

STEM EDUCATORS ACADEMY RESEARCH BRIEF

SUMMARY

This paper reports on the promising findings of our STEM Educators Academy, an ExpandedED Schools initiative where classroom teachers and after-school educators engage in joint professional development at premiere science institutions and then work together back at their schools to teach maker-design projects that spark student interest and cultivate curiosity in STEM subjects.

BACKGROUND

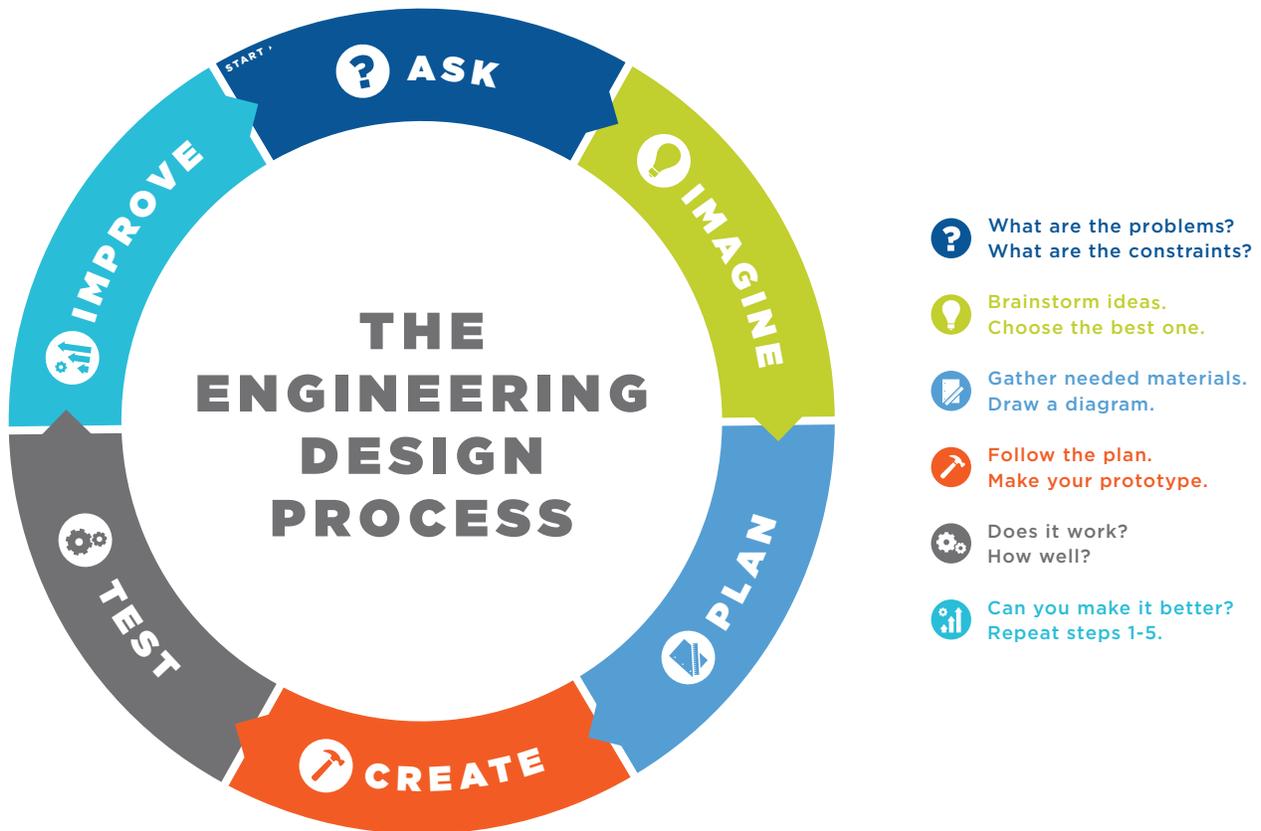
In order to solve the problems of an increasingly complex future, we need to help our young people innovate effectively and creatively. Communities can address this challenge by fostering critical-thinking, problem-solving and collaboration skills and empowering tomorrow's workforce to be effective leaders and enthusiastic scientists. Learning science, technology, engineering and math skills is a lot like learning a new language: in order to build their fluency, young people need opportunities to practice their STEM skills in immersive, hands-on ways both in and out of the classroom. In response to a charge from The Pinkerton Foundation to form collaborations, ExpandedED Schools partnered with the New York Hall of Science (NYSCI) to launch the STEM Educators Academy. The Academy offers young people immersive learning experiences through programs that combine classroom and “real world” learning opportunities. We do this by blending the time and talents of classroom science teachers, community educators of after-school programs and experts at premiere science institutions.

