

LONG-TERM, PART-TIME STEM EDUCATION

2012

Connecting students with science, technology, engineering, and math (STEM) professionals to educate and inspire the next generation of innovators, problem solvers, and citizens.

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THE OPPORTUNITY EQUATION

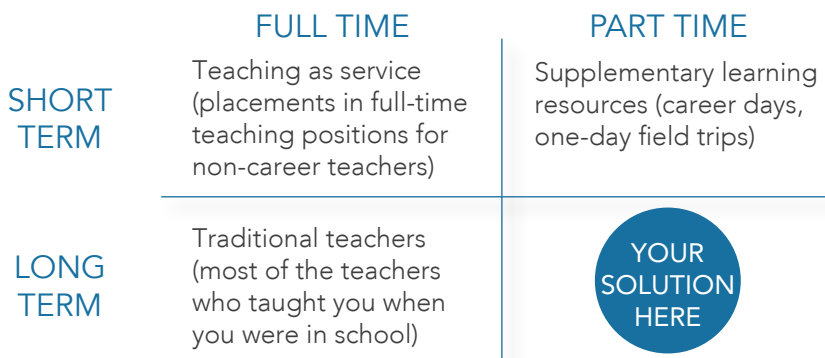
PREPARED BY:

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While our nation’s imperative to reinvigorate and improve STEM education is a daunting challenge, we have powerful assets in favor of success. Key ingredients for a renewed commitment to excellence in STEM education can be found in the expertise and creativity of professionals who persistently demonstrate the strength of our STEM talent in industry, universities, and the public sector; in the innovative spirit and commitment of educators; and in the natural curiosity of students eager to explore the world through meaningful, hands-on experiences and discover new passions that will lead the way to a love of learning and bright career opportunities.

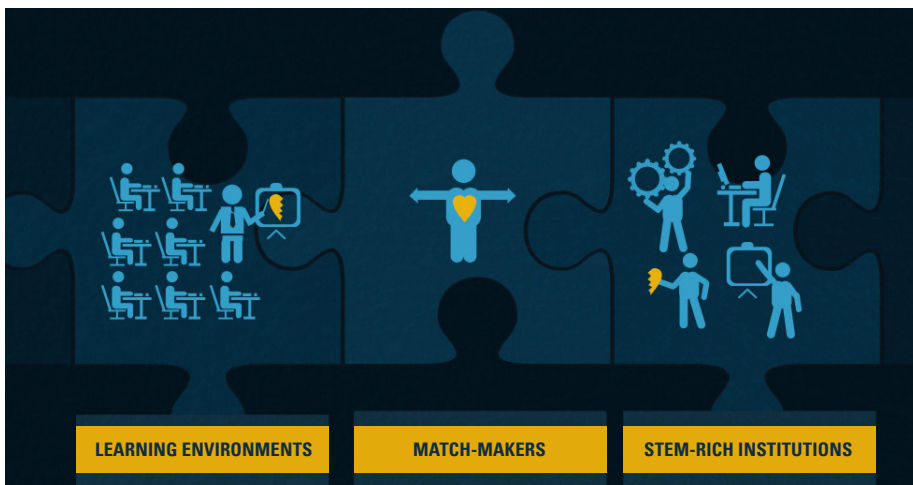
To identify initiatives that are combining these ingredients into a recipe for success, Carnegie Corporation of New York and The Opportunity Equation, in partnership with Ashoka Changemakers, hosted a nationwide competition, *Partnering for Excellence: Innovations in Science + Technology + Engineering + Math (STEM) Education*. The 2011 competition surfaced innovative partnerships that bring STEM professionals into schools to transmit their knowledge, skills, and passion in ways that support teachers and engage students. The competition was designed to elicit and highlight potent models with a “long-term, part-time” approach to partnership, providing rich, consistent, collaborative opportunities for STEM professionals to be a part of educating and inspiring the next generation of STEM experts in their communities.

A “long-term, part-time” relationship, as outlined in the graphic below, is one in which STEM professionals engage in classrooms to deliver STEM content and skills on an ongoing, but part-time basis. It is designed to be enduring enough for the participants—students, teachers, and STEM professionals—to develop a meaningful partnership that offers support, trust, and mentorship, and yet is episodic enough in nature to be a manageable complement to participants’ significant other responsibilities. And it is designed to have a profound impact on students: palpable excitement about exposure to real world applications of STEM subjects, transformative relationships with professionals who inspire them to envision a future in STEM fields, and mastery of skills that form the foundation of a meaningful, productive career in the economy of the future.



