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STEM = Strategies that Engage Minds

Afterschool programs are prime venues for STEM education



Head in hand, eyes glued to the computer, high school student Paris Fears stared intently at a screen. She scoured the seemingly endless lines of programming and code multiple times, attempting to fix the problem. No matter what she tried, though, the outcome remained the same: a message that read

“Error on Line 177.”

Eventually, her mentor at Shodor, an afterschool computational science program, stood beside her. Together, they worked through the problem, and, within minutes, Fears learned how to correct what was wrong. A wide smile broke across her face.

“It worked!” she said, amidst laughs and high-fives with her friends. “I can’t believe it! I’m just so glad it finally worked!”

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Fears' experience at Durham, N.C.-based Shodor isn't unique, but it's one that doesn't happen often enough. While schools offer science, technology, engineering, and math (STEM) curricula, that instruction rarely includes hands-on, inquiry-based experiences. Afterschool (or what is commonly referred to now as out-of-school time) programs can fill this void when armed with proper resources and detailed guidance.

In fact, afterschool programs are prime venues for STEM education, according to education experts. Participants can master skills at their own pace, there are fewer time restrictions, and the relaxed format encourages otherwise reticent students to speak up and become actively engaged.

"The afterschool setting allows for hands-on, longer-term, project-based activities that build upon and reinforce concepts learned in school without feeling like more school time," said Anita Krishnamurthi, Ph.D., director of STEM policy for The Afterschool Alliance. "It provides a venue in which children and youths can experiment and play with STEM concepts without fear of failure."

STEM teaches inquiry, she said, and it's imperative that students learn to ask questions and apply the knowledge they've gained. These skills better prepare them for the future. And, as the demand for STEM-trained workers steadily increases, the need for afterschool opportunities is clear.

Creating a successful, effective program, however, requires substantial planning and collaboration for existing and new ventures alike. Missions must be clear; funding must be secured; and partnerships must be formed. Reaching these goals, however, experts said, isn't always easy.

The Challenges Facing Afterschool

Without a doubt, designing an afterschool STEM program invites many challenges. According to experts, though, the biggest of them all is

identifying sufficient funding.

“Funding is always an issue that gets in the way,” Krishnamurthi said. “There are 8.5 million children in afterschool around the country, and there simply isn’t enough funding to make sure quality STEM education is available to all of them just yet.”

Consequently, afterschool programs frequently find themselves in tight competition with other initiatives for grant monies or scrambling to find funders that match well with their missions.

Program administrators often turn to private foundations, such as the Burroughs Wellcome Fund and the Noyce Foundation, for support.

Government agencies, such as the National Science Foundation or the U.S. Department of Agriculture, are also frequent financial sources. Still other programs pursue corporate funding. For example, Change the Equation is a national organization that connects businesses interested in fostering STEM education with STEM programs.

Finding the right funder can be overwhelming. To make this stressful situation easier, The Afterschool Alliance—the only organization advocating nationally for afterschool investment—created its Funding Database where program leaders can fine-tune their search for financial support. StemConnector® also offers an extensive list of organizations and agencies that actively partner with and fund STEM initiatives.

Identifying strong potential partners is only the first step, said Nicole Yohalem, director of special projects at The Forum for Youth Investment, a non-profit group focused on ensuring students have the proper educational foundation for future successes.

“The clearer program staff can be about their mission as they approach potential partners, the more concrete conversations will be,” she said. “If they say, ‘Here’s what we’re trying to do, and here’s how we think you can fit in,’ then funders will

be more responsive.”

However, according to Shodor’s executive director Robert Panoff, most programs have an operating budget that exceeds what grants can support. In those cases, program directors must find another avenue for raising money.

“We’ve had to adopt a financial model where we charge some students to participate,” he said. “You can’t just keep writing grants to get funding. If you have a fee associated with your program, the parents who can pay cover the cost for the parents who can’t afford to.”

Adding a monetary expense to the program can also change participants’ attitudes, he said. Knowing the experience isn’t free adds value to the time students spend in a STEM program, and they take the curricula more seriously.

But finding enough funding isn’t the only roadblock many programs face. Sometimes, the bigger issue is making STEM information and concepts accessible to students. Integrating STEM professionals into a program is an easy way to introduce students to STEM careers, but it takes more than their knowledge and expertise to ignite a long-term passion in students.