The Academy was designed to increase STEM skills through targeted professional development for educators (both classroom teachers and community educators), who would then deliver high-quality STEM activities to youth in after-school and expanded learning settings. To develop strong STEM skills, children need access to powerful STEM learning opportunities they can plug into, but many communities lack the resources that can boost young people's development of these skills, including the professional development necessary to support educators' delivery of robust STEM learning experiences. This uneven distribution of STEM learning resources results in disparities in STEM learning outcomes from community to community. We targeted underresourced communities in order to narrow these disparities.

The Academy was piloted in 2013-14, serving 200 students in five New York City public schools with the New York Hall of Science as a cultural partner. Each of the five schools developed a co-teaching team comprised of one classroom teacher and two after-school community educators. In 2014-15, the STEM Educators Academy expanded to 12 schools with 15 teams in total, serving 640 students, and The Institute of Play joined the Academy as a new cultural partner. In 2015-16, the Academy expanded once again, serving 1,500 students in 23 schools with 25 teams and added the Intrepid Sea, Air and Space Museum as a partner.

Each team participates in a weeklong institute over the summer, learning design projects that they can implement in the classroom to fuel STEM interest and excitement. The cultural partners deliver collaborative professional development that engage teachers and community educators in the fundamentals of scientific inquiry and the engineering design process through the lens of maker design, gaming and system mechanics. The design process is a key feature of new science

and engineering standards and helps students understand the problem-solving, development and rigorous testing that goes into all kinds of engineering, such as creating household appliances, mobile apps or civic infrastructure projects.



