



# From Niche to Necessary:

**Scale and Sustainability Lessons from the Frontiers  
in Urban Science Education (FUSE) Initiative**



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Cover Photo: Courtesy of the Nashville After Zone Alliance | Design by: madebywe.org

# Executive Summary

**The Frontiers in Urban Science Education Initiative (FUSE) was launched in 2007 by Every Hour Counts, the national network of expanded learning intermediaries, and ExpandedED Schools with significant multi-year support and leadership from the Noyce Foundation and the STEM Next Opportunity Fund.**

Every Hour Counts and ExpandedED Schools commissioned this report to share lessons learned in scaling and sustaining the FUSE initiative. The intended audience includes stakeholders focused on increasing young people's access to high-quality STEM learning -- schools and school districts, intermediaries focused on expanded learning at the city and state levels, community-based afterschool and summer program providers, STEM-expert organizations, funders, researchers, policymakers and others.

## FUSE Overview

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**The Frontiers in Urban Science Education Initiative (FUSE) brings together talented educators from in and out-of-school who combine knowledge of STEM content and practices, deep pedagogical skills, and youth development expertise to help young people build critical skills for a complex future.**

FUSE's goal is to increase access to active, quality, student-centered STEM learning in multiple settings-- particularly for young people who are traditionally under-represented in STEM due to income, race, ethnicity and gender.

Implemented at a broader scale, FUSE has the potential to help diversify the STEM workforce and equip all our young people, regardless of what profession they ultimately choose, with the skills and capacities they need to contribute fully to economic, social and civic prosperity.

Across four cities, students participating in the FUSE initiative are engaged in STEM in a variety of ways, with leadership provided by the following intermediary organizations: Boston After School & Beyond, ExpandedED Schools (NYC), Nashville After Zone

Alliance, and the Providence After School Alliance.

FUSE partnerships include an expanded learning intermediary, school district, STEM-expert institutions and community-based after school and summer program providers collaborating to provide:

- 1 More time for young people to engage in STEM learning across multiple settings**
- 2 Collaboration between formal and informal educators in teaching, professional development and planning**
- 3 Engaging instruction around the Common Core and Next Generation Science Standards to build young people's understanding of science and engineering practices**
- 4 STEM learning that develops 21st century social-emotional skills, with a focus on critical thinking, collaboration and perseverance**

# Findings

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## Impact on Youth

FUSE has reached more than 7,500 youth. More than 70% of students reported growth in critical thinking, perseverance, relationships with adults and relationships with peers; while more than two-thirds reported increased STEM engagement. Strong majorities of educators noted that students in FUSE programming were consistently engaging in scientific and engineering practices as defined by the Next Generation Science Standards, including “asking questions and defining problems” and “obtaining, evaluating, and communicating information.”

## Scale and Sustainability

The FUSE approach to scale and sustainability is informed by the framework developed by scholars Cynthia Coburn and Christopher Dede (Corrigan, Coburn and Dede, 2007). Instead of focusing exclusively on the number of students reached by a reform, Coburn and Dede’s conception of scale defines interrelated dimensions of depth, sustainability, spread, shift and evolution.

The paper details how FUSE has helped intermediaries lead a broad shift in mindsets of community and education leaders toward:

- **An expanded view of how, where, when and with whom high-quality STEM learning takes place.** In FUSE cities, STEM learning goes far beyond the classroom to encompass a variety of learning spaces, led by a mix of educators, including teachers and informal educators, supported by high-quality professional development and well-designed curricula.
- **A realization that learner-centered STEM can help young people engage in science and engineering practices and develop social-emotional skills,** making FUSE an ideal approach to reach multiple goals and connect what are often disparate education reforms.
- **An appreciation of the value of deeply connecting classroom teachers and out-of-school educators.** Participating in FUSE catalyzes change in educators – classroom teachers often adapt their pedagogy to learner centered approaches; deepen their excitement for teaching; and assume leadership roles. Afterschool educators also grow in confidence, expertise and leadership to facilitate STEM activities from standards and content taught during the school day.

## Key Strategies

As the mindsets of leaders in schools, local government and community-based organizations shift, they are deploying their own resources differently and becoming more open to exchange and collaboration. Interviews with FUSE stakeholders surfaced powerful examples of this, and also revealed the use of five broad strategies to accelerate the infusion of FUSE elements into each community's learning ecosystem.

### 1 Measuring impact using common assessments

### 2 Building quality and capacity of community providers

### 3 Improving effectiveness of cross-sector educator teams

### 4 Building awareness within diverse stakeholder networks

### 5 Catalyzing city, district and state leaders to broadly adopt FUSE elements

As the strategies have taken root in cities and stakeholders across formal and informal sectors have solidified new partnerships, public and private funders have taken note and made major investments. The U.S. Department of Education invested multi-million dollar grants in Boston and New York City for FUSE-inspired initiatives. The Providence After School Alliance influenced the transformation of the city and school district's approach to summer learning. And in Nashville, FUSE has changed the way the Parks Department thinks about the potential of after-school as a space for STEM learning.

FUSE cities have also become leaders in the national STEM Learning Ecosystem Community of Practice.

## Challenges

FUSE leaders set out in 2015 to demonstrate successful strategies for building and scaling robust STEM education using a community-centric approach. In interviews, they detailed many examples of the progress they have made, but also described major challenges to creating conditions for scale, and how they have worked to overcome these obstacles.

### • **Breaking out of the education reform 'silos.'**

FUSE is a cross-sector effort operating within an environment that is characterized by single-issue approaches.

### • **Scheduling time for cross-sector teams.**

Scheduling school and afterschool educators to co-plan, attend joint professional development, and co-teach is difficult amid all the priorities and requirements competing for limited time.

### • **Accessing sustained funding for afterschool programming and cross-sector collaboration.**

In an environment of constrained resources, funding to support collaborative infrastructure is often hard to come by.

### • **Gaining attention for science education.**

Having successfully strengthened relationships with city and state science leaders, intermediaries were often disappointed to discover the paucity of resources these leaders have to work with, as science education is still under-prioritized in many state and local education systems.

## Recommendations

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FUSE cities are continuing to increase time for STEM learning across settings; deepen cross-sector collaborations; and focus on SEL and science and engineering practices as young people engage in active learning. The paper offers recommendations to cities, regions and states that are looking for ways to embed these elements in their own approaches as they strive to improve young people's access to high-quality STEM learning in and out of school.

### Policy Recommendations

- Advance FUSE-informed approaches to professional development.
- Advance policies that support meaningful and effective formal-informal STEM collaborations.
- Amplify awareness of FUSE's impact on youth and educators.

### Research Recommendations

- Better understand FUSE's impact on formal and informal educators.
- Expand research and development of formative assessments for use in informal environments.
- Explore the intersection of science and engineering practices and youth voice in formal and informal learning environments.

### Practice Recommendations

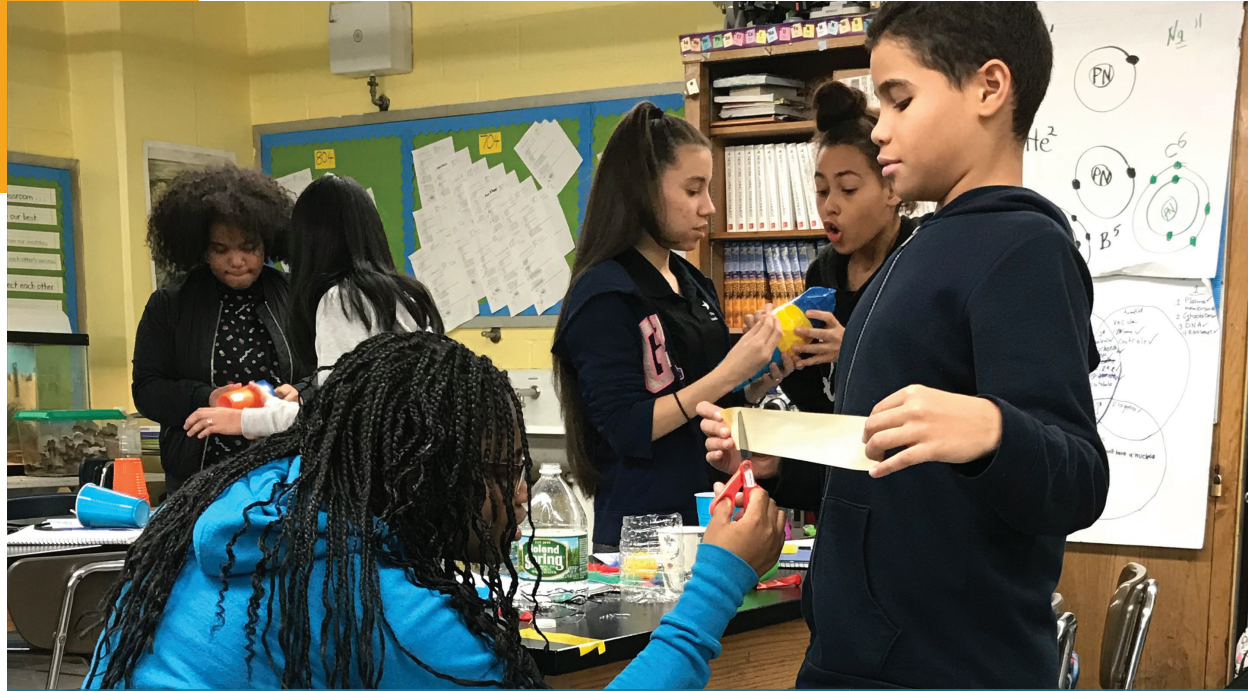
- Tap intermediaries as the natural leaders of cross-sector, STEM expanded-learning collaboratives.
- Flexibility in implementing the core elements, adequate support for practitioners, and a commitment to continue common assessments should anchor new FUSE efforts.
- Improve the conditions for scaling cross-sector collaboration.
- Explore opportunities to integrate FUSE elements into pre-service teacher preparation.

## Conclusion

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The FUSE cities continue to sharpen their effectiveness, working at the point of service to support transformative adult-youth interactions and meaningful educator-to-educator collaboration; and at the systems level to ensure policy and funding decisions encourage and enable cross-sector collaboration as a way of doing business.

Every Hour Counts will continue to convene stakeholders, disseminate knowledge and catalyze change, and identify opportunities to deepen and broaden these new strategies and approaches. Our vision is that all young people have opportunities to build the full set of skills, knowledge and experiences that are the foundation of an innovative, compassionate and creative civic community.



Youth in the Mosholu Montefiore Community Center afterschool program at the New School for Leadership and the Arts in New York City engineer miniature air cannons. | *ExpandedED Schools*

# Scale and Sustainability Lessons from the Frontiers in Urban Science Education Initiative

## Introduction

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Across four cities, middle schoolers participating in the Frontiers in Urban Science Education (FUSE) initiative are engaged in science, technology, engineering and mathematics (STEM) in a variety of ways.

