

STEM Education Case Story

# **Building for the Future:** The importance of STEM education

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## Where did the program originate?

The vital importance of STEM education for younger generations is well-known. The U.S. Department of Commerce reports that STEM occupations are growing at 17%, while other occupations are growing at an average of 9.8%.<sup>1</sup> STEM education creates critical thinkers, increases science literacy and empowers the next generation of innovators, who will help develop new products and processes that sustain our economy. Despite the significant role that STEM industries will play in the near-future, mathematics and science scores on average among U.S. students are lagging behind other developing countries, ranking 29th in math and 22nd in science.<sup>2</sup>

It is crucial that all students – regardless of gender, race, ethnicity and economic background – are encouraged in STEM subjects from an early age. This is where NTC and the APS Foundation's *BrainSTEM* enters the picture. A charitable branch of Arizona Public Service – the largest and longest-serving electric company in Arizona – the APS Foundation is dedicated to nurturing STEM education among Arizona students, with a focus on raising the number of skilled workers in the state. Through a grant from the APS Foundation, The National Theatre for Children presented *BrainSTEM*, a novel educational programming module, to rural Arizona students in grades 4 through 8.

## What approach was used in implementing this program?

A total of 24,729 students and 1,136 teachers were provided STEM education in the form of a live play and supporting classroom instruction focusing on the importance of science, technology, engineering and math, with a particular emphasis on STEM-related careers. The 45-minute live performance engaged upper-elementary and middle school students through a series of improvisational comedy sketches while calling on student volunteers to convey important lessons in STEM education.

<sup>1</sup>As of February 2016. [engineeringforkids.com/article/02-02-2016\\_importanceofstem](http://engineeringforkids.com/article/02-02-2016_importanceofstem)

<sup>2</sup>According to the US Department of Education. [www.ed.gov/stem](http://www.ed.gov/stem)



Taking suggestions from the audience, two professional theatre ambassadors encouraged students to help create the show that they saw, forming a unique program with each presentation.

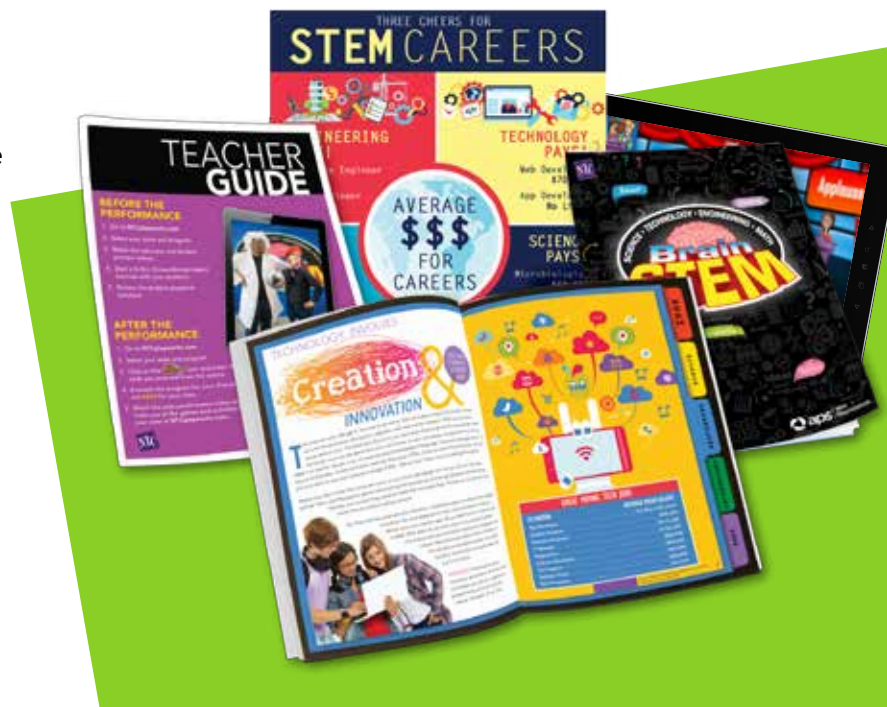
In addition to the live in-school assemblies, *BrainSTEM* featured student playbooks, teacher guides, classroom posters and digital games and activities themed around the show. The program armed students with valuable information, encouraging them to achieve a high level of scientific and engineering literacy while engaging their parents and families in the process through take-home assignments. In addition, teacher guides provided educators with innovative solutions for providing STEM education in stimulating ways.

## What distinguishes this program from others?

Exciting live events delivered directly into schools impact students in ways that traditional methods cannot. These assemblies, involving audience participation and improvisational elements based on student suggestions, spark the imagination and present STEM education in an appealing way, adding a dynamic arts element to evolve into a STEAM program. *BrainSTEM*, customized to

demonstrate the APS Foundation's support of STEM education while aligning with the foundation's STEM objectives, is measured both qualitatively and quantitatively through teacher evaluations and detailed metrics.

The *BrainSTEM* campaign features live, educational theatre performances powered by The National Theatre for Children's professional, theatrically-trained field staff. No two children learn in the exact same way, and *BrainSTEM* addresses a variety of learning styles. The live theatre component excites, engages and stimulates discussion, in many cases introducing young students to live theatre for the first time. By including audience participation in the program, the students are directly involved and become a part of not only the learning process, but the creative process as



well. In this way, the “Four Cs” of 21st-century learning skills – collaboration, communication, critical thinking and creativity – are incorporated.

The program also addresses STEM-related careers in a matter-of-fact way. Given the growing prevalence of STEM careers on a global scale, *BrainSTEM* seeks to prepare young minds for a future in the STEM industries and to connect partnering organizations with the innovators that might become their future thinkers and engineers. In view of the APS Foundation’s efforts toward building a workforce of STEM-proficient Arizonans, NTC feels it is important to target not just the building of interest and skill, but solid reasons why students should care – as well as goals to strive for.

