STEM & Afterschool

Introduction

A robust body of research demonstrates that out-of-school-time activities can be an effective vehicle for increasing children and youths' enthusiasm for and investment in Science, Technology, Engineering, and Mathematics (STEM). There is growing concern across the nation that unless educators can increase students' knowledge of, interest in, and engagement with STEM disciplines, the United States will be unfit to face the challenges of the twenty-first century global economy. Because science and technology underpin nearly every aspect of society, all students will need to be literate in these disciplines regardless of whether or not they plan to pursue careers in STEM. Like their peers across the United States, Rhode Island children and youth are lagging behind in these disciplines.

The promising news is that afterschool and summer learning practictioners in Rhode Island have a wealth of resources to put to good use—from the rich, seaside landscape to a broad range of passionate, qualified individuals to partner with (e.g., academics, STEM professionals, enrichment providers, educators, etc.). Additionally, a host of practitioners in the state are already modeling innovative ways of integrating STEM learning into their afterschool and summer learning programs. With this foundation in place, the afterschool field is well positioned to expand its reach and clear a new path for children and youth across the state.

What is STEM?

STEM is an acronym for Science, Technology, Engineering, and Mathematics. In addition to the common categories of mathematics, natural sciences, engineering, and computer and information sciences, the National Science Foundation defines STEM fields more broadly to include such social and behavioral sciences as psychology, economics, sociology, and political science.[1] Other groups advocate for the addition of the arts (STEAM); arts and manufacturing (STEAMM); or reading, writing, and the arts (STREAM). While RIASPA encourages afterschool practitioners to find inventive methods of blending these fields with additional disciplines, for the purposes of this policy brief STEM will refer to science, technology, engineering, and mathematics.

The Challenges

National Challenges

A 2009 report found that just 14 percent of all U.S. college undergraduates are enrolled in STEM fields.[2] Commonly these students were those who took trigonometry, pre-calculus, or calculus in high school; earned a GPA of B or higher; had college entrance exam scores in the highest quarter; and expected to attain a graduate degree in the future.[3] Also, enrollment was highest among male students, younger students, and students with more advantaged family backgrounds.[4] Thus, there is a critical need to improve access to STEM fields and careers among underserved populations. African-American/Black and Hispanic/Latino students each account for six percent of all STEM workers, but 11 percent and 14 percent, respectively, of overall employment. Women make up 48 percent of the workforce, but they hold only 24 percent of STEM jobs.[5] As a result, women and minorities are underrepresented in many high-paying, high-growth professions, and the nation is deprived of the full benefit of their unique talents and perspectives.[6]