> Students in Providence, Rhode Island set about building seaworthy vessels using only cardboard and duct tape, guided by a team of educators that included a middle school math teacher and staff from the community-based organization Save the Bay. Grouped into teams, the students put lessons about buoyancy and boat construction to immediate use as they engaged in the design and build process and their boats slowly took shape. On a sunny day in August, the young people carried their finished boats onto a dock jutting into Providence Bay. Two to a boat, they clambered in and took up oars. The starting whistle blew, teammates cheered, and the race was on. Most of the boats stayed afloat! Post-race, the students sat down for a group reflection – how can they improve not just their vessel for next time, but their preparation, and the dynamics of their teamwork?

> Over the course of a few weeks last autumn, seventh graders at M.S. 108 in Brooklyn, New York became

‘slime’ engineers. Given samples of inferior slime, student teams were tasked with figuring out what was wrong, engineering an improved recipe, and producing, marketing and selling their product. Guided by an educator team that included schoolteachers and afterschool staff from the school's partner organization, Community Counseling and Mediation Services, the young people analyzed ingredients, identified problems, and iterated a variety of possible solutions. They measured, mixed, tested, remixed and re-tested. They mastered science concepts such as solubility, mixtures and types of changes as they evaluated each other's work. Their final product worked so well that they sold it to their peers as a fundraiser for their afterschool program.

> In Boston's Roxbury neighborhood last summer, a group of rising eighth graders focused their energies on improving their own community. Guided by an educator team comprised of Boston Public School (BPS) teachers and staff from the community-based



Providence After School Alliance AfterZone youth race cardboard boats they designed and built in Save the Bay's Explore the Bay program.

The common thread across these stories is the sense of wonder, excitement and accomplishment shared by the young people and the teams of adults guiding them as they worked through various obstacles to reach their goals.

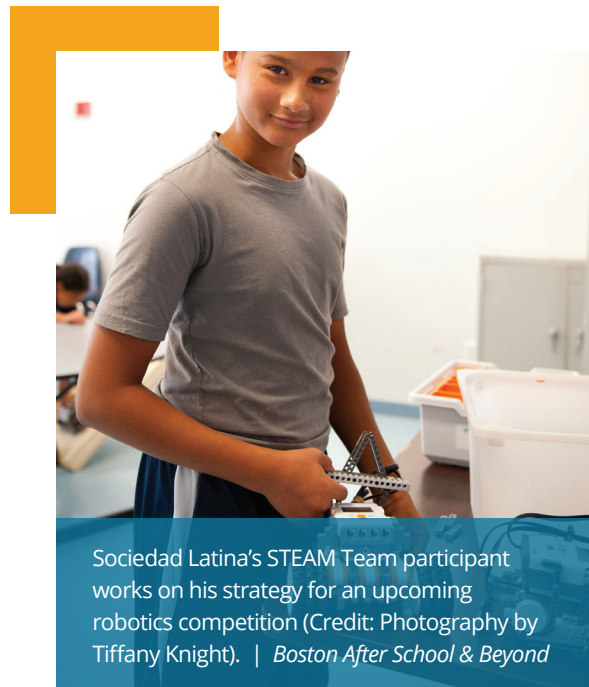


partner, Sociedad Latina, the young people interviewed residents and business owners and completed online research to better understand zoning regulations, recreational space, public transportation and other key factors impacting neighborhood quality of life. They divided into teams to develop proposals to improve their neighborhood: a new homeless shelter with an employment program, a soccer stadium, and stricter fines for graffiti. They presented their ideas, including scale models, budgets and other documentation, to family and community members. The teaching team brought complementary strengths to the project, with BPS teachers supporting English language acquisition for the young people, all of whom were English language learners. Sociedad's educators took the lead on connecting the youth to community resources, creating an environment of positive youth development, and engaging families.

> Last fall, a group of Nashville, Tennessee middle schoolers set about designing the best habitat for the pair of mice they were planning to adopt as class pets for their afterschool program. Seeing an opportunity to have the students formulate, test and refine questions emulating science and engineering practices, the educator team guided the students to hone in on the question: “which shapes or designs make it easiest for a mouse to run through in a maze?” As the students immersed themselves in finding the best solution, an unexpected donation of two guinea pigs catalyzed a change in focus. Noticing that the guinea pigs were highly anxious, the students changed their research question to “what environment will best calm anxious guinea pigs?” The key priority for the cross-sector educator team was to empower their students to exert ownership over the purpose and design of the activity,

facilitating their reflections on successes and failures, and guiding them to ask questions they could test using available resources.

The common thread across these stories is the sense of wonder, excitement, and accomplishment shared by the young people and the teams of adults guiding them as they worked through various obstacles to reach their goals. These four sites are part of **Frontiers in Urban Science Education (FUSE)**, a national STEM learning initiative. FUSE convenes talented educators from in and out-of-school environments to form cross-sector teaching teams. The teams combine knowledge of STEM content and practices, deep pedagogical skills, and youth development expertise to help young people build critical skills for a complex future. FUSE's goal is to increase access to the types of STEM learning experiences described above – particularly for young people who are traditionally under-represented in STEM due to income, race, ethnicity and gender.



Sociedad Latina's STEAM Team participant works on his strategy for an upcoming robotics competition (Credit: Photography by Tiffany Knight). | *Boston After School & Beyond*

## Purpose of this Report

**Every Hour Counts, the national network of intermediaries leading the FUSE project, commissioned this report to better understand the progress made by FUSE sites in Boston, Nashville, New York City and Providence in scaling and sustaining the core elements of the initiative.**

This report is intended to share lessons learned with key stakeholders across the country focused on increasing young people's access to high-quality STEM learning. Our intended audience includes schools and school districts, intermediaries focused on expanded learning at the city and state levels, community-based afterschool and summer program providers, STEM-expert organizations, funders, researchers, policymakers and others. The FUSE partners believe that we can all benefit from understanding the successes and challenges of scaling and sustaining a collaborative

approach to increasing opportunities for young people of color, girls and young people from urban and low-income environments to experience active, student-centered STEM learning in multiple settings.

Data collection methodologies for this report included site visits and phone interviews with a set of cross-sector stakeholders, review of proposal and evaluation documents and additional research. The inquiry focused on the following questions:

- How have intermediaries fostered a commitment to the FUSE approach within their local communities?
- Which strategies are most effective?
- What are the major challenges to creating conditions for scale?
- What recommendations can FUSE offer in the areas of practice, policy and research to advance scale and sustainability efforts?

### A Note on Terminology Used in this Report

**Formal learning environments:** schools and school systems

**Informal learning environments:** afterschool or summer programs, may take place at schools, community-based organizations, STEM-expert institutions or other places

**STEM-expert or STEM-rich institutions:** science or STEM-focused museums, centers or other types of organizations with STEM expertise, such as institutions of higher education or private sector companies in the STEM fields

**Teachers, formal educators:** K-12 schoolteachers

**Informal educators:** staff of community-based youth programs or STEM-expert institutions

## Overview of FUSE

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**FUSE originated in 2007 with Expanded Schools<sup>1</sup> in New York City. Expanded Schools founding President Lucy Friedman was an early proponent of the idea that afterschool programs – the best of which offer exploratory, supportive, and flexible settings for young people’s learning and development – are ideal settings for STEM.**

Said Friedman, “When we began to spread quality STEM learning opportunities in afterschool in New York City, we knew very well this was a national issue and that there was lots of interest from other communities in what we were doing. We also knew we wanted to learn what others were doing.”

“The genius of FUSE was in figuring out how to get schools, community organizations, and science experts to team up to deliver these great experiences for kids.”

– **RON OTTINGER,**  
**Executive Director,**  
**STEM Next Opportunity Fund**

Friedman enlisted the support of the Noyce Foundation to launch the FUSE initiative. Ron Ottinger, Executive Director of the Noyce Foundation until its sunset in 2015, explained, “Research shows that we need to turn kids on to STEM by their early teens, if not before. Our bet was to focus on afterschool

and summer programs as viable and powerful places to light that spark in kids, and help them build important skills we all need to succeed in today’s world -- how to think critically, work with others, and solve problems with creativity and persistence. The genius of FUSE was in figuring out how to get schools,

community organizations and science experts to team up to deliver these great experiences for kids.” Ottinger now heads the STEM Next Opportunity Fund, established after Noyce’s sunset to continue to advance the initial work of the foundation. Matching funds from local philanthropies at each site have amplified the core support provided by Noyce and the STEM Next Opportunity Fund.<sup>2</sup>

In each site, the FUSE partnership is driven by:

- A strong intermediary that is an effective broker between the informal and formal sectors and coordinates a mature afterschool/summer program network with the capacity to focus on STEM and 21<sup>st</sup> century/social-emotional skills
- A school district that understands the value of cross-sector collaboration
- STEM-expert institutions
- Community-based afterschool and summer program providers.

Every Hour Counts manages the project, facilitates the national community of practice and site-based technical assistance, and oversees the project’s evaluation. Every Hour Counts<sup>3</sup> is a national network of intermediaries established in 2006 by a group of intermediary leaders. Jessica Donner, Executive Director of Every Hour Counts, attests: “FUSE is core to our work. The hands-on approach and inquiry-based pedagogy, combined with a focus on transformational learning experiences with a cross-sector approach, fosters stronger and better expanded-learning systems. FUSE helps us reach more students with higher-quality programs and change teaching practice in the process.”

Resources from the STEM Next Opportunity Fund and local matching funds are allocated to:

- Cross-sector professional development
- Coordination of local partnerships that include out-of-school intermediaries, school districts and schools, OST providers, STEM-expert institutions, funders, city and state government
- Facilitation of a national community of practice and providing site-based technical assistance
- Research and evaluation
- Expert consultants focused on developing alignment to the Next Generation Science Standards and other aligned state science standards, incorporating 21<sup>st</sup> century and social-emotional skill development, and developing formative assessments.

Since its inception in 2007, FUSE leaders have iterated the design and structure of the initiative. This paper focuses on FUSE 3.0, as launched in 2016 and implemented in Boston, Nashville, New York City and Providence. The key advancements that characterize FUSE 3.0 are: the set of core elements (detailed on pages 9-12), the national learning community, and the use of common youth, educator and program assessments across sites. In late 2017, After School Matters (ASM)<sup>4</sup> in Chicago joined the initiative. The Chicago FUSE effort centers around an emerging Makerspace within ASM's new facility in the underserved Belmont Cragin neighborhood. ASM is convening formal and informal educators to develop a dynamic space designed for teens both in and out of school time. As the effort launched late in 2017, it is too new to provide lessons on scale and sustainability for this paper.