The four case studies included in this document represent highly innovative, scalable models from the 2011 competition. They are among the top-rated entries for tapping into and combining the powerful ingredients that exist in nearly every community in America. They are by no means the only initiatives creatively reimagining STEM education to positive effect—and there is a lot of room for flexibility in the design and implementation of such programs. But these four, while quite different in many ways, share a number of important hallmarks in their “long-term, part-time” approaches that have proven effective:

- The cultivation and implementation of innovative “long-term, part-time” partnerships between schools/districts and STEM-rich companies, organizations, and institutions.
- An embrace of non-traditional educators with rich STEM backgrounds—casting a wide net to include a broader definition of “teacher,” and leveraging untapped expertise in the community.
- The use of non-traditional scheduling—injecting flexibility into the typical school day and/or finding extracurricular pockets of time to capitalize on the availability of non-traditional educators.
- Flexibility in content development—welcoming input from non-traditional educators, creatively supporting required curriculum, and/or including extra-curricular projects.
- The brokering of inspiring, effective teams—of teachers, administrators, and professionals—either through the efforts of schools and/or STEM-rich institutions, or through separate “match-making” institutions.



“Long-term, part-time” innovations like these have the potential to play a strong role in a renaissance of STEM education, both on a broad scale—to solve a systemic, decades-long decline in our national commitment to STEM education—and on a smaller but equally significant scale—to reach that singular student whose moment of connection with a passionate adult may catapult her to a future in STEM that she had never before imagined.

THE PROGRAM IN ACTION

Working as a team with STEM professionals including NASA and US Naval Academy scientists and an environmental conservationist, teachers at a Maryland middle school created a year-long, hands-on series of interdisciplinary projects to study the Chesapeake Bay watershed, culminating with the planting of 200 trees. “When we planted the trees, it was the first time I saw my students truly excited about science. They were really engaged,” said Susan Brown, science department chair at Central Middle School in Edgewater, MD. “In science we had studied the impact trees make in the health of the Chesapeake Bay watershed. We’d learned about the importance of native species and the negative impact of invasive species. In math, they had estimated how much water uptake their trees would contribute and how much carbon dioxide they would hold. And then they got to be a part of making a difference through science.

TECHNOLOGY ACCESS FOUNDATION'S TAF ACADEMY

TAF Academy is a small, grades 6-12 school in Kent, WA that is co-managed by the Federal Way Public School district (FWPS) and Technology Access Foundation (TAF), which is dedicated to advancing STEM education among minorities. The school, which opened in 2008, partners with local STEM institutions and individuals to give students frequent and immersive hands-on learning experiences with STEM professionals—in their classrooms, at offices and labs, via videoconferencing, and through internships. From college-level biomedical research with top cancer scientists to mobile game development with a team of Microsoft programmers, students learn state-of-the-art STEM content and skills from adults who are passionate about their careers.

The Academy invites STEM professionals to engage with the school at virtually any level, from one-time lectures and career day presentations to more sustained commitments of time and energy that bolster school curriculum. This includes a “long-term, part-time”^{*} program called Teacher/Scientist Partnerships (TSP), through which STEM professionals and TAF Academy teachers collaborate to improve teachers’ understanding of fast-changing, real-world STEM applications and create engaging lesson plans that resonate with students. These STEM professionals also have direct contact with students—they teach classes, communicate with students via online forums and videoconferencing, and evaluate student work. Their presence in the classroom frees up teachers’ schedules, allowing them to spend time collaborating with their fellow faculty, an opportunity rarely afforded teachers in resource-strapped schools serving underserved populations like the one at TAF Academy. The Academy’s deliberate recruitment of minority and female TSP participants allows its students of color and girls—a majority of its population—to see themselves in exciting careers that may have previously seemed unattainable. TAF Academy offers other STEM programs to bring together STEM professors and students.

INNOVATION ESSENTIALS

- STEM professionals collaborate with teachers to develop lessons.
- STEM professionals teach classes.
- Teachers are freed up to collaborate with school colleagues.
- Recruiting STEM professionals of color, who reflect and inspire the student body, is a priority.
- Students, teachers, and professionals are all seen as both learners and teachers.

LEARNING ENVIRONMENTS

Where the students are

TAF Academy (Grades 6-12)
in Kent, WA

MATCH MAKERS

How they connect

STEM professionals serve
as non-traditional educators
and collaborators in TAF
classrooms

STEM RICH INSTITUTIONS

Where the talent comes from

Local STEM institutions

INNOVATIVE PARTNERSHIPS

Partnerships with foundations and corporations are part of the DNA of TAF Academy. The school itself is a public-private partnership, and it has leveraged outside talent to collaborate on curriculum and extra-curricular learning. From its inception, while most of the school's relationship building has been through informal channels, such as the TAF administration's personal connections with employees at regional STEM companies, the school is beginning to formalize partnerships at the administrative level.

MICROSOFT

- TAF and Microsoft work together to create a TSP team of two to eight professionals to build in shared responsibility and accountability.
- The team works together with teachers to design and teach a semester-long, weekly, 90-minute computer science class for 9th and 10th graders.
- Microsoft allows TSP participants to include time spent in the TAF Academy classroom as part of their regular workweek.