“The biggest challenge a STEM professional can have is figuring out how to take information down to a child’s level,” said Moni Singh, founder of Raleigh, N.C.-based STEM for Kids, an organization that designs STEM curricula for elementary students. “You have to make it work for children. If you use too much jargon and load them up with concepts, you will lose them. Think about ways to keep a program really hands-on.”

For example, she said, students in a STEM for Kids-supported computer science afterschool program create avatars that “magically” read their parents’ minds by applying what they’ve learned about binary numbers.

There are lesser-known roadblocks to consider, as well. While some afterschool STEM programs generate from within schools, many are outside initiatives looking to come in, said Jamie Knowles-Griffiths, director of the North Carolina Center for Afterschool Programs (NC CAP), a state-wide group dedicated to increasing student access to high-quality afterschool programming.

“Sometimes there is an access issue, and it can be challenging because it’s a local decision that has to be made,” she said.

“Program leaders aren’t in charge of whether they can enter into a contract with a school, and it doesn’t always happen easily.”

The best way to clear that hurdle and build a strong foundation, she said, is to create an eclectic team by casting a wide net into the community. Schools and museums are excellent partners, but including elected officials, health department staff, or law enforcement can strengthen community support for a STEM program. Local businesses, community groups, and faith-based organizations can also offer unique ideas and perspectives on how to reach young people. Giving these groups a seat at the planning table often results in greater engagement and a wider pool of resources from which to draw in the future.

Maintaining enrollment can also be a problem, said Linda Rosen, Ph.D., Change the Equation’s chief executive officer. Afterschool programs aren’t required, so there is always a chance students will choose other activities over STEM education.

“As kids get older, there are lots of things that pull on their time and attention—soccer, scouting, religious youth groups, or part-time jobs,” she said. “One of the biggest challenges afterschool providers have is taking advantage of the time they do have with students.”

One way to spark interest is to not only ensure

curricula cover interesting topics, but to also make it relevant to students' lives, said Kris Brenton, director of the New York Academy of Sciences (NYAS) Afterschool STEM Mentoring Program. This program pairs interested afterschool programs with graduate and doctoral students trained to teach STEM disciplines.

"You may have the super cool factor of dissecting a sheep brain, but kids want a deeper connection or relevance to their own lives," he said. "Instead of just talking about the anatomy of that sheep brain, talk about diseases that affect memory. Look at things that are happening in the lives of students and pitch to that."

Keeping students engaged is also easier if programs show them how STEM relates to potential careers, Panoff said. For example, Shodor's middle school students learn the intricacies of forensic science technology by solving a fabricated crime. Using chromatography, they identify from which pen ink used to write a ransom note came. They simulate the use of reagents in blood typing, and they analyze fingerprints. Their job is the same as any real-world investigator: identify the perpetrator.

Designing a Successful Program

Even with all these obstacles in the way, it is still possible to create a program that effectively introduces students to STEM and makes it an important part of their lives. To reach this goal, program administrators must have a well-considered plan.

"The very first thing a program must do is be very deliberate and intentional about what they're looking to do," Krishnamurthi said.

"STEM is hot right now, and a lot of people are very interested in offering it. But you have to figure out a vision for what you want your program to look like."

The program's mission, however, must meet an immediate need in order for the initiative to flourish. Knowles-Griffiths recommended conducting a community needs assessment to identify whether a proposal is on-target or needs modification.

"These needs assessments are often overlooked, but they're very important," she said. "We read a lot of grant applications and have talked with folks across [North Carolina], and they sometimes assume they know the best fit for their program. But they haven't researched other programs or what could be good partnerships."

Program administrators must also be careful to set reasonable expectations based on available resources, she said. Promising more than a program can deliver makes the effort less likely to succeed.

Once it's clear how a STEM program can effectively address a local educational desire, Knowles-Griffiths suggested program staff sit down with their team of partners to pinpoint opportunities for collaboration, as well as any barriers that might exist.

It's also equally important to choose a teaching method that will prompt students to respond positively, said Shodor's Panoff. Getting students involved with instruction is a good way to increase their engagement.

Although Shodor staffers are always present as content experts, much of the actual instruction is student-to-student. High school students mentor middle schoolers, and college students work with high schoolers. Not only does this strategy reinforce STEM learning for the older students, Panoff said, but younger students also respond positively when they work with someone close to their own age.