Youth in Coleman Park Community Center's (Nashville Metro Parks) summer program prepared for their field trip to Wave Country by studying how waves move through space; the youth also learned about sound waves and light rays over the course of the summer. | *Nashville After Zone Alliance*

## FUSE Core Elements

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- 1 More time for STEM learning across multiple settings**
- 2 Collaboration between formal and informal educators in teaching, professional development and planning**
- 3 Engaging instruction to build young people's understanding of science and engineering practices**
- 4 STEM learning that develops 21<sup>st</sup> century and social-emotional skills, with a focus on critical thinking, collaboration and perseverance**

**In 2010, a committee of experts convened by the Center for Advancement of Informal Science Education (CAISE) examined the value of collaborations among schools and informal science partners to science learning.**

Their report called for “more intentional and strategic deployments of resources, leading to collaborations that build on the particular affordances and strengths

of different institutional types to meet shared goals of making science learning more accessible and compelling to young people in our communities.” (Bevan, et al., 2010). FUSE answers that call.

It is grounded by a set of four core elements that ensure fidelity to a shared vision for STEM learning across communities and serve as guideposts for flexible implementation that is responsive to a community's STEM ecosystem and specific pathways to scale.

## **1 More time for STEM learning across multiple settings**

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Classroom time on science has declined in the past two decades, but it is not just more time in school that young people need to become ‘fluent’ in STEM. Just as people need to be immersed in real-world situations to learn a language, children and youth need to explore STEM in their lives outside of the classroom to fully understand and become fluent in these subjects.

A 2015 National Research Council report on out-of-school STEM learning asserted: “Access to productive out-of-school opportunities that engage young people in authentic STEM experiences is a critical piece of the STEM learning ecosystem. Such out-of-school opportunities can support STEM learning independently from classroom learning, and they are particularly well suited to building interest in STEM and identity as a STEM learner” (National Research Council, 2015).

Research on how people learn offers insight into why experiencing STEM in informal environments is so important. The 2015 NRC report notes that “STEM learning results from dynamic interactions that occur over time among the diverse settings in which learning occurs (e.g., home, school, youth groups, hobby clubs, museums, libraries, afterschool programs), the community and culture in which these activities are embedded, and the characteristics of the learner (e.g., interests, dispositions, values).” (National Research Council, 2015). The efficacy of STEM learning in out-of-school time (OST) was reinforced last year with the release of a large national study finding more than 70% of approximately 1600 students enrolled in 160 STEM OST programs across 11 states reported positive gains

in areas such as STEM interest, STEM identity, STEM career interest and career knowledge, and 21<sup>st</sup> century skills, including perseverance and critical thinking (Allen, et al., 2016).

FUSE provides young people with access to informal learning environments where they can tackle problems that are relevant to them in low-stakes settings, with STEM methods, tools and practices. Students in FUSE programs participate in STEM activities during school, after school, and/or in summer programs, in a variety of settings (e.g., wildlife refuges, salt marshes, zoos, design labs).

## **2 Collaboration between formal and informal educators in teaching, professional development and planning**

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At the heart of FUSE is cross-sector collaboration among educators working with young people: K-12 teachers, afterschool/summer staff at community-based youth organizations, and informal educators within STEM-rich institutions.

Cross-sector partnerships are not new, but most have been limited in scope, duration and intensity (Bevan, et al., 2010). FUSE collaborations have reached a unique level of depth and intentionality in their quest to realize the potential of this approach to benefit young people. As a result, FUSE has increased the field’s knowledge of the critical success factors and potential impact of in-depth cross-sector collaboration. This knowledge is valuable, because the vision of STEM literacy embodied in the Framework for K-12 Science Education, the Next Generation Science Standards and the Common Core State Standards in Mathematics cannot be achieved

“It’s fascinating to bring together the different worlds of school and afterschool to create a power team.”

– JASMINE MALDONADO,  
Science Coach Manager,  
New York Hall of Science

by a single sector alone. As argued by the 2015 National Research Council report, “multiple, diverse learning experiences connected across settings and providing young people with many ways to develop complex

knowledge, skills and understandings can only happen within an ecosystem of STEM learning” (National Research Council, 2015).

Jasmine Maldonado, Science Coach Manager of the New York Hall of Science, explained: “It’s fascinating to bring together the different worlds of school and afterschool to create a ‘power team.’ Schoolteachers often bring content expertise, knowledge of the standards and academic vocabulary, while community educators often bring an understanding of youth development and a sense of fun, and even specialized skills such as technology into the program. The community educators are really in touch with the students – often they are from the same community and closer in age to the students. With FUSE, these two sets of educators are learning from each other as equals. How does it benefit the students? Kids get the content expertise and they see a reflection of themselves in the team that is teaching them. They have a different kind of relationship with their teaching team than in school.”

### 3 Engaging instruction to build young people’s understanding of science and engineering practices

FUSE cities set out to develop an instructional approach that integrates knowledge and practice in alignment

with the Framework for K-12 Science Education, the Next Generation Science Standards and other similar state science standards.

### Science and Engineering Practices Next Generation Science Standards

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Cross-sector professional development, planning and teaching focus on creating experiences that build young people’s knowledge and strengthen their capacity to engage in the design process, discourse and other scientific practices.

### 4 STEM learning that develops 21<sup>st</sup> century and social-emotional skills

How well young people develop the broad set of skills and capacities often referred to as 21<sup>st</sup> century or social-emotional skills has captured the attention of a broad swath of educators, funders, policymakers and researchers. Last fall, a group of scientists and scholars

from the fields of brain science, medicine, economics, psychology and education research convened by the Aspen Institute's National Commission on Social, Emotional, and Academic Development published a brief entitled, *The Evidence Base for How We Learn*. The brief affirmed the scientific consensus supporting the

interconnectedness of social, emotional and academic development as central to the learning process (Jones & Kahn, 2017). In 2016, FUSE leaders incorporated an overt focus on three key skills that are relevant to STEM and more broadly foundational to success: critical thinking, collaboration and perseverance.

## FUSE Impact on Youth

### Increased 21<sup>st</sup> Century/SEL Skills & STEM Engagement

The FUSE initiative reached more than 7500 youth over the course of the initiative as part of this initial proof of concept phase.

The impact of program participation on youth was tracked by the Holistic Student Assessment (HSA), focused on social-emotional development and The Common Instrument Suite, focused on STEM interest and identity, both student self-report tools developed by researchers at the PEAR Institute of Harvard Medical School and McLean Hospital. Educators also completed an internal survey about the extent to which students engaged in science and engineering practices in FUSE programs. In 2017, more than 70% of students completing the HSA reported growth in critical thinking, perseverance, relationships with adults and relationships with peers. More than two-thirds of students completing the retrospective change version of the Common Instrument reported increased STEM engagement.

#### Increased 21<sup>st</sup> Century / SEL Skills and STEM



Source: Holistic Student Assessment (HSA) and The Common Instrument Suite, Data from September 2016 – August 2017.



# Increased Engagement in Science and Engineering Practices

FUSE educators completing an internal program survey were asked to select the NGSS science and engineering practices that their students regularly engaged in. Nearly three quarters of respondents identified “asking questions and defining problems.”

## FUSE Students Engage in Science & Engineering Practices

CHART DISPLAYS THE PERCENTAGE OF FUSE EDUCATORS REPORTING THAT THEIR STUDENTS PARTICIPATED IN THE SCIENCE AND ENGINEERING PRACTICE DURING FUSE PROGRAMMING (2016-2017 DATA).



## Approach to Scale & Sustainability

The FUSE approach to scale and sustainability is informed by the framework developed by scholars Cynthia Coburn and Christopher Dede. Instead of focusing exclusively on the number of students reached by a reform, Coburn and Dede's conception of scale defines interrelated dimensions of depth, sustainability, spread, shift and evolution.

Specific goals related to these dimensions were built into the FUSE strategy:

- Deepen the practice of teachers and community educators facilitating effective and engaging STEM learning to: a) increase student understanding of science and engineering practices and b) improve student 21<sup>st</sup> century/SEL skill acquisition (*Depth*).
- Cultivate local commitment to a robust model with core elements for success (*Sustainability*).
- Deliver high-quality STEM learning to more youth (*Spread*).
- Foster joint ownership by school districts and intermediary partners in adapting and scaling the model (*Shift, Evolution*).



At Sociedad Latina's STEAM TEAM summer camp students prepare identity murals to communicate values & experiences across languages (Credit: Photography by Tiffany Knight). | *Boston After School & Beyond*

# Exploring the Process of Scaling Up<sup>5</sup>

Source: Cynthia Coburn and Christopher Dede: *Exploring the Process of Scaling Up*, 2007

## Dimensions of Scale

Taking an educational innovation completely to scale involves five dimensions that reflect different aspects of making an intervention effective in one setting useful across a wide spectrum of contexts.

### **Depth**

Getting to scale produces deep and consequential changes in practice. Requires evaluation and research to understand and enhance the causes of effectiveness.

### **Sustainability**

Sustaining scaled growth means maintaining these changes in practice over substantial periods of time. Requires robust design to enable adapting to negative shifts in context.

### **Spread**

Scaling up is achieved by diffusion of the innovation to large numbers of users. Requires modifications to retain effectiveness while reducing the resources and expertise required.

### **Shift**

Ownership of the innovation is assumed by users, who deepen and sustain the innovation via adaptation. Requires moving beyond “brand” to support users as co-evaluators, co-designers, and co-scalers.

### **Evolution**

The innovation as revised by its adapters is influential in reshaping the thinking of its designers. Requires learning from users’ adaptations about how to rethink the innovation’s model.

# Findings

## How have intermediaries fostered a commitment to the FUSE approach within their local communities?

FUSE has helped intermediaries lead a broad shift in mindsets of community and education leaders toward:

- **An expanded view of how, where, when and with whom high-quality STEM learning takes place.** In FUSE cities, STEM learning goes far beyond the classroom to encompass a variety of learning spaces, led by a mix of educators, including teachers and informal educators, supported by high-quality professional development and well-designed curricula.
- **A realization that learner-centered STEM can help young people engage in science and engineering practices and develop social-emotional skills,** making FUSE an ideal approach to reach multiple goals and connect what are often disparate education reforms.
- **An appreciation of the value of deeply connecting classroom teachers and out-of-school educators.** Participating in FUSE catalyzes change in educators – classroom teachers often adapt their pedagogy to learner-centered approaches; deepen their excitement for teaching; and assume leadership roles. Afterschool educators also grow in confidence, expertise and leadership.



After their five week Summer Learning experience on Thompson Island, Orchard Gardens students share the books they've written on native flora and fauna at the culminating Publishing Party (Credit: Casey Atkins Photography). | *Boston After School & Beyond*

## Which strategies are most effective?

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As the mindsets of leaders in schools, local government and community-based organizations shift, they are deploying their own resources

differently and becoming more open to exchange and collaboration. Interviews with FUSE stakeholders surfaced powerful examples of this, and also revealed the use of five broad strategies to accelerate the infusion of FUSE elements into each community's learning ecosystem.