## What were the significant and measurable impacts of this program?

In the fall of 2015 and winter of 2017, *BrainSTEM* reached a reported 24,729 students and 1,136 teachers in 86 Arizona schools, receiving rave reviews from the students involved, their parents and teachers, school administrators, community leaders and the media. The program was able to achieve consistency at scale by delivering educational messages to the largest possible audience while retaining a high level of quality.

Teacher evaluations allowed NTC to quantitatively measure the value of the program. Based on a scale of 1 to 7, teachers and educators rated *BrainSTEM* an average of 6.46 on overall educational value, and 99% reported they would like to see the program return to their school. See Table 1 for additional responses to the teacher survey.



In addition, educator comments proved that *BrainSTEM* successfully engaged upper-elementary and middle school students and increased their enthusiasm for STEM learning. See below for just one example of the hundreds of positive comments provided by educators.

TABLE 1: BRAINSTEM TEACHER EVALUATIONS*		
QUESTION	FALL 2015	WINTER 2017
Overall educational value	6.49	6.43
Likelihood students will retain the material covered	6.41	6.28
Ability to stimulate classroom discussion	5.94	5.89
Ability of live theatre to increase capacity for retaining information	6.49	6.44
Overall value of printed materials	6.11	5.86
Overall value of digital games and activities	5.71	6.23

\*Ratings are on a scale of 1 to 7

Lastly, press articles and social media mentions about *BrainSTEM* garnered substantial earned media for the APS Foundation, adding to the program's already substantial capacity for public outreach. Articles in the Phoenix Business Journal, Yuma Sun, and the website for NBC's Yuma affiliate, KYMA, highlighted *BrainSTEM* and labeled it "an exciting and engaging educational program for underserved students in Arizona." Posts and photos on schools' official social media pages extolled *BrainSTEM's* educational value and ability to entertain students while teaching them valuable STEM subjects.

As the Director of Curriculum and Instruction for the Casa Grande Elementary School District, I am always looking for educational and theatrical events that my students can attend. As a rural district in a poverty stricken community, many of our students would not have the opportunity to experience these types of high quality activities without outside support. As other opportunities come available, I am hopeful we can work together to offer these opportunities to many of our schools. Thank you APS for sponsoring this program.

– Barbara Wright  
Cactus Middle School, Casa Grande, Arizona



## Can this model be replicated and scaled by other organizations?

The National Theatre for Children has 40 years of experience creating and deploying successful in-school educational theatre programs. It is replicable and scalable for use by many different organizations using varying models. Our unique and proven engagement programs have delivered notable results for organizations involved in STEM across the country.

Any school-based STEM education program can be successful when it:

- Offers something to schools that they can't get elsewhere (like live theatre)
- Aligns program materials with state educational standards
- Adds proper motivation for schools, teachers and students to influence parents

In addition to the *BrainSTEM* program, NTC provides a scalable alternative for elementary schools entitled The Knights of STEMalot, with its own unique set of supplemental materials (including a brand new graphic novel) designed to inspire passion in students for STEM subjects as early as possible.

## What lessons did we learn from the implementation of this program?

NTC learned that, with the right approach, it really is possible to reach upper-elementary and middle school students, get them excited about STEM education and prepare them for a rapidly changing future. *BrainSTEM* provided an opportunity for Arizona students to experience professional theatre –many of them for the first time. Teacher evaluations, photos and videos of the performances and social media postings by the schools proved that dynamic and innovative teaching methods can stimulate young minds about subjects in which they might otherwise express little interest.



In The National Theatre for Children's industry, a consistent barrier is convincing schools to accept and pursue this type of educational programming. Schools have oftentimes already embraced the science curriculum that's been set in place, so The National Theatre for Children is challenged to enlighten teachers and administrators on the benefits of educating students in a new form, such as live in-school theatre.

These types of issues may be reflected in the students' home lives as well. It can often be a challenge to motivate upper elementary and middle school-aged children to talk openly with their parents. NTC's programs give students and their parents a topic and activity to engage with one another in a productive way. The unique structure of this "Trickle Up" system is what makes it so effective, as it grants students the opportunity to share knowledge with their families and inspire real change in their communities.

During this campaign, we also discovered that what The National Theatre for Children refers to as "the School Channel" is an invaluable tool regarding effective STEM education. The School Channel is made up of 111,465 schools in the United States, totaling 53,727,000 students and 3,219,400 teachers. STEM education organizations, through programs such as *BrainSTEM*, have the opportunity to connect with the students and educators who play a vital role in preparing for the future of STEM. As the fields of science, technology, engineering and math evolve and expand at a rapid pace, the ability for programs like *BrainSTEM* to inspire young minds becomes increasingly indispensable.



NTC is a premium provider of educational programming with operations in the U.S., Australia and New Zealand. We work directly between schools and clients to promote beneficial behaviors and life skills to students in grades K-12 on a local, regional and national level.

Since 1978, we have formed connections and helped develop relationships between thousands of schools and corporations, nonprofits and governmental organizations. Our value is not just in the impact we create; our turnkey services also change the lives and trajectories of students, mobilize parents and entire families with beneficial messages, and cultivate community-wide goodwill for clients.

Our award-winning educational programs are provided free for schools and are customizable to accommodate specific messages and goals for clients. Through formats including live performance, in-class discussion, graphic novels, print curriculum, and digital games and activities, we present topics such as energy conservation, safety, financial literacy, STEM, water and environmental stewardship, and health and social responsibility in ways that engage and empower students. In doing so, we are helping our clients to be forces of change for students, parents and communities.

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