HOW IT WORKS

The Microsoft TSP is currently the most robust of the partnerships at TAF Academy and serves as a model for the growth of others. The members of the Microsoft team work closely with teachers to create engaging lessons that combine core curriculum requirements with STEM workforce needs, including computer programming and software design. They rotate teaching responsibilities and meet as a group weekly to evaluate the previous week's lesson and plan for the next. Meetings between the professionals and teachers are informally organized as needed, and their time in the classroom overlaps for up to a half-hour each week to allow them to review and support one another's work and learn from each other.

Other STEM partnerships follow different models. For example, through the partnership with the Fred Hutchinson Cancer Research Center, six students participate in a five-hour, twice-monthly internship performing research under the supervision of top researchers. Students participate for three years, building sustained relationships with mentors and intellectual and creative momentum in their research. Some of the students take on full-time, paid summer internships at the lab. IBM, Boeing, and FrontRunner Labs have small but growing partnerships that also bring employees into TAF Academy classrooms.

NON-TRADITIONAL EDUCATORS

TAF Academy has, from the beginning, embraced professionals from outside the field of education. While all classroom teachers are certified district employees and members of the teachers union, top administrators include a lawyer, a software engineer, and a policy analyst, among others, each with a history of creativity and disruptive innovation. The school nurtures an environment that breaks down the traditional hierarchies and roles in education and views everyone in the building as both teacher and learner. A culture of innovation, experimentation, and risk-taking pervades the organization, making it a receptive setting for the TSP program.

“Our students learn today’s best practices directly from industry leaders, not a curriculum that will be out-of-date a soon as the textbook is published.”

SCHOOL

STEM PROFESSIONALS AS COLLABORATORS AND TEACHERS

- 30-50 STEM professionals participate in various roles at TAF Academy each year, with about 10 actively involved in TSP each semester.
- STEM professionals in TSP have significant input in the development of curriculum, through collaboration with teachers.
- STEM professionals involved in TSP include software engineers, graphic designers, doctors, environmental scientists, and project managers.
- TSP STEM professionals expose students not only to cutting-edge skills, but also to the collaborative work process that is fundamental in STEM careers.
- The professionals act as mentors and represent the racial, ethnic, and socio-economic diversity of the student body, providing inspiration and giving students a tangible vision of success.
- TAF Academy offers a large “menu” of ways for busy professionals to become involved, including hosting student interns, presenting guest lectures, and teaching workshops.

NON-TRADITIONAL SCHEDULING

Non-traditional learning time and flexible scheduling is integral to the school’s design. TAF Academy does not adhere to a sequence of grade-specific 50-minute classes like most traditional schools. Students’ schedules include an extended school day, a longer academic year, unconventional time blocks (some 90 minutes or longer), multi-age and interdisciplinary project time (which gives older students an opportunity to teach younger ones), and flexibility for students to pursue independent and group learning opportunities on and off site. TAF teachers have been the driving factor in convincing skeptics among stakeholders, such as some members of the teachers union and some school district administrators, that such innovation is valuable.

- The Fred Hutchinson Cancer Research Center interns each spend 10 hours per month at the lab without missing instructional class time. The internships take place while students on campus are pursuing other non-traditional learning opportunities (such as the Microsoft TSP).
- Having STEM professionals lead class time frees up teachers to meet with other faculty and collaborate—a deliberate design feature of the TSP program and a rarity for teachers in underserved communities.
- Flexible scheduling means professionals can choose a variety of time commitments, ranging from five hours a week in class to several hours a month assisting teachers with lesson planning.

FLEXIBILITY IN CONTENT DEVELOPMENT

As students at a public school, TAF’s students are subject to state standards, but because of its unique standing as a public-private model, TAF has latitude to pursue innovative options and resources to achieve those standards.

“Authenticity is the name of the game around here, and having industry professionals in the classroom is very authentic and credible. It helps that the [STEM professionals] are young and cool, but when you factor in that everything they are teaching and talking about comes from something they did at work yesterday, their credibility is unmatched.”

Brook Brayman
TAF Academy teacher,
participant in TSP

BROKERING INSPIRING, EFFECTIVE TEAMS

While the TAF administration spearheads the relationship building that fuels the Teacher/Scientist Partnerships, connecting STEM professionals with the school to create strong TSPs is a communal “matchmaking” affair. Current participating STEM professionals, community members, funders, and teachers help to find and foster new relationships for the program. The Academy now has a dedicated staff member for creating and maintaining institutional partnerships, ensuring accountability, and building effective TSP teams.

ASSESSMENT

Early results show TAF students outperform their district and state counterparts in several categories, but the school expects improvements in achievement after several more years of operation. TAF’s internal assessment is more informal and is based on both qualitative and quantitative data—including student work, college readiness, engagement, participation, behavior, test scores, and attendance—and demonstrates positive outcomes. The first graduating class had a 100% college acceptance rate, with several students bound for top science and technology institutions.

SCALING

A second TAF academy is set to open in nearby Renton, WA in 2013. TAF is weighing whether it can have the most impact by continuing to open individual schools in the Seattle area or by sharing its model and consulting on the development of similar programs throughout the country.

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