### 1 **Measuring impact using common assessments**

### 2 **Building quality and capacity of community providers**

### 3 **Improving effectiveness of cross-sector educator teams**

### 4 **Building awareness within diverse stakeholder networks**

### 5 **Catalyzing city, district and state leaders to broadly adopt FUSE elements**

#### 1 **Measuring Impact Using Common Assessments**

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Within the Coburn framework, the dimension of depth underscores the importance of continually engaging in assessment and analysis to understand how core practices produce outcomes. FUSE has chosen a set of

common measures to track impact on youth, educators and program quality. The resulting data helps the sites develop more effective approaches and find the optimal mix of FUSE core elements for each community.

The impact of FUSE on youth as measured by internal program surveys (detailed on page 12),

the Common Instrument and the Holistic Student Assessment student self-report surveys. Program quality is assessed using the Dimensions of Success Observation Tool (detailed on page 19) and educator impact is assessed with internal program surveys (detailed on page 20).

To gain an even deeper understanding of what individual students are learning and identify those who might need extra support, pairs of informal and formal educators from each site came together as a cross-city team to develop formative assessments designed for use in out-of-school environments. Said Chris Smith, President and Executive Director of Boston After School & Beyond (BASB): “We are rolling up our sleeves as a community and collectively defining what we expect young people to be able to do to demonstrate critical thinking and perseverance. We have learned through this process that there is no substitute for deep and focused planning. There is no shortcut to a standardized solution. It takes defining shared expectations, developing the tasks and agreeing on what different levels of performance look like.”

The desire to better understand impact led two of the cities to secure U.S. Department of Education funds for FUSE-inspired initiatives that include rigorous evaluations: Boston’s BoSTEM and New York City’s Design2Learn. “Boston and New York are building on the foundation laid by FUSE to get to the next level. Their rigorous research in areas that are difficult to measure -- such as how certain practices lead to skill development among young people and their educators, and how to increase student engagement – will inform the work nationally,” said Jessica Donner, Executive Director of Every Hour Counts.

## 2 Building Quality and Capacity of Community Providers

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Because FUSE relies on strong networks of community-based providers offering high-quality STEM programs, the citywide intermediaries have prioritized building the capacity of providers to achieve and sustain quality programming over time. FUSE is using the PEAR Institute’s Dimensions of Success (DoS) observation tool to track the quality of STEM learning opportunities and to pinpoint strengths and weaknesses. DoS is a validated program observation tool that measures twelve indicators of STEM program quality in out-of-school time. A recent program evaluation using DoS found that FUSE partners are implementing higher quality STEM programs in comparison to other OST providers nationwide, and the major areas of growth from initial surveys were in the areas of student engagement and the implementation of inquiry-based activities.

Smith of BASB explained: “DoS gets us to a deeper level in helping programs identify how to improve the learning environment and increase student engagement.” Boston and Providence are engaged in further study of FUSE sites to examine student engagement levels during various moments of program participation. Said Smith: “We chose FUSE sites for further study because they are the best at engaging kids. We are identifying the practices that engage kids in out-of-school programs and comparing what we find to the school day.”

“We are rolling up our sleeves as a community and collectively defining what we expect young people to be able to do to demonstrate critical thinking and perseverance.”

– CHRIS SMITH, President & Executive Director, Boston After School & Beyond

## THE DoS STEM PROGRAM OBSERVATION TOOL

### Features of the Learning Environment

Organization

Materials

Space Utilization

### Activity Engagement

Participation

Purposeful Activities

Engagement with STEM

### STEM Knowledge & Practices

STEM Content Learning

Inquiry

Reflection

### Youth Development In STEM

Relationships

Relevance

Youth Voice

Each intermediary engages in a variety of activities to strengthen their local network. Explains Ann Durham, Deputy Director of the Providence After School Alliance (PASA): “We invest in the success and stabilization of our nonprofit partners. We are doing everything we can to support them through difficult economic circumstances and strengthen their relationships to the school system. Through FUSE, we’ve built a metric and assessment system that delivers solid outcomes. Having that data convinced the state to accept some of our best providers to teach high school courses for credit and award badges under the new personalized learning system. Our partners are now deeply interwoven into the school system.”

In New York City, ExpandedED Schools trains afterschool staff to use STEM-based curricula such as Engineering is Everywhere (developed by the Museum of Science, Boston), and other STEM and literacy activities through the city’s Department of Youth and Community Development (DYCD).

In Boston, FUSE helped set the stage for the city’s new summer learning initiative - the 5th Quarter. Said Smith, “We advocated that the Request for Proposals require community-based partners to show evidence of successfully teaching SEL practices and having the capacity to partner with the district. Because we have a network of CBOs who have been working with us over the years and doing exactly those things, they are well positioned to be a part of the new initiative and build even deeper partnerships with BPS.”

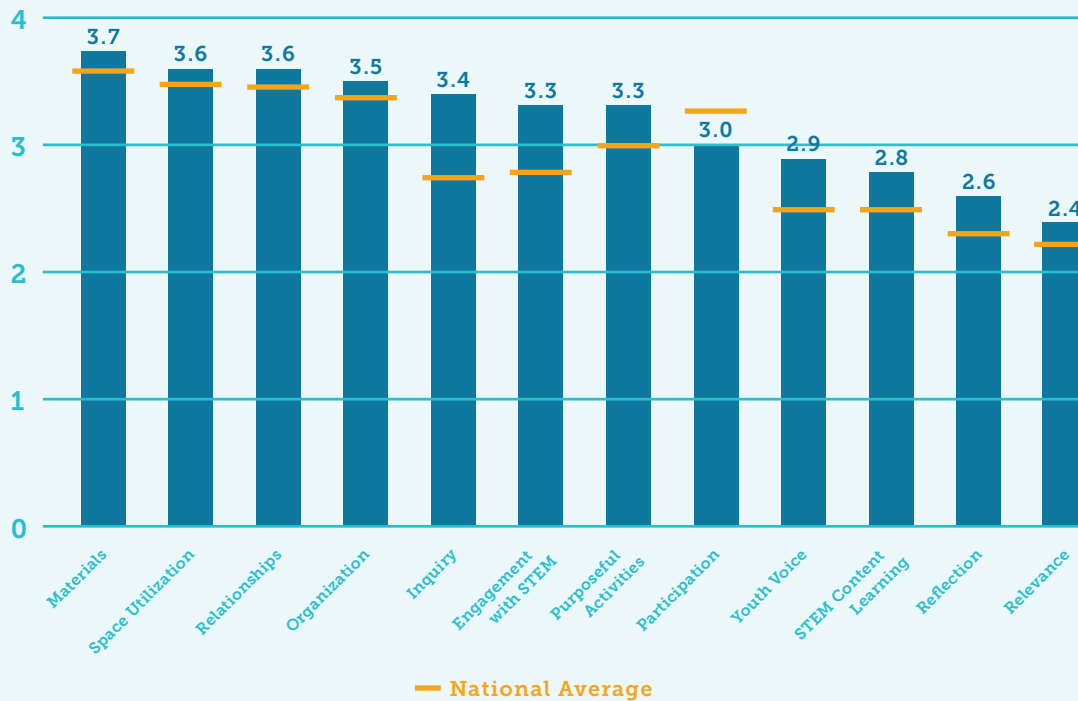
Boston After School & Beyond<sup>6</sup> has created the Insight Center, curating best practices, case studies, research and data for use by practitioners. BASB emphasizes peer-led capacity building with community-based organizations. BASB taps partner organizations to lead workshops in their areas of expertise, including:

Source: PEAR Institute of Harvard Medical School & McLean Hospital

# FUSE OST Program Quality FY 2017

FUSE PROGRAMS EXCEEDED THE NATIONAL AVERAGE IN ALL DOS DIMENSIONS EXCEPT PARTICIPATION IN FY2017

Source: Year 2 DoS Observations (N=45) & DoS National Averages (N=606)



- *Practicing Science and Mastering Content: Key Takeaways* by Olga Feingold of Thompson Island Outward Bound Education Center - focused on incorporating science and engineering practices into activity design and questioning and discussion strategies.
- *Equitable and Inclusive STEM Practices* by Jenna Nackel of Sociedad Latina on strategies to support English language learners in STEM programs and a discussion of *But That's Just Good Teaching! The Case for Culturally Relevant Pedagogy* by Gloria Ladson-Billings.
- *Implementing Science Practices and Aligning with BPS* by Pam Pelletier, BPS Director of K-12 Science and Technology/Engineering on the Next Generation

Science Standards science and engineering practices and the role out-of-school time STEM can play in supporting and broadening K-12 STEM learning.

In Nashville, the Nashville After Zone Alliance (NAZA)<sup>7</sup> sponsored a STEM Day of Learning for its provider network last year. Said Coordinator Anna Harutyunyan, "Those not doing STEM were able to get a sense of what we've been doing and what students are experiencing. There was a tremendous amount of interest. Everyone understands that this is exactly how to equip students with greater 21<sup>st</sup> century skills and a stronger sense of empowerment and capacity to advocate for what they want to do."



### 3 Improving Effectiveness of Cross-Sector Educator Teams

The FUSE cities have been at the forefront of developing and refining practices for cross-sector teams for several years. This work also fits within the *depth* dimension of the Coburn framework. Among the challenges the cities have tackled: bridging the different cultures of educators in formal and informal learning environments; building high-functioning teams; and

A PASA workshop focuses on how critical thinking, collaboration & perseverance are manifested within both the science standards and the out-of-school quality rubrics.

better understanding how team teaching benefits students. Annual convenings by Every Hour Counts have provided FUSE leaders with opportunities to problem solve together. Said Sabrina Gomez, Senior Director of FUSE and the Expanded Pathways project for Expanded Schools, "Our intent is to go deep enough to catalyze change for educators and students

-- bridging cultures, supporting risk-taking, developing mutual respect and relationships over time. Being a part of the national FUSE network has enabled us to work with a community of innovators who share similar goals. It is so valuable to our effort in New York City."

Hillary Salmons, PASA's Executive Director noted: "In Providence, FUSE has enabled us to invest in teams over several years and they have become a community of practice – growing, reflecting and deepening their skill and commitment to the work. This work is analogous to how the private sector invests in research and development – we need to do the same."