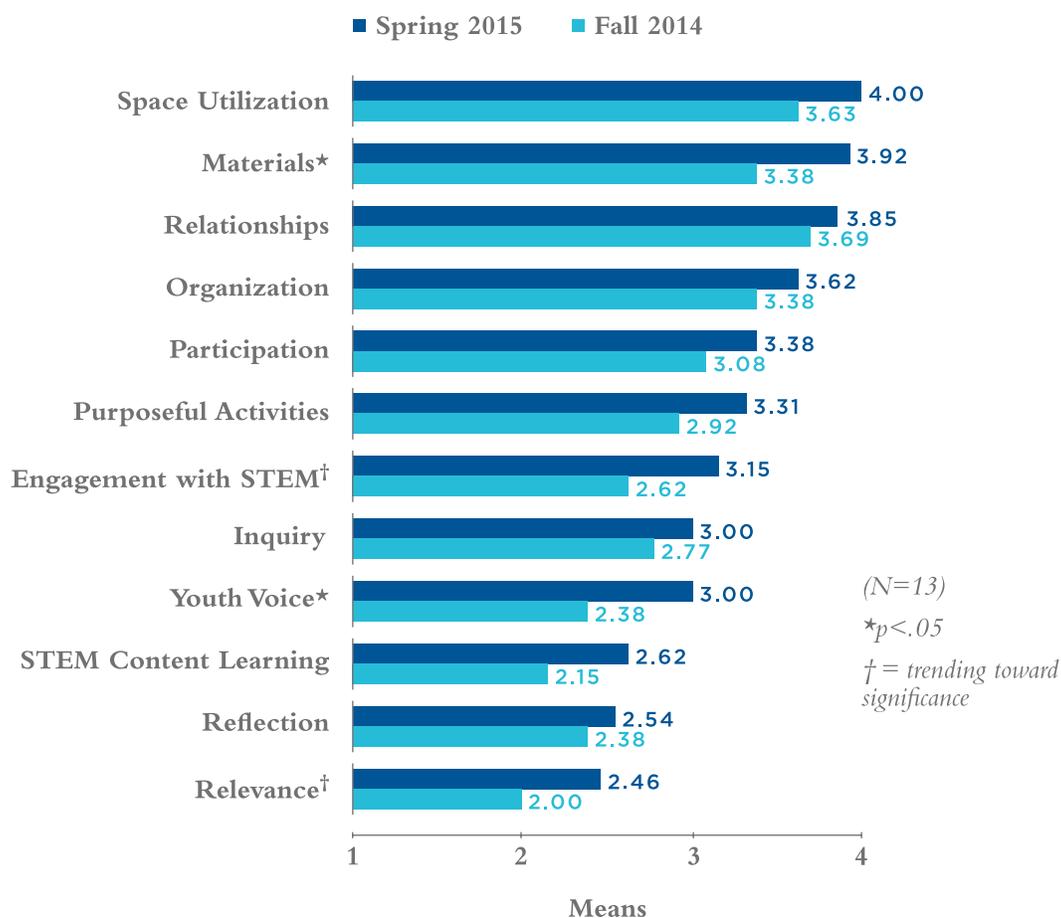
After the summer institutes, the educator teams meet together back at their schools to plan and team-teach projects throughout the year that support the curriculum. They meet weekly to design and plan activities that bridge school day and out-of-school learning, applying the strategies, instructional techniques and skills they learned at professional development workshops. Educator teams use the NYC Science Scope and Sequence and the Science and Engineering Practices of the Next Generation Science Standards as a foundation for their lesson plans. For example, 4th and 5th graders learning about the hydrosphere and water cycle designed and created a water filtration device with available materials, using the engineering design process as they built, tested and measured the performance of their devices.

This paper describes key findings from an evaluation conducted during the second year (2014–15) of the Academy. We routinely look at ways in which we can improve the effectiveness of our work. We hope these interim findings will be useful to others who are considering collaborative teaching strategies to boost STEM learning.