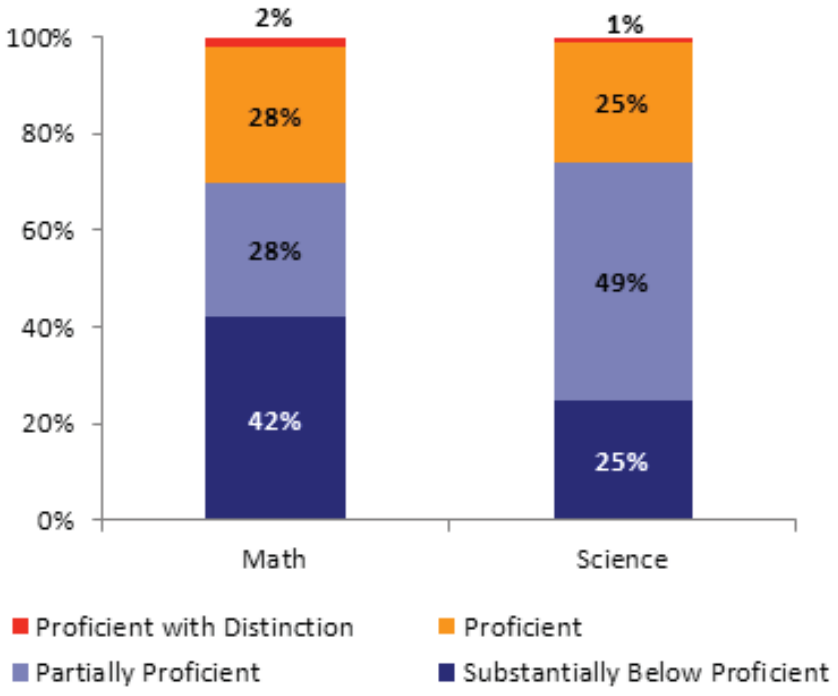
Local Challenges

While it is discouraging that American students are losing ground to their international peers when it comes to earning degrees and going into careers in the lucrative, burgeoning STEM fields,[7] it is especially disheartening to know that Rhode Island students struggle to keep up with their peers in the United

States. Rhode Island ranks 29th in math scores nationally at the eighth-grade level, whereas our neighbors in Massachusetts and Vermont score first and fourth, respectively.[8] Rhode Island students face an enormous achievement gap in mathematics, with just 16 percent of low-income eighth graders at proficiency in 2011. English Language Learners lag an astonishing six grade levels behind their native English-speaking peers in eighth-grade math.[9] These numbers have steadily increased since 2008, when the average proficiency in science was just 16 percent across the state.[10]

Rhode Island Youth's Proficiency in Science & Math in Eleventh Grade[11]

By the time they reach the eleventh grade, many youth are beginning to consider what major they will pursue in college or what professional field they will enter upon high-school graduation. Many rewarding STEM jobs will be available in the future, and our nation's economy depends on our ability to excel in these industries. Are Rhode Island youth prepared?



How do underrepresented groups fare in Rhode Island?
(data are from the 2011 academic school year)

African-American or Black Students
Just 9% are proficient in math and 7% are proficient in science.

Hispanic or Latino Students
A mere 11% are proficient in math, and just 8% are proficient in science.

Economically Disadvantaged Students
14% are proficient in math and 11% are proficient in science.

The Interest Gap

Unfortunately, the statistics regarding the achievement gap and the STEM disciplines are compounded by an interest gap; that is, the problem is not just a lack of proficiency in these fields, but also a lack of interest in them. This intensifies as youth get older. Children ages 6 to 12 report a high level of interest and confidence in their science abilities; by age 14, interest and self-confidence related to science drops off.[12]

How Afterschool Can Help

In 2011, the Afterschool Alliance conducted a scan across STEM-related evaluation reports throughout the United States. The research confirmed that high-quality STEM afterschool programs yield the following benefits for youth:

- Improved attitudes toward STEM fields and careers;
- Increased STEM knowledge and skills; and,
- A higher likelihood of high-school graduation and pursuing a STEM career.[13]

There is encouraging research that indicates that when girls participate in out-of-school-time STEM programs, they experience increased confidence in math skills, improved attitudes toward and engagement in math, and increased plans to attend or enroll in college.[14]

The afterschool and summer learning fields have a unique opportunity to blend STEM learning with enrichment activities and youth development expertise in order to sustain, spark, or reignite children and youth's interest in and passion for STEM disciplines in an environment that is nonthreatening, informal, collaborative, and personal. This is especially critical as research demonstrates that an interest in science

in the eighth grade is a better predictor that a student will choose a STEM career than high academic performance.[15] Many struggling students who later achieve success in STEM professions gain their first real experience with the field via an afterschool activity.[16]

Federal STEM Policy

The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act contains a range of provisions to improve and advance STEM education, including greater coordination across federal agencies in their work. The 2013 Budget invests $3 billion in programs across the Federal goverment on STEM education. Of that, the President's Fiscal Year 2013 Budget proposes $48 million go toward the National Science Foundation's Advancing Informal Science Learning program, which aims to identify the most effective means and innovative models for engaging today's youth and adults in science outside of school settings.[17]

Local Efforts

Providence After School Alliance (PASA)

The PASA AfterZone program has exhibited a great deal of leadership in promoting STEM education in Providence, offering a menu of options at six Providence middle-school sites. The PASA model includes strong partnerships with local organizations and enrichment providers like Save the Bay, the Museum of Natural History, Roger Williams Park Zoo, Providence CityArts for Youth, Audubon Society of Rhode Island, and Recycle-A-Bike. PASA's offerings integrate STEM activities with other disciplines from the arts to financial literacy to cooking to creative writing.