Specific strategies developed by FUSE cities include:

- **Holding pre-service professional development** to set the overall context for informal/formal teams, enabling them to build relationships and access shared language. For example, a PASA<sup>8</sup> workshop focuses on how critical thinking, collaboration and perseverance are manifested within both the science standards and the out-of-school quality rubrics, and cross-walks "inquiry learning" and "youth development."
- **Employing expert educators to provide follow-up coaching onsite for every teaching team** In Providence, schoolteachers provide the coaching while in New York City the coaches are educators from the New York Hall of Science (NYSCI).
- **Preparing teams to plan for complexity.** Anna Harutyunyan of NAZA said, "In one of our most successful teams, the teacher helped the informal educator realize that giving the students more voice and choice meant being prepared to focus the science and engineering practices on wherever the kids decided to take the conversation. That level of readiness is difficult, but good planning helped this team empower youth voice, and guide their students in developing key skills."

**Offering a curriculum and detailed supports.** When Expanded Schools and NYSCI initially trained educator teams for their Design2Learn initiative, they focused on the engineering design process without linking it to a specific curriculum. Explained Gomez: "Teams struggled for practical applications to make the instructional shifts we wanted. When we investigated how teams were using their co-planning time, we realized they were spending too much time figuring out what to teach, and too little time

discussing co-facilitation and how to differentiate based on student needs.” For the second year of the program, ExpandedED Schools and NYSCI co-developed a toolkit of 20 engineering design challenges, with accompanying pacing guides, connections to science and engineering practices and alignment to the New York City Department of Education STEM scope and sequence. Designed for cross-sector teaching teams, the toolkit suggests roles for multiple teachers from different settings. Latoya Braswell, STEM Coordinator and Mentoring Coach at the Highland Park Community School, said, “This is the best professional development I have ever been to. The group is happy, engaged and excited to try these new ideas. Lesson plans are amazing! They offer so many options and so much more support than we are used to.”

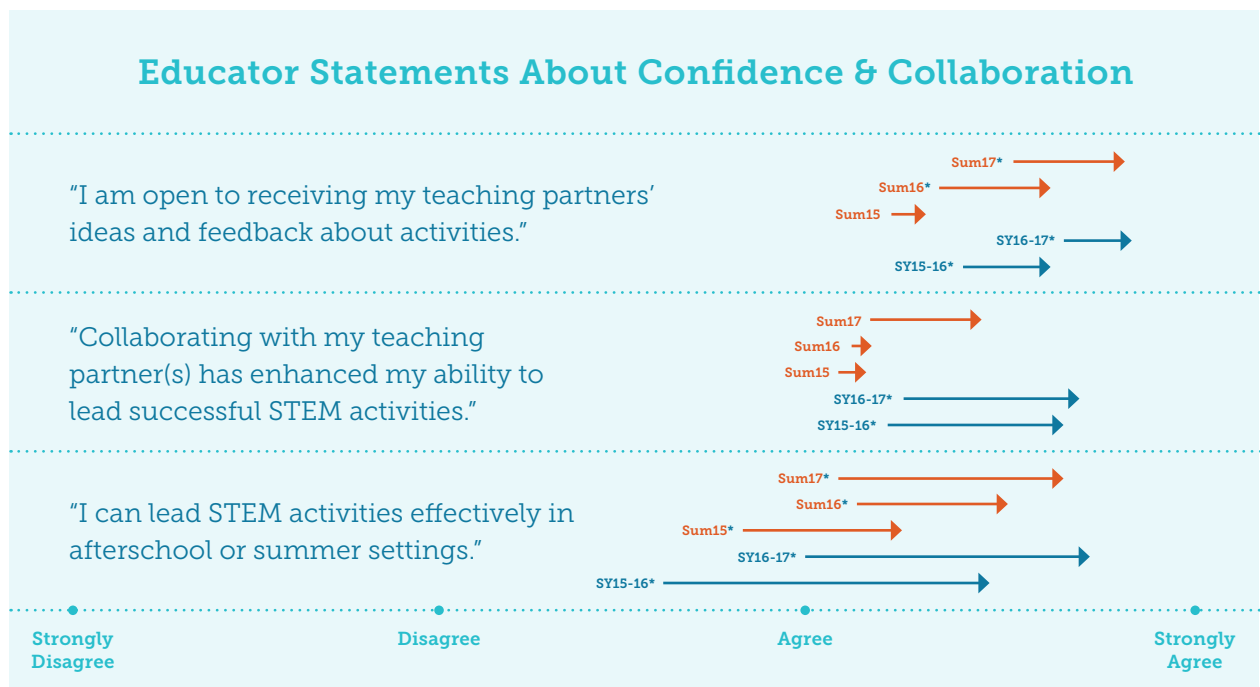
**Helping teams balance the challenge of preserving the informal culture of afterschool with the deep learning expectations of FUSE.** Said Emma Banay, Director of ExpandedED STEM Opportunities, “Getting

students to reflect on what they have learned in an activity is tricky – too many pointed questions make them feel like they are in school, but skimming on reflection means they don’t build that skill, and we don’t know as much about what they have learned. In professional development and follow-up coaching, we work with the teacher teams to naturally integrate open-ended questions into the conversation with students – preserving the informality, but still getting to the deep learning.”

These strategies are seeing results, according to a recent survey of FUSE educators. When asked to identify the ways in which the FUSE initiative impacted their approach to teaching, the most common response from educators across sector (69%) was that

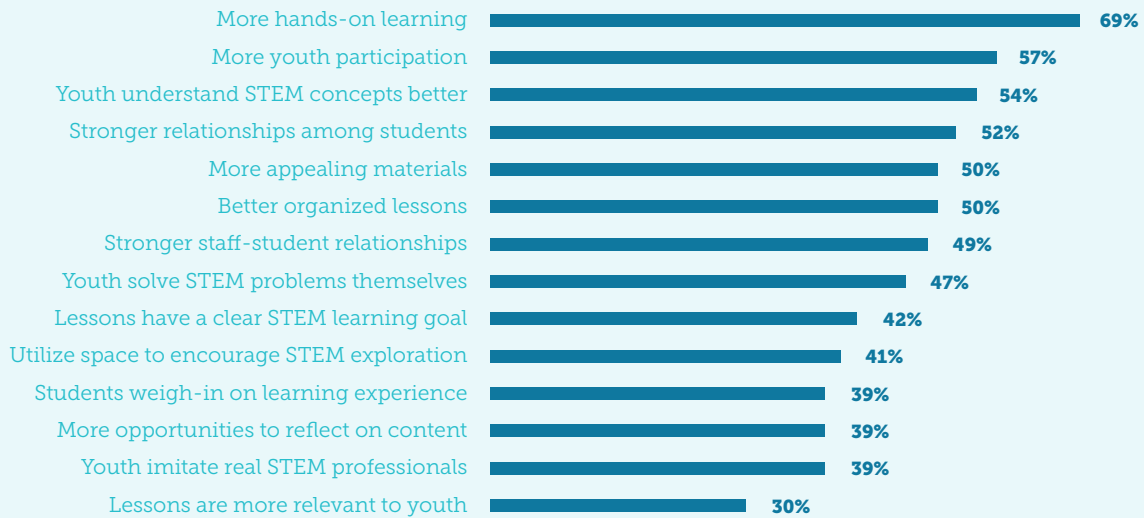
“We work with the teacher teams on preserving the informality but still getting to the deeper learning.”

– EMMA BANAY,  
Director of ExpandedED  
STEM Opportunities,  
ExpandedED Schools



## How did participation in FUSE impact educators' lessons?

MORE THAN HALF OF EDUCATORS REPORTED THAT PARTICIPATION IN FUSE RESULTS IN MORE HANDS-ON LEARNING AND GREATER YOUTH PARTICIPATION IN ACTIVITIES



it encouraged more hands-on learning. K-12 teachers noted that the initiative's most significant impact was in facilitating stronger student-to-student and staff-to-student relationships, while community educators were more likely to indicate that the initiative helped them organize their lessons and helped their students understand STEM concepts better.

Said Nikhol Bentley, Providence Public School District math teacher who co-taught with Save the Bay for the past two summers: "The school year after my first summer with PASA and Save the Bay was my most successful as a teacher. My approach is now a lot less teacher-led and a lot more student-led. I learned in the summer that students do a lot better and are more engaged when you trust them to work it out using each other and not the teacher as their primary resource.

I was so used to that approach from the summer it carried over. It took me awhile to realize – that's how I am teaching now! Then my students showed the highest growth on standardized tests in my school."

Donna Casanova, Supervisor of Science for the Providence Public School District, said: "The key for the teacher is to facilitate students' attention around relevant curiosities, and have the students take the lead in learning. NGSS calls for exploration, problem solving, testing, arguing with evidence, etc. One way we are supporting our teachers' growth is creating strategic and meaningful partnerships with community-based organizations. Teachers who work with informal educators get jazzed up, and just blossom in understanding the relevance of the subject to the real world."

#### 4 Building Awareness Within Diverse Stakeholder Networks

In Coburn's framework, *spread* requires diffusion of the innovation to large numbers of users. In the FUSE context, teachers and school leaders, STEM-expert organizations and community-based youth program providers are diffusing FUSE innovations through their own affiliate networks, professional learning opportunities and sector-building organizations – whether local, regional or national in scope.

##### For example:

- The Audubon Society of Rhode Island is bringing lessons learned from FUSE to the Rhode Island Environmental Education Association and the Rhode Island Science Teachers Association. The New York Hall of Science is presenting to the Association of Science and Technology Centers and the National Science Teachers Association. FUSE intermediaries have presented about their work to the Every Hour Counts and STEM Learning Ecosystems networks.
- At the Nashville Parks Department, afterschool educators who participated in FUSE have advocated for an expansion of the STEM focus throughout all programs. Said NAZA's Harutyunyan, "We want to empower afterschool educators to change the minds of people about why STEM is important for our youth, so we can bring these experiences to elementary and high school educators, and everywhere in Nashville."
- Teachers participating in FUSE have become STEM leaders in their schools. In New York City, Ruth Levantis, K-5 Science Teacher at P.S. 59 partnering with the Committee for Hispanic Children, has participated in FUSE for three years. She has taken

what she's learned at the trainings at NYSCI back to her site to facilitate smaller workshops for afterschool staff. Other FUSE sites have raised awareness beyond the school building, hosting a STEM Night inviting parents, families and the

community to participate alongside young people. M.S. 61 partnered with the New York Junior Tennis League to host two family events featuring STEM design challenges. "The families told us how they incorporated

knowledge of STEM into their thinking process and how they problem-solved each challenge," explained Nellie Spalding, a science teacher at M.S. 61. Nikhol Bentley, Providence Public School District math teacher, noted, "my colleagues and principal are listening, and I am saying, put students at the center."

"My colleagues and principal are listening, and I am saying, put students at the center."

– NIKHOL BENTLEY,  
Providence Public School  
District Math Teacher



Staff from afterschool programs funded by the Nashville After Zone Alliance experience a design challenge for themselves during the 'STEM Day of Learning' that was planned and facilitated by their peers – three informal educators from Metro Parks who engaged in Nashville's FUSE project.