"Having near-peer teachers helps keep the material

grade-appropriate,” he said. “It also reflects the flow of material and keeps kids involved as the material itself develops.”

Shodor also offers older students real-world work experience through internships and apprenticeships. These students work alongside Shodor staff, maintaining and servicing the organization’s own databases. And, for this work, they receive a stipend. It’s on-the-job training, Panoff said, that will set the students apart from their future competitors in the job market.

According to NYAS’s Brenton, the STEM Mentoring Program mirrors Shodor’s near-peer approach. After teaching graduate and postdoctoral students how to teach STEM curricula to children and youths, NYAS places them in afterschool programs as mentors and instructors. Oftentimes, they are the first STEM professionals students meet.

“The question of ‘why is this important?’ isn’t asked because they’re presented with a person who does this as their job,” Brenton said. “It provides a depth and authenticity that young students can feel.”

Professional Development

As mentioned earlier, STEM professionals and afterschool program staff need more than content expertise to convey their knowledge to students. Many, if not all, need guidance on how to translate often complex information to a young audience.

Rich professional development opportunities are particularly important, Krishnamurthi said, because they also help program staffers select and deliver the right curriculum for their students. Shodor offers this guidance in addition to its on-site afterschool programs.

According to Panoff, he and his colleagues visit existing programs and teach a session while

program staff observe. It's an effective method to demonstrate how best to impart STEM knowledge to students.

"Our suggestion for STEM education professional development is a watch one-do one approach," he said. "We go in and show them the things we do, whether it's astrophysics, environmental science, or programming and web design. Modeling how to teach the curriculum gives them a little bit of confidence that they don't have to start from scratch."

Programs are, then, free to implement the curriculum, and Shodor staff will provide additional assistance if needed.

Getting program administrators involved in curriculum design also strengthens their ability to teach students, said STEM for Kids' Singh, especially when afterschool programs strive to meet state science standards.

"It's really guidance in terms of content, as well as approach and delivery," she said. "For example, if someone comes in and wants to conduct a third-grade workshop on electricity, we help them figure out what might be a way to best bring this concept to their students. And, then, we have a session about delivery so they know how to keep the topic exciting."

There are also professional development resources available for afterschool programs that can't find such opportunities locally. For example, Wheelock College in Boston offers professional development courses online. The National Alliance for Partnerships in Equity's STEM Equity Pipeline also offers remote access to professional development resources. In addition, the Center for STEM Education for Girls maintains a list of nationwide professional development seminars for interested program leaders.

Afterschool Efficacy and Future

Improvement

The quality and quantity of afterschool STEM programs have come a long way in recent years, and according to a January 2013 Afterschool Alliance report, “Defining Youth Outcomes for STEM Learning in Afterschool,” they’ve had some significant successes.

Education experts evaluated eight indicators, such as the desire to participate in STEM activities or the awareness of STEM careers, and determined afterschool programs effectively reach three goals. They prompt interest in STEM and STEM activities, augment student abilities to productively engage in this learning, and lead students to value the STEM knowledge they gain.

Given these accomplishments, surveyed experts recommended afterschool leaders take additional steps to build upon achievements to date. Afterschool programs should actively embrace additional research efforts that delve into the long-term impacts of STEM learning outside the classroom. According to the report, these types of investigations may be the best tools through which “value and contributions of afterschool programs can be fully articulated and ultimately assessed.”

Following these recommendations could help afterschool programs identify previously unrecognized needs and open doors to untapped resources, Krishnamurthi said. It’s also important to remember that, even with additional resources, these initiatives must remain true to their original missions. Rather than extend school-day STEM instruction—and risk duplicating curricula—afterschool programs must use their resources to give participants the opportunity to immerse themselves in STEM and learn with their hands.

“Schools and teachers are trying hard to work with kids, and after six or seven hours, kids are ready for

something different,” Krishnamurthi said. “There are constraints on the school day and teachers. Afterschool, though, provides a great venue for afterschool facilities to build on what students are learning.”

By Whitney L.J. Howell, a freelance journalist based in Durham, N.C.

This article was originally published as part of a guide to creating an effective science program. The guide was published for applicants and recipients of the Student Science Enrichment Program. See below to download your free copy.

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