-networked and supported afterschool system. City intermediaries like those in Every Hour Counts and statewide afterschool networks are leading efforts to build strong systems for out-of-school time. Advocating for stable funding streams such as the U.S. Department of Education's 21st Century Community Learning Centers program ensures afterschool providers are able to collaborate as equal partners with schools and science institutions.
- **Share success and invite others to join.** Those who help spark good ideas must leave ample room for others to join the effort so ideas about collaboration may diffuse and spread.

The interest in formal and informal collaborations to strengthen STEM learning in and out of school is growing as educators and decision makers see the benefits. We hope our efforts thus far will continue to pave the way for future collaboration between formal and informal education sectors—collaboration that will inevitably lead to stronger, more vibrant programming to help all young people develop the skills, self-reliance, and strong values necessary to fulfill their potential.

About ExpandED Schools

For nearly two decades, ExpandED Schools has created opportunities for students to immerse themselves in science, technology, engineering and math (STEM), along with the arts, sports, and other character-building activities, in an effort to close the learning gap and ensure equity of access to enriched education experiences. These activities enable children to develop problem-solving, teamwork, and critical-thinking skills and to explore other aspects of scientific practice and engineering design. As its name suggests, ExpandED Schools focuses on enhanced programming throughout the learning day, both in school and after the traditional school day ends. To expand into the afternoons, ExpandED Schools has promoted partnerships between schools and youth-serving community organizations as a way to strengthen STEM. Thanks to these and other efforts, there has been an explosion of STEM in afterschool and expanded learning programs over the last decade—to the point that in New York City nearly 92 percent of afterschool site directors reported offering STEM.

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Saskia Traill is the Senior Vice President, Policy & Research, at ExpandED Schools, dedicated to closing the learning gap by increasing access to enriched education experiences. Saskia leads the organization's research and policy efforts in expanded learning, including opportunities for children to engage in quality science, technology, engineering and math (STEM). Prior to working at ExpandED Schools, Saskia was a Program Manager for the Insight Center for Community Economic Development, working to build collaborative state systems for early care and education. She has authored and co-authored articles for peer-reviewed journals, policy briefs and reports on a range of issues, including STEM ecosystems, cross-sector collaborations, and STEM assessment and evaluation. She received her B.A. from Columbia University and a Ph.D. in research psychology from Stanford University.