## 5 Catalyzing city, district and state leaders to broadly adopt FUSE elements

Defined by Coburn, *shift* happens when “ownership of the innovation is assumed by users, who deepen and sustain the innovation via adaptation.” Intermediaries in FUSE cities are achieving *shift* by catalyzing district, city and state leaders to adopt FUSE elements into STEM policy frameworks, requests for proposals, and pedagogical expectations for teachers. District-level STEM administrators are inviting community-based educators to participate in school-sponsored professional development alongside teachers. In many cases, district leaders are turning to educators in the informal STEM community to lead professional development sessions for teachers. Beyond STEM-focused efforts, intermediaries are finding ways to infuse many high-profile education initiatives with FUSE elements. As these efforts take hold, they will inform shifts in the FUSE approach aligned with the final dimension of the scaling framework, *evolution*. Already, the cities are experimenting with the balance of co-planning, professional development and co-teaching that delivers desired outcomes. We expect that adaptations to the core elements, and the way they are implemented, will inform further scale and sustainability work championed by Every Hour Counts.

### ***FUSE elements inform STEM policy frameworks, program designs, and funding priorities***

In 2017, Boston Public Schools and the Mayor’s Office launched the 5th Quarter summer learning initiative with 31 sites serving 2,175 youth, supported by an investment of \$1.4 million from BPS and \$700,000 in private funds raised by BASB. Said Superintendent Tommy Chang in announcing the program, “When you

go to classrooms where young people are working on projects, it’s powerful. They’re producing things that change their lives and affect the community. And summer is a great time to be able to do this sort of learning” (Larkin, 2017). BASB’s Smith said: “The 5th Quarter codifies and funds hands-on summer learning delivered through partnerships with BASB and community-based organizations -- clear evidence of how BPS leadership has embraced FUSE-informed practices.” The elements of the 5th Quarter reflect the FUSE core elements:

- Partnership with community
- Cross-sector professional development
- Hands-on activities
- Student engagement
- Universal assessments including the Common Instrument, DoS and SEL measures and program performance measures.

BASB’s partnership with the United Way of Massachusetts Bay/Merrimack Valley resulted in a \$3.9 million grant from the U.S. Department of Education for the FUSE-inspired BoSTEM initiative. “BoSTEM’s hands-on approach keeps students engaged in the skills that will build relevance to today’s innovation economy and the increasingly technological world around them,” BPS Superintendent Dr. Tommy Chang said at the grant announcement in January 2018. “In Boston Public Schools, we’re preparing our students for the careers of the future. Some of the jobs our young people will have in five or 10 years haven’t even been invented yet, but we can make sure students have the tools and resources they need to succeed,” said Boston Mayor Martin J. Walsh.

BASB is also advancing policy change through advocacy for legislation at the Massachusetts State House that would expand FUSE elements to other high-poverty cities across Massachusetts, supporting cross-sector partnerships that focus on academic and college and career readiness skills, including critical thinking, collaboration and perseverance.

**“ExpandedED Schools has laid the groundwork for the important partnerships between teachers and out-of-school-time personnel.”**

**– LINDA CURTIS-BEY,  
Executive Director, STEM  
Department, New York City  
Department of Education**

providers, a first-ever collaboration that included an increase in the City’s financial commitment. The RFP was the result of cross-sector planning led by the City and school district. In 2017, the City doubled the number of young people served in summer learning programs. Said Lily Gutterman, Deputy Policy Director, City of Providence: “PASA has been a critical partner informing our ideas of what out-of-school learning can look like. Their model demonstrates the power of the collaboration between community-based educators and classroom teachers and has informed our approach to summer learning.” Said PASA’s Salmons, “There were so many little pieces in the RFP that showed the City and the school district really get it and see the benefits of what we’re doing. Through that RFP, the City and PPSD expanded elements of the FUSE model to students in

In Providence, PASA has influenced the transformation of the city and school district’s approach to summer learning. In 2016, the Providence Mayor’s Office and the school district released a request for proposals for summer learning

elementary schools, far more students than we would have been able to serve in the programs supported by FUSE alone.”

Simone Palmer, Science and Technology Specialist at the Rhode Island Department of Education (RIDE), oversees science education for the state. She is working with PASA to convene educators from formal and informal environments from across Rhode Island for joint professional development. Said Salmons: “PASA and RIDE both have a vision that we are all science educators and we should be one system, not operate in systems that are wholly separate from each other.” Palmer explained: “Our goal is to create a statewide community of practice of science educators from all sectors. PASA really made me aware of the importance of considering each sector’s interest and needs and identifying what is going to motivate them to partner with each other. How do we get everyone at the table? One of the key reasons working across sectors is so important is equity. Children who attend districts in wealthier communities are already accessing these enrichments – children without economic means must be able to do the same.”

In New York City, education policy frameworks are strongly reflecting FUSE elements, and city agencies have infused FUSE elements in the development of new partnerships and programs. “ExpandedED has shared with us their vision of the importance of coordinating out-of-school-time STEM programs and activities with what happens during the school day. They have laid the groundwork for the important partnerships between teachers and out-of-school-time personnel,” said Linda Curtis-Bey, Executive Director, STEM Department, Division of Teaching and Learning, New York City Department of Education (NYC DOE).

The NYC DOE STEM Framework names Strategic Partnerships as one of four primary domains, noting that “building a collaborative learning community, where teachers work together with each other, with partners, and across disciplines, is necessary for a school to develop a fully integrated STEM program.”

After FUSE implementation for several years, the New York City Department of Youth and Community Development required all publicly funded after-school programs to incorporate STEM into their initiatives, signaling that STEM is no longer a “nice to have” and is now an expectation for after-school. And, at the urging of Expanded Schools, NYC DOE for the first time partnered with the New York Department of Youth and Community Development (DYCD) to influence Summer in the City, New York City’s approach to summer learning, co-locating mandated summer schools with summer programs, focusing both on STEM. Summer in the City has both mandated and enrichment programs for students featuring full-day programming with a focus on engineering design, supported by joint professional development for teachers and afterschool educators. “Expanded Schools got us to the table with DYCD, and our ideas just kept getting bigger,” said Nancy Woods, Director of Technology and Engineering, Division of Teaching and Learning, NYC DOE. “The first year of the enrichment program STEM Summer in the City, we had 800 students; now we have 4000 students; with a 90% return rate for teachers. We’re getting emails and videos from parents telling us that a spark has been lit in their children.”

In Nashville, city agencies are also infusing FUSE elements into afterschool and summer programming approaches. Stephen Neloms, Superintendent of

the Nashville Parks Department, the city’s largest afterschool provider, explained that before NAZA and FUSE, “STEM was foreign to us. We were about getting the kids playing and moving and paying attention to their health. This is a different element. FUSE and NAZA have changed the way we think about programming, and what we can do. We have always been focused on a well-rounded experience, but now we see we can help kids do better in school, through STEM.”

Angela Simpson, Nashville Parks Department Program Coordinator, said: “When we brought afterschool and schoolteachers together for professional development, they realized they often have very different perspectives about the same child. By the time they get to middle school, a lot of kids do not like school anymore. But they do like afterschool. They can be themselves and relax a little. When teachers co-teach in the afterschool program, they see the children in a different light. They see how they interact with adults in a different way.”

In 2016, Metro Nashville Public Schools (MNPS) launched an afterschool STEM initiative for middle schools funded by the US Department of Education’s Investing in Innovation Fund. Regina Etter, i3 STEM Coach for MNPS, said: “NAZA’s afterschool educators built relationships with our teachers through the i3 training. It’s exciting. Working alongside the afterschool staff reinforces for everyone that the community is a part of the education system for our students. At the training, you might not know who was who – everyone was learning, building relationships and respect. We bring different things to the table, but we are all at the table.” Added Laura Nichols, MNPS Grants Manager, “Partnering with NAZA on FUSE has helped to further the district’s goal of engaging middle school students in project-based,

standards-aligned STEM learning in and out of school, and has expanded the collaboration between school-day and afterschool staff to ensure seamless connections.”

***Beyond STEM: infusing many high-profile education initiatives with FUSE elements***

PASA's Salmons notes, “We’re not implementing FUSE separately from everything else going on around it. We’ve taken what we’ve learned about the practices, the tools, the cross-sector teaching teams, the integration of skills/knowledge and alignment with NextGen and SEL and we have amplified these in any way we can. We’ve been growing stuff in a big way because of the FUSE investment.”

For example, PASA has been tapped by Rhode Island education and corporate leaders to share its expertise in teaching and measuring teamwork, critical thinking, perseverance and other SEL skills during the development of key education and workforce initiatives, including Career Pathways, Computer Science for All, and revision of the state’s secondary school regulations. In fall 2017, PASA and the school district teamed up to win a Barr Foundation grant for their jointly developed high school pathways initiative.

Boston’s approach also embeds FUSE core elements in many contexts. Smith of BASB said, “We have to show that these elements apply to more than one content area to change mindset, and then policy. We are scaling, by working with a collective of partners that together engages kids with the diverse learning opportunities they need: different experiences, different environments, different educators and adults. We are building a coordinated

effort where we can measure across settings and organize around common strategies for getting better.”

ExpandedED Schools’ Senior Vice President Saskia Traill said: “In New York City, education priorities are constantly changing, driven by many stakeholders. We look at the high-profile issue of the day and see how to embed collaboration, cross-sector teams and a focus on active, student-centered learning.” Chris Whipple, ExpandedED Schools’ former Vice President for Programs, added: “FUSE has had a profound impact on increasing respect for the afterschool space among formal educators. For ExpandedED Schools, FUSE has provided the foundation to launch both Design2Learn and Early Risers, and for numerous opportunities to collaborate with NYC DOE and DYCD.” The Early Risers project – a partnership with NYC Men Teach supported by 100Kin10, matches pre-service educators, all men of color, with classroom teachers as their mentors. The pairs attend joint professional development and co-teach STEM in afterschool programs, with the classroom teacher mentoring the NYC Men Teach Fellow.

