COMMUNITIES OFTEN DO NOT ADVOCATE FOR SCIENCE, TECHNOLOGY, OR ENGINEERING.

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01
CONTEXT AND TRENDS

More than ever, a strong educational foundation in the science, technology, engineering, and mathematics (STEM) disciplines is a necessity for all young people. The complexities and challenges of a rapidly changing world require lifelong learning skills, including the ability to solve difficult problems, gather and evaluate evidence, and make sense of information from varied print and media outlets. Success is determined not just by what one knows, but what one is able to do with that knowledge (Bailey, Kaufman, & Subotic, 2015; Betrus, 2015; Dweck, Walton, & Cohen, 2014; Volmert, Baran, Kendall-Taylor, & O'Neil, 2013). The process of learning and practicing the STEM disciplines has been found to develop these skills, along with persistence, teamwork, and a passion for inquiry and discovery (Bailey et al., 2015; Betrus, 2015). According to the U.S. Department of Education Office for Civil Rights (2014), the STEM fields have become "the gateway to America's continued economic competitiveness and national security, and the price of admission to higher education and higher standards of living for the country's historically underrepresented populations" (p. 2). The December 2015 passage of the Every Student Succeeds Act (ESSA), and the Obama administration's Computer Science for All Initiative further affirm the importance of all of the STEM subjects, including computer science and engineering, in providing all students a well-rounded education.

The broader public's understanding of the universal civic and social benefits of STEM education remains limited, however, particularly when coupled with gendered and minoritized stereotypes about who excels in these fields (Volmert et al., 2013).

02
DISCUSSION

Strengthening community ties to STEM requires the recognition that learning is grounded in one's family and cultural values (Boyer, 2006; Volmert et al., 2013). STEM teachers can promote these ties by better connecting STEM content to the stores of knowledge and lived experiences of the students and communities being served (STEMpact, 2013). This may be especially important in the emerging fields of technology and computer science, which are typically viewed among members of the public as complex, inaccessible, and add-on or supplementary subjects, only appropriate for the most gifted and talented students (Volmert, et al., 2013).

Meaningfully engaging parents and families in innovative ways can empower them to contribute to their children's learning by helping them see how they use STEM in their daily lives. For example, schools can encourage families to share native and cultural mathematical and scientific knowledge systems with the school community to help teachers and students see the links between classroom activities and family and cultural knowledge (STEMpact, 2013; Boyer, 2006). School leaders and teachers also can visit the neighborhoods of their students to identify local resources and applications of STEM that can serve as familiar examples of concepts being learned in the classroom (STEMpact, 2013). Professional development providers can help teachers more deeply understand "how children have been culturally prepared to engage in learning and respond to and use this knowledge for leverage in the classroom" (Bevan, 2016, p. 5). When teachers are aware of what is familiar and of interest to their students, they can let them and their parents know about summer camps or internships that focus on that topic and resources that help them access these activities. Out-of-school opportunities can both boost engagement in STEM learning and introduce students to role models and possible career pathways (Bevan, 2016; Traphagen & Traill, 2014).

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BRIGHT SPOTS

More research is needed to identify what works best in building stronger community connections to STEM in particular contexts and to serve diverse students. In the meantime, however, the nation can look to theories of learning, particularly culturally relevant theories of learning, to improve engagement and outcomes in STEM. In addition, several communities are engaged in innovative efforts that can serve as models from which lessons can be learned and new knowledge and experience gained.

One example of a promising national initiative that is currently in place is the STEM Ecosystems Initiative, supported by the STEM Funders Network. The goal of the initiative is to nurture and spread effective STEM learning opportunities for all youth through a national community of practice composed of locally connected and engaged networks. These local networks are intended to create learning experiences for students that are more relevant by connecting youth with organizations and people with shared STEM interests (Bevan, 2016). The OC STEM Initiative in Orange County, California, and Hive NYC Learning Network are two examples of local learning ecosystems that are engaging youth and connecting communities to STEM learning in ways they hadn't been before.

In thinking about better connecting historically underserved communities with STEM, the National Science Foundation's Rural Systemic Initiative (RSI) may serve as important models. RSI projects sought to align the unique values, strengths, and cultures of America's indigenous and particularly rural communities with the values of the education system to develop sustainable networks of STEM learning (Boyer, 2006).

The success of networked communities or ecosystems of STEM learning is contingent on the effective implementation of culturally relevant approaches such that students are able to "recognize and honor their own cultural beliefs and practice, while acquiring access to the wider culture and to STEM cultures" (Wilson-Lopez, 2016, p 1). Project-based activities should explicitly connect in- and out-of-school practices, such as organizing and running a family business with maximum efficiencies, using mathematical analyses to examine issues of social injustice, or draw on the knowledge of tribal elders to design solutions to local problems (Kern et al., 2015).

The learning settings themselves can be shifted away from the physical classroom to strengthen community connections and understanding of where STEM fits in their lives. For example, the National Geographic Society's BioBlitzes engage students and their immediate communities in 24-hour biodiversity counts. Teams of students, families, and community members work alongside scientists to make observations, record data, and map findings.

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At a more global level, the FrameWorks Institute is spearheading an initiative to identify and develop effective communication strategies to shift and expand the public conversation around STEM learning (Volmert, 2013). The institute has published an online toolkit, Telling the STEM Chapter of the Education Core Story, that includes a collection of research, recommendations, and sample communications that can be used to build more inclusive and accessible narratives about STEM.

04 CONCLUSION

A strong STEM education can no longer be a luxury reserved for just a few. Concerted efforts to build community connections like the ones described here can correct misconceptions about STEM, break down the barriers that isolate and marginalize historically underrepresented populations, and allow all students and their families to envision themselves as mathematicians, engineers, and scientists (Traphagen & Traill, 2014; Volmert et al., 2013, STEMPact, 2013).

ABOUT THE GRAND CHALLENGES WHITE PAPERS

In 2017, 100Kin10 released an unprecedented representation of the big, systemic challenges to preparing and supporting STEM teachers following over two years of extensive research alongside more than 1,500 STEM teachers and hundreds of other education experts. As a part of this work, 100Kin10 commissioned a series of short white papers from well-versed thinkers and practice-oriented researchers to synthesize the most relevant research around the specific challenge areas. Together, they compose a thoughtful and well-rounded examination of the systemic challenges currently facing STEM teaching.

05

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