KEY FINDINGS / STRENGTHS

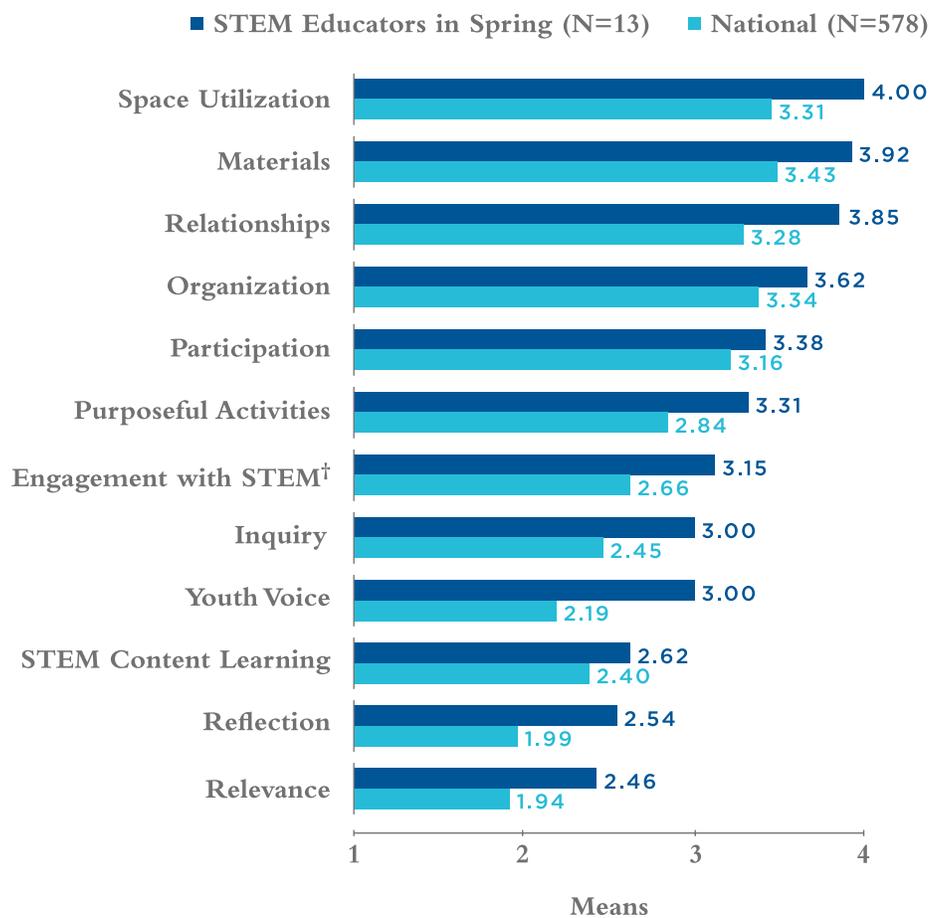
The quality of STEM activities increased over the course of the year. ExpandedED Schools looked at changes in program quality over time using observation data gathered through the Dimensions of Success (DoS) tool. This tool, developed by The PEAR Institute: Partnerships in Education and Resilience at Harvard, is used nationally across after-school and summer programs and measures STEM activity quality in twelve dimensions, ranging from space utilization to building positive relationships. In our study, the same teaching teams were observed in fall 2014 and spring 2015. Activities were scored higher in all twelve dimensions in the spring compared to the fall (see Figure 1). Scores of STEM content learning, reflection and relevance remained low relative to other dimensions of success. The largest increases were in the extent to which educators used appealing and appropriate materials and created opportunities for youth voice and choice during STEM activities.

Figure 1. Mean Changes for Science Dimensions From Fall 2014 to Spring 2015



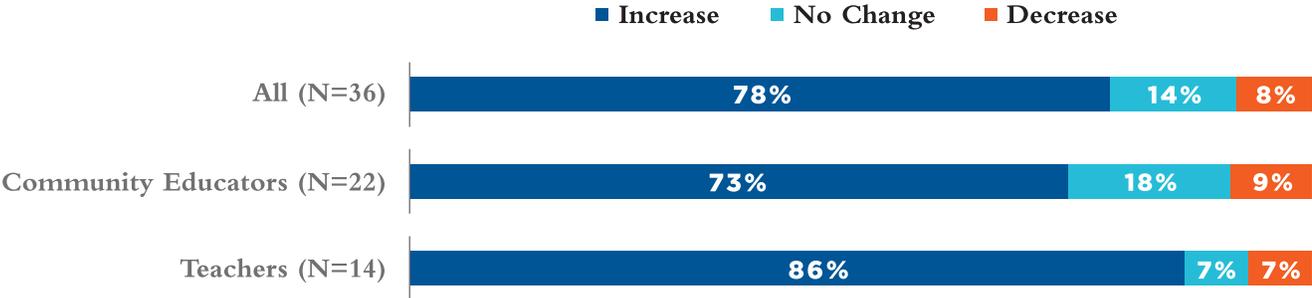
STEM Educators Academy programs surpassed national norms for quality. ExpandedED Schools compared the results from STEM Educator Academy sites to national data. Academy teams' activities scored above the national means for eight dimensions in Fall 2014 and above the national means for all twelve dimensions in Spring 2015 (see Figure 2). A key achievement was the increase in the mean for STEM Content Learning, which was below the national mean in the fall, but surpassed the national mean in the spring.