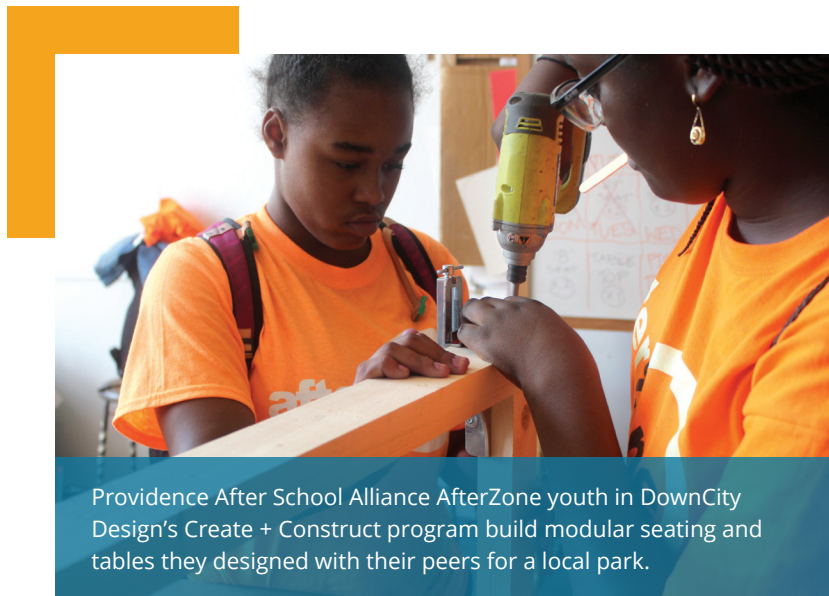
NAZA’s Harutyunyan explains, “The city of Nashville has shown a determination to connect the dots between in-school and out-of-school STEM opportunities. It’s clear that helping youth develop soft skills, like critical thinking, problem solving, flexible thinking, and frustration tolerance are priorities for the public schools, for the city, and for the community-based program providers, and each have invested what they have into doing that with STEM. Having initiatives like FUSE provides an opportunity for each to provide their best resources in a way that impacts youth.”



# Challenges

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**FUSE leaders set out in 2015 to demonstrate successful strategies for building and scaling robust STEM education using a community-centric approach. In interviews, they detailed many examples of the progress they have made, but also described challenges to creating conditions for scale.**



**Breaking out of the education reform 'silos.'** FUSE is a cross-sector effort operating within an environment that is characterized by single-issue approaches. For example, education reforms that focus on improving classroom teacher effectiveness; incorporating social-emotional skill-building; or increasing students' competencies in specific subjects. FUSE crosses all these and more, and it is challenging for its proponents to work within, across and around the funding and policy parameters determined by these silos.

**Scheduling time for cross-sector teams.** Scheduling school and afterschool educators to co-plan, attend joint professional development, and co-teach is difficult amid all the priorities and requirements competing for limited time. Some of the cities found that co-teaching in particular, was trying due to timing and resource constraints, and shifted their focus to ensuring the educators collaborated through joint professional development and planning sessions.

**Accessing sustained funding for afterschool programming and cross-sector collaboration.** In an environment of constrained resources, funding to support collaborative infrastructure is often hard to come by – even though investing in staff that build and sustain cross-sector connections will often leverage additional resources for program expansion. In addition, the threatened elimination of the federal 21<sup>st</sup> Century Community Learning Centers program, expected budget shortfalls at state and local levels, and unstable levels of philanthropic commitment mean that core funding for high-quality programs remain uncertain.

**Gaining attention for science education.** Having successfully strengthened relationships with city and state science leaders, intermediaries were often disappointed to discover the paucity of resources these leaders have to work with, as science education is still under-prioritized in many state and local education systems.

# Recommendations

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**FUSE cities are continuing to increase time for STEM learning across settings; deepen cross-sector collaborations; and focus on SEL and science and engineering practices as young people engage in active learning. We offer recommendations to cities, regions and states that are looking for ways to embed these elements in their own approaches as they strive to improve young people's access to high-quality STEM learning in and out of school.**

*"FUSE is a deep dive into what it really takes to build teams of teachers, afterschool staff, and science experts that work together to turn kids onto STEM. FUSE is delivering results – and its lessons can inform diverse ecosystems across the country,"*

**– RON OTTINGER,  
Executive Director, STEM  
Next Opportunity Fund**

science experts that work together to turn kids onto STEM. FUSE is delivering results – and its lessons can inform diverse ecosystems across the country," said Ron Ottinger, Executive Director of the STEM Next Opportunity Fund and Co-Chair of the STEM Learning Ecosystems Initiative.

In particular, the STEM Learning Ecosystems (SLE) initiative is well positioned to examine lessons from FUSE. SLE supports 56 communities working across sectors to dramatically improve young people's opportunities to succeed in STEM (Boston, Providence, New York and Chicago are part of the SLE initiative). "FUSE is a deep dive into what it really takes to build teams of teachers, afterschool staff, and

We hope this paper piques the interest of schools, youth program providers, intermediaries, STEM institutions, funders, researchers and policymakers. Every Hour Counts envisions expanding its national community and continuing to learn from a growing network of talented innovators across the country. We present recommendations in the areas of practice, policy and research:

## Practice Recommendations

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- **Tap intermediaries as the natural leaders of FUSE collaboratives.** Intermediaries well-positioned to lead FUSE collaboratives include citywide organizations such as the Every Hour Counts network, members of the STEM Learning Ecosystems initiative, or statewide afterschool networks, among other possibilities. All of these would bring the needed core competencies, including experience brokering cross-sector partnerships among schools and external partners; managing quality improvement and professional development systems for out-of-school programs; and designing and implementing effective educator professional development. In addition, because they understand systems change, intermediaries can seize opportunities, manage unpredictability, and find ways to leverage resources to scale and sustain the effort.
- **Flexibility in implementing the core elements, adequate support for practitioners, and a commitment to continue common assessments should anchor new FUSE efforts.** Current FUSE

leaders should closely examine the efficacy and costs of co-planning vs. joint professional development vs. co-teaching to provide guidance to new communities. As sites adapt to local constraints and opportunities, the national network can provide key support and continue to demonstrate youth, educator and system impact.

- **Improve the conditions for scaling cross-sector collaboration.** If possible, cross-sector professional development should be designed to align to the professional development requirements for both teachers and out-of-school educators, resulting in credit for each within their own systems. Planning toolkits and detailed curricula can decrease the time needed to prepare cross-sector teams; while attention to choosing successful matches between teachers and informal educators will pave the way for high-functioning teams.
- **Explore opportunities to integrate FUSE elements into pre-service teacher preparation.** Expanded Schools' Early Risers initiative, through NYC Men Teach, is designed so that pre-service teachers gain experience in high quality afterschool settings, alongside school-day teachers as their mentors. Similar partnerships with teacher education institutions and programs could substantially expand the number of pre-service teachers gaining clinical experience in out-of-school programs while being mentored by certified teachers.

## Policy Recommendations

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- **Advance FUSE-informed approaches to professional development.** Many school-day

teachers participating in FUSE confirm that the joint professional development has impacted their teaching more than any school-led professional development. This is particularly true in relation to making the instructional shifts necessary to meet the expectations of the new science standards. Policy and funding improvements within local and state education systems would enable more teachers to access professional development that meets their stated needs, including support in designing/leading active learning approaches; follow-up onsite coaching that provides non-evaluative feedback; and specific curricula and activity supports.

- **Advance policies that support meaningful and effective formal-informal STEM collaborations.** FUSE has helped strengthen relationships among systems-level decisionmakers that can pave the way for the adaptation of FUSE elements at greater scale. We have already seen examples of this in the current FUSE cities with Boston's proposed summer learning legislation and New York City's STEM Framework that emphasizes the importance of partnerships. These efforts can be accelerated to leverage current and evolving education priorities. For example, at the state and district levels, ESSA plans related to STEM should directly incorporate meaningful and effective informal STEM collaborations.
- **Amplify awareness of FUSE's impact on youth and educators.** This report found that stakeholders are already spreading awareness of FUSE through many of their own networks and communities. A strategic effort to add compelling case studies and individual stories to the quantitative data and help publicize through local, regional and national

networks would help strengthen policy and advocacy efforts in many contexts.

## Research Recommendations

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- **Better understand FUSE's impact on formal and informal educators.** Anecdotal evidence and educator surveys indicate that participating in FUSE impacts classroom teachers and community educators in profound ways. Research is needed to explore the range of ways that participating in FUSE may impact educators, including increased confidence, skill acquisition, retention, advancement, and assumption of leadership roles.
- **Expand research and development of formative assessments for use in informal environments.** The FUSE community has

developed initial formative assessments of science and engineering practices designed for use in informal learning environments. Further research and development could improve these efforts and examine how to effectively assess student learning without disrupting the key characteristics of the informal learning environment.

- **Explore the intersection of science and engineering practices and youth voice in formal and informal learning environments.** Youth voice and agency are often undervalued in both formal and informal learning environments. What does it look like to focus on the development of science and engineering practices with an emphasis on fostering young people's agency over their own learning? Although FUSE sites offer promising examples, more research is needed to explore this approach.



A STEAM Team participant demonstrates programming for family & friends at Sociedad Latina's final showcase (Credit: Casey Atkins Photography). | *Boston After School & Beyond*

# Conclusion

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## **Global and local education assessments confirm there is no shortage of challenges facing American public education.**

Among the most troubling, given the rapid pace of change in today's economy: how the narrow definition of academic achievement codified in the 2001 No Child Left Behind Act changed instruction in ways that under-prioritized science education, constrained student agency, blunted innovation and ignored development of 21<sup>st</sup> century skills. While there are signs that the pendulum is swinging toward embracing a more holistic view of the set of skills, capacities and knowledge critical for college and career success in today's world, progress is slow, and stunted by continuing inequities in opportunity due to race, ethnicity, income, and geography.

The notion that 'schools can't do it alone' as they face these complex challenges is now nearly ubiquitous. But what does it mean? Schools have plenty of partnerships that are limited in scope and transactional in nature. What does it look like when school districts and community partners deeply connect formal and informal environments to deliver on broad learning and development goals for young people? That's the question FUSE cities set out to answer. Their progress over the past few years has been significant and has begun to shift mindsets among systems leaders and frontline educators toward embracing the belief that young people need a broad mix of connected learning experiences, across time and settings, to fully develop their knowledge, skills and identities.

FUSE has also put a spotlight on the potential of the informal learning environment to support teachers' shifts to more learner-centered pedagogy. The FUSE cities have shown that, in the informal learning environment, teamed with community educators and freed from the demands of scope, sequence and test-based accountability, teachers begin to transform their practice.

The FUSE cities continue to sharpen their effectiveness, working at the point of service to support transformative adult-youth interactions and meaningful educator-to-educator collaboration; and at the systems level to ensure policy and funding decisions encourage and enable cross-sector collaboration as a way of doing business.