A Youth's Story—Theodora

In 2011, Theodora Logan, a rising 7th grader from Providence, participated in the AfterZone Summer Scholars Camp. The overarching goal of her four-week group project was to partner with the Audubon Society of Rhode Island to create Neutaconkanut Park's first field guide describing the types of birds visitors might see. During the first week of the program, Theodora hiked at the park and contributed to data collection through avian diversity surveys and bird banding. In the second week, the camp facilitators—a Providence public school teacher, an Audubon Society educator, and PASA's STEM coordinator—encouraged Theodora to take on a leadership role in the program. Despite her quiet nature, Theodora played a crucial role on the editorial board for the field guide, volunteering to help curate the content and design the cover. Theodora's vibrant personality shone as she became more engaged. She spent time at home drafting the cover for the field guide, and gathered feathers outside of camp and brought them in to share with her fellow campers. The final guide is a testament to Theodora's strengths and accomplishments, and is currently used by the Neutaconkanut Hill Conservancy to help park visitors learn about Rhode Island's ecosystem.

Center for Dynamic Learning (CDL)

CDL's Science Learning Industrial Design Engineering (SLIDE) department offers inquiry-based, exploratory STEAMM opportunities to youth in grades six to twelve. With curriculum developed by a professional engineer, this program promotes workforce development and meets all RIDE and National Educational Standards.

Rhode Island Environmental Education Association (RiEEA)

RiEEA is a collaboration across 19 organizations dedicated to encouraging and promoting effective environmental education in both formal and informal settings and strategizing about the environmental education needs of our state.

Rhode Island STEM Center at Rhode Island College

This center provides professional development; collects and disseminates best practices; and fosters networks and partnerships among PK-12 teachers, teacher candidates, higher-education faculty, students, parents, and other community stakeholders.

"Bringing to the table a unique, twenty-year career as an electro-mechanical engineer, I have been an informal STEAMM educator in Rhode Island for several years. I found it easy to spark youths' interest by teaching them to design and build whatever they wished. We started with skateboards and have expanded our lab to create solar go-karts, dune buggies, motorcycles, and four wheelers. Upon getting permission to shut down an entire street, we gave youth and their families a once-in-a-lifetime opportunity to participate in a legal drag race and showcase their amazing creations and talents. Learning should be fun for both students and teachers, and the best way to develop a fun environment is to allow the youth in your program to have an equal say in what they want to learn and how they wish to learn it. It is the future of education as we know it."

—Kevin Cunha,
Center for Dynamic Learning

Recommendations

In order to ensure the state's economic vitality in the future, Rhode Island should prepare young people for success in fast-growing, lucrative industries by delivering high-quality STEM learning experiences in and out of the classroom. Rhode Island should expand or deepen its investments in out-of-school-time programs that foster high-quality STEM learning and professional development.

Schools and afterschool programs should collaborate across their respective curricula and actively partner in new ways to promote STEM learning. Afterschool practitioners should become familiar with common core standards in math and science, and should integrate those standards into their STEM programming. When possible, joint professional development should be made available for classroom teachers and afterschool practitioners.

Afterschool and summer learning programs should partner with external organizations and enrichment providers (e.g., staff from museums, universities, private businesses, and environmental organizations; STEM professionals; science educators, etc.) to introduce children and youth to adults who possess exciting careers and expertise. In so doing, children and youth will both gain knowledge and have the opportunity to envision themselves pursuing a STEM career.

A framework should be developed for local businesses, STEM professionals, and community partners to collaborate with afterschool and summer learning programs to offer jobs, mentorships, and internships to middle- and high-school youth as well as afterschool and summer learning professionals to extend learning beyond the classroom and mobilize advocacy in support of STEM education.

As policies and initiatives are developed and decisions are made about advancing science education in Rhode Island, involve afterschool and summer learning stakeholders in the discussion, planning, and execution.

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