Figure 2. STEM Educator Academy Sites vs. National Sample: Spring 2015



STEM Academy educators increased their confidence. Over three-quarters of survey respondents, including both community educators and teachers, increased their confidence overall (Figure 3). Nearly three-fourths of community educators reported an increase in confidence; interestingly, this included both those educators with and without a STEM background. For classroom teachers, the results were particularly striking: 86% of these respondents reported increases in confidence. Teachers reported that the STEM Educators Academy had “impacted my teaching science during the day” because “I [now] plan my activities and labs in a new way” and helped ensure that they are “connecting what students learn during the day with the science-related activities that students participate in during ELT [expanded learning time].” They also reported that the Academy inspired them to “create much more interesting science experiments and experiences for the students,” and that the trainings “opened my eyes to how design can work in a classroom.”

Figure 3. Staff Instructional Confidence Score Change



KEY FINDINGS / CHALLENGES

Teachers are building the learning environments where our nation’s future is developing. These builders need sturdy scaffolding – with great attention to the details of that support – and sufficient resources to do their work effectively. The quality of the scaffolding that supports educators will affect how well they can do their job for students.

Teachers and community educators need additional support to incorporate opportunities for reflection and relevance in STEM learning. Programs under observation were strong in some dimensions of informal science learning and youth development, such as using appealing and appropriate materials and building relationships. However, educators found it challenging to incorporate reflection and relevance into their activities—not only purposefully creating these opportunities during activities, but having young people themselves reflect substantively on the concepts they learned and then connect these activities to their everyday lives.

Teachers and community educators need support to find and use planning time effectively. Classroom teachers reported that using planning time effectively and developing after-school STEM activities that linked to school day curricula were the biggest challenges to collaborative planning time. For community educators, it was a different story: finding time to meet with their educator teams was the biggest challenge.

RECOMMENDATIONS

ExpandedED Schools suggests the following strategies for those working to immerse young people in hands-on, enriching STEM education:

- **Encourage collaborative teaching methods to boost learning.** Whether at the district, school or classroom level, we believe that collaboration between the formal and informal sectors leads to student success. Education agencies, intermediaries, cultural institutions and funders can enable opportunities for joint professional development that incorporate relevance and reflection, as well as strategies for hands-on learning and engagement. Lessons from the STEM Educators Academy might be expanded to other content areas as well. ExpandedED Schools has already applied this approach to literacy.
- **Use data about what is and isn't working to drive professional development.** Using observation data gathered from the DoS tool last year, our cultural partners identified what was working and what wasn't. From this, they modified their professional development and training sessions to include strategies to make reflection time and relevance more explicit, such as encouraging educators to ask students, “What worked in your design?” or “How would you modify it next time?” It's already working: this year, programs are scoring higher in these areas than the previous year. Reflection and relevance are areas for growth across STEM education settings and sharing effective strategies will accelerate success.

- **Build in adequate time for teaching teams to plan together.** Encourage teams of teachers and community educators to set and be accountable for co-planning times during the school year or summer program to create high-quality STEM lessons, and recognize that they may need more than what is scheduled. This may allow teams to improve their collaboration.

The STEM Educators Academy’s collaborative model has generated positive impacts—not only on classroom and community educators, but also on the young people who participate in these STEM activities. This trailblazing initiative is a practical, feasible solution for schools and communities to help build strong STEM learning activities that connect across the learning day. We’ve seen teachers take what they’ve learned from the program and employ these strategies in their school-day science classes. And we’ve seen informal educators find new ways to activate STEM learning. Together, these educators are offering children opportunities to experiment with STEM ideas in real-world situations. We hope others can benefit from our learnings and forge partnerships that will provide robust STEM education to even more students around the country.

ExpandedED Schools is a nonprofit dedicated to closing the learning gap by increasing access to enriched education experiences. In school, after school and during the summer, we seek to ensure that *all* kids have opportunities to discover their talents and develop their full potential.

To learn more about the Academy, contact Saskia Traill, Vice President of Policy & Research, at straill@expandedschools.org or (646) 943-8757.

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ExpandedED Schools
Close the learning gap. Open the world.

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