**Every Hour Counts will continue to convene stakeholders, disseminate knowledge and catalyze change. Our vision is that all young people have opportunities to build the full set of skills, knowledge and experiences that are the foundation of an innovative, compassionate and creative civic community.**

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# External Links

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- (1) <https://www.expandedschools.org/>
- (2) <https://stemnext.org/>
- (3) <https://www.everyhourcounts.org/>
- (4) <https://www.afterschoolmatters.org/>
- (5) <http://stemecosystems.org/wp-content/uploads/2015/10/Dede-Scaling-Up-Chart.pdf>
- (6) <https://bostonbeyond.org/>
- (7) <https://nashvillez.org/>
- (8) <http://www.mypasa.org/>

# Boston



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School District

Boston Public Schools

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STEM-Expert Institutions

The PEAR Institute: Partnerships in Education and Resilience; Boston Public Schools, Science Department

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Community-Based Program Providers

Community Boat Building – Harvard-Kent; Community Boat Building – Young Achievers; Citysprouts – Higginson Lewis; Citysprouts – Orchard Gardens; Thompson Island Outward Bound – King; Thompson Island Outward Bound – Neighborhood House Charter School; Thompson Island Outward Bound – Young Achievers; Breakthrough Greater Boston – Boston Campus; Breakthrough Greater Boston – Cambridge Campus; Boston Plan for Excellence at Dearborn STEM Academy – Summer Learning Academy; Hale Reservation – Hale Outdoor Learning Adventures (SLA); Sociedad Latina – STEAM Team Summer; Thompson Island Outward Bound – Summer Connections

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Funders

Linde Family Foundation, United Way of Massachusetts Bay and Merrimack Valley, US Department of Education

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Other Partners

United Way of Massachusetts Bay & Merrimack Valley; City of Boston; National Institute on Out-of-School Time; CitySpan; AmeriCorps (VISTA program) ; Boston and Metro North STEM Network (PIC); Massachusetts STEM Advisory Council

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**Boston After School & Beyond**

Boston After School & Beyond is a public-private partnership that seeks to ensure that every child has the opportunity to develop to his or her full potential. Its role is to increase learning and skill development opportunities for students during the afterschool hours and summer months. In 2017, BASB worked with the City of Boston, Boston Public Schools, 183 programs, 90 district schools, 10 funders, and local and national research organizations to expand high-quality learning opportunities for 13,500 Boston youth. Through these partnerships, BASB aims to equip all of Boston’s young people with skills necessary to navigate the challenges of school, college, work, and life.

# Chicago



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School District Chicago Public Schools

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STEM-Expert Institution Northwestern University's Office of Community Education Partnerships and the Chicago STEM Ecosystem

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Community-Based Program Provider After School Matters

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Local Funder Relativity Gives

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Other Partner Inventibles

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## After School Matters

After School Matters provides Chicago high school teens with high quality, out-of-school time opportunities to explore and develop their talents while gaining critical skills for work, college and beyond. Since 1991, After School Matters has offered more than 300,000 teen opportunities in After School Matters' hands-on, project-based after-school and summer programs in the arts, communications and leadership, sports and STEM. Programs take place at locations throughout the city including Chicago public high schools, Chicago Park District and Chicago Public Library locations, community-based organizations, the Michael and Karyn Lutz Center for After School Matters on the north side, and downtown at the Gallery 37 Center for the Arts.

# Nashville



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School District Metro Nashville Public Schools

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STEM-Expert Institutions Nashville Public Library's Studio NPL; Mr. Bond; Science Guys; Engineering for Kids; Urban Green Lab; Adventure Science Center

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Community-Based Program Providers Metro Parks, Moves and Grooves, PENCIL Foundation (no longer operating programming), Martha O'Bryan Center, Conexión Américas

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Local Funders James Stephen Turner Family Foundation, First Tennessee Foundation

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## Nashville After Zone Alliance (NAZA)

The Nashville After Zone Alliance (NAZA) is an expanded learning system that aims to strengthen free, high-quality expanded learning opportunities that prepare Metro Nashville Public Schools (MNPS) students to succeed in high school and beyond. In partnership with more than 20 youth-serving organizations, NAZA engages approximately 2000 students annually through coordinated delivery of afterschool and summer programs. Additionally, NAZA provides professional development and other capacity building supports to youth serving organizations to foster a citywide culture of safe and supportive environments for youth across Nashville. NAZA was established by the Mayor's Office in 2010 but is now housed in the Nashville Public Library. NAZA partner with Metro Schools, the Mayor's Office, Nashville Public Library, and youth-serving organizations.



# New York City



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School District                      New York City Department of Education

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STEM-Expert Institution                      New York Hall of Science

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Community-Based Program Providers                      Sheltering Arms Children and Family Services; Millennium Development Corporation; Chinatown YMCA; Maspeth Town Hall, Inc.; Kingsbridge Heights Community Center; Global Kids, Inc.; NIA Community Services Network; Eastside House Settlement; Cypress Hills Local Development Corporation; Mosholu Montefiore Community Center; New York Junior Tennis League; Sports and Arts in Schools Foundation; Community Counseling and Meditation Services; South Bronx Neighborhood Center; Aspira of New York Inc.; Hands in 4 Youth; Play Study Win; University Settlement; Partnership with Children; The Educational Alliance; Good Shepherds Services; Toast Program; The New Teacher Center

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Local Funders                      The Pinkerton Foundation, The Overdeck Family Foundation, Carroll Petrie Foundation, Google, 100Kin10

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Other Partners                      New York City Department of Education, NYC Department of Education Office of Teacher Recruitment & Quality, New York City Men Teach, Department of Youth and Community Development, City University of New York, La Guardia Community College, Hostos Community College, Bronx Community College, New Teacher Center

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**Expanded Schools**                      ExpandedED Schools is a nonprofit dedicated to its mission of closing the learning gap by increasing access to enriched education experiences. In 1998, ExpandedED Schools was founded as The After-School Corporation and created the nation’s first citywide system of quality K-12 after-school programs. Today, ExpandedED Schools has built on that experience, and whether in school, after school or during the summer, ExpandedED Schools seeks to ensure that all kids have opportunities to discover their talents and develop their full potential.

ExpandedED schools also has extensive experience evaluating a broad range of after-school programs and using proven systems for quantitative and qualitative data collection that rely on empirically sound and validated instruments, analysis and reporting. For a decade, ExpandedED Schools has served as the external evaluator of more than 150 21st Century Community Learning Center programs, improving education for tens of thousands of kids throughout New York City.

# Providence



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School District	Providence Public Schools
STEM-Expert Institution	Providence Community-Based Providers
Community-Based Program Providers	Roger Williams Park Zoo; Save the Bay; Audubon Society of Rhode Island; Recycle-a-Bike; Woonasquatucket River Watershed Council; Providence CityArts for Youth; RiverzEdge Arts; DownCity Design; SmartTest Inc; Brandaris Maritime; Community Boating Center; Rhode Island Museum of Science and Art; Southside Community Land Trust; Tri-Tech Pathways, Inc; CityYear Providence; Boys & Girls Clubs of Providence; Providence Public Library; Center for Dynamic Learning
Local Funders	City of Providence; Providence Public Schools; Providence Journal; Rhode Island Department of Education; Bank of America; Textron; Dassault Systemes
Other Partners	RI STEAM Center; Providence/Cranston Workforce Board; Rhode Island Environmental Education Association; Afterschool Leadership Circle of the United Way of Rhode Island

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## Providence After School Alliance

Since 2004, the Providence After School Alliance (PASA) has created engaging learning environments that help Providence young people succeed in- and out-of- school, while sparking new passions and interests that can last a lifetime. PASA was created to knit Providence's wide range of after-school programs together into a coherent system of consistently high quality, developmentally aligned programs that help ensure all Providence youth can experience a diversity of dynamic learning opportunities in STEM, the visual and performing arts, athletics, and career exploration.

PASA accomplishes this by building sustainable partnerships with City departments, the Providence Public School District, 70 community-based program providers, community development corporations, and district teachers. As a result, PASA's AfterZone and Hub expanded learning systems provide middle and high school youth with a citywide community of caring adults that come together to help them build lifelong essential skills like teamwork and communication, and provide hands-on learning experiences that are novel to many of the City's low-income youth.

# Every Hour Counts: Expanding Learning, Expanding Opportunity

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Every Hour Counts is a leading voice in promoting the work of building expanded-learning systems.

## Every Hour Counts:

- Supports a community of practice by sharing promising practices and engaging in knowledge-sharing activities.
- Leads demonstration projects that test the feasibility of policy and practice concepts, and disseminates findings and tools for replication.
- Developed a Measurement Framework that describes common measures for outcomes at the youth, program and system levels. This framework provides a blueprint for coordinated accountability and improvement, so quality practices lead to measurable, improved outcomes for students.
- Catalyzes city-wide STEM initiatives in seven cities in partnership with the Noyce Foundation and STEM Next. These efforts shift a cultural mindset to make STEM an expectation in expanded learning and bridge the informal and formal sectors through collaborative teaching.
- Advocates for policy change. We partnered with Congressional leaders to develop the “Community Partnerships in Education Act,” introduced by Congressman David Cicilline (RI) and Senator Sheldon Whitehouse (RI). This legislation resulted in a priority on partnerships and intermediaries in the Every Student Succeeds Act (ESSA).
- Convenes stakeholders to share knowledge and ideas. We host an annual national system-building institute that has attracted teams from more than 30 communities around the country.
- Provides local, customized technical assistance.

The Every Hour Counts coalition represents longstanding partnerships with more than 3,500 schools, districts, and community based-organizations that provide quality after-school and summer programming. Every Hour Counts partners and learning community members support initiatives that reach more than 500,000 students each year.

## Every Hour Counts partner organizations:

[After School Matters](#), Chicago  
[Boston After School & Beyond Collective for Youth](#), Omaha  
[ExpandED Schools](#), New York City  
[Family League of Baltimore](#)  
[Nashville After Zone Alliance](#)  
[Partnership for Children and Youth](#), Bay Area  
[Prime Time Palm Beach County](#)  
[Providence After School Alliance](#)  
[Youthprise](#), Twin Cities, MN

## Every Hour Counts learning communities:

[Alleghany Partners for Out-of-School Time](#), Pittsburgh  
[Dallas Afterschool](#)  
[Denver Afterschool Alliance](#)  
[The Skillman Foundation](#), Detroit  
[California Teaching Fellows Foundation](#), Fresno  
[CASE](#), Houston  
[Youth Development Executives of King County](#), WA  
[Newark Thrives!](#)  
[Next Up RVA](#), Richmond, VA  
[Greater Rochester After School Alliance](#)  
[Sprockets](#), St Paul



Students today need more ways to learn so they are prepared for college and career. But the young people who most need additional learning opportunities are least likely to have them. Every Hour Counts is a coalition of citywide organizations that increases access to quality learning opportunities, particularly for underserved students. Our approach - called an expanded-learning system - coordinates the work of service providers, public agencies, funders, and schools, so dollars stretch farther and more young people are served.



STEM Next Opportunity Fund, legacy to the Noyce Foundation, is a venture philanthropy fund playing a critical role in bringing in- and out-of-school STEM learning opportunities to millions of children and closing the gender gap in STEM careers. STEM Next Opportunity Fund is a national leader, strategic guide, policy advocate, and investor that is bringing about a transformative expansion of high-quality and inclusive STEM learning opportunities. By investing early in the life of our children, we are transforming their lives and preparing them for the 21<sup>st</sup> century economy.