

science IMPACT



Fab Lab Program Fosters Student and Professional Relationships

At one computer station in Fab Lab Carnegie Science Center, a 15-year-old boy and an automation engineer are designing the parts they need to build a drone.



Dylan Stone, a student at Nazareth College and Career Prep, and his mentor, Dan Ferris, an automation engineer, work together to design and build a drone.

A few computers away, a 15-year-old girl and a chemist are looking for a unicorn design they can put on the checkers-type game pieces they will be making with a 3D printer.

They are among 10 high school students and 10 professionals who participated in the inaugural Mentors in the Making program at Fab Lab Carnegie Science Center. The program began in October and concluded in May. Together, the teens and their mentors learned how to use design software and high-tech digital fabrication equipment, such as a vinyl cutter, a laser cutter/engraver for working with wood or acrylic, and a 3D printer.

The culmination of the eight-month program was a capstone project created and built by each student/mentor pair. The students fulfilled a commitment to participate in the program for 32 hours and earned a laptop loaded with the design software they learned to use.

Liz Whitewolf, Director of Science and Education for the Science Center, said she wanted to give students, particularly those from underserved backgrounds, long-term experiences in the Fab Lab with the support

of responsible adults. The mentoring model is based on that of Computers4Kids, a nonprofit organization in Charlottesville, Va., that provides high-tech experiences for youths. “Their mentoring relationships are built around learning about computers, but we wanted to use the technology in the Fab Lab,” Whitewolf said. The model was tweaked to meet local needs, and Whitewolf secured funding for the first year from Partner4Work, the Pittsburgh region’s workforce-development organization. Initially, students and mentors did projects such as designing and making a keychain

ornament out of wood or acrylic with a laser cutter; designing and making stick-on nametags with a vinyl cutter; and using an extruder, which is like a hot-glue gun, to create a design out of a thread of biodegradable plastic.

The program, which includes dinner, took place once a week in the evening. Dinner was included as a convenience because of the time, but it became an important part of the program because of the great conversations students and mentors were having while they shared a meal together. Throughout the program, the mentors had plenty of opportunities to share their life experiences with the youths and provide tips to help them prepare for college and careers. The casual atmosphere fostered this kind of conversation. “It’s more comfortable to be here than in a more professional environment asking them about their everyday lives,” said Dylan Stone, a student at Nazareth College and Career Prep, formerly Holy Family Academy, in Emsworth.

Dylan said he enjoyed learning about 3D printing and using a programming language to create a computer game. He also enjoyed getting to know his mentor, Dan Ferris, an



Destany Best shows off the gameboard and decorated pieces she created on a 3D printer for her capstone project.

Directors' Note



Carnegie Science Center Co-Directors Ron Baillie and Ann Metzger

Can you remember when you were in elementary and high school how you felt at the start of a new school year? The anticipation of winter holidays? The excitement leading up to summer vacation? At the Science Center, we offer memorable activities for each of those occasions and throughout the year. In the fall, our Mobile Fab Lab and Science on the Road teams hit the pavement visiting schools around the region and even across the country to get kids excited about STEM — science, technology, engineering, and math. Meanwhile, teachers prepare their students for Science Center competitions and themed field trips. During fall and spring, our walls are bursting with groups of energetic students and the promise of winter and summer holidays, and our summer camps provide active, enriching, and extremely memorable experiences for explorers ages 4–18. Teachers and school administrators are in planning mode and participating in our professional development programs, so they, too, can provide experiences that resonate with their students and make them better prepared for the workforce of tomorrow.

Because our hands-on STEM programs provide engaging options for students and teachers, we have been expanding our offerings for many years. Over the last two years, for example, we have added the Teaching Excellence Academy, Mentors in the Making in Fab Lab Carnegie Science Center, Storybook STEM, and Comp Sci Adventure with Alice and Cozmo. Now, once again, this month is a time of new beginnings and a major milestone in the history of the Science Center as we celebrate the opening of the PPG SCIENCE PAVILION™.

This addition not only will allow us to host blockbuster touring exhibits and provide a modern event space with a stunning view of The Point, it will allow us to expand and enhance our student programming by 40 percent. The FedEx STEM Learning Labs provide 6,000 square feet of flexible classroom and lab space that can be divided into nine distinct learning areas. The suite will include a wet lab and an area designed especially for preschoolers. Outside, the Nimick Forbesway Foundation Rain Garden will show students how rainwater from the PPG Science Pavilion roof can be filtered naturally by a series of bioswales before it reaches the river.

We are so thrilled to provide more and better STEM programming for young people. Exciting students about science and preparing them for careers in STEM fields is a key component of the Science Center's mission. Our themed field trips, competitions, and other programming inspire students to solve problems, learn by doing, and collaborate, which will help them succeed in the workforce and in life. Our new wing is increasing our footprint on Pittsburgh's North Shore and our impact on today's youths and future generations. We can't wait to see what those children and teenagers will do with what they are learning.

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Carnegie Science Center delights, educates, and inspires through interactive experiences in science and technology. By making science both relevant and fun, the Science Center's goal is to increase science literacy in the region and motivate young people to seek careers in STEM (science, technology, engineering, and math).

The Science Center also serves as a town square for community dialogue on science and its social implications and seeks to showcase regional science and technology advances.

One of the four Carnegie Museums of Pittsburgh, the Science Center is Pittsburgh's premier science exploration destination, reaching more than 700,000 people annually through its hands-on exhibits, camps, classes, and off-site education programs.

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automation engineer. “We get to share experiences with each other,” Dylan said.

The student said Ferris has taught him a lot about being an engineer. “It’s more redoing than actually doing,” Dylan said. “You need to go back and change what you’re doing constantly. I thought people could blow right through (a project) and call it a day.”

Ferris said he has enjoyed being a mentor and fostering Dylan’s interest in aerospace engineering—for their capstone project they crafted pieces for and built a drone. “I’d love in a few years to have a leadership role in my career so I can mentor incoming employees,” he said.

Destany Best’s capstone project was like a checkers game with squares on a board and plastic pieces decorated with mermaids or unicorns. She used a 3D printer to create the pieces and a laser cutter to create the wooden board and a storage box. The Nazareth student said she joined the program because she wants to be a chemical engineer and needs to know about science and technology. Destany enjoyed learning how to use the equipment. “All of this stuff is useful,” she said.

Destany’s mentor, Sharlene Lewis, a chemist for Covestro, LLC, said mentors played a vital role in her life. “That’s why I became a scientist,” she said. Because of that, she wanted to participate in Mentors in the Making. “I just wanted to pay it forward,” Lewis said. She said the program also gave her the chance to use equipment such as a 3D printer and a laser cutter for the first time. “I knew about the concepts but had no hands-on experience,” she said. “It was nice to see it in action.” Lewis said she has enjoyed getting to know Destany and the other students. ■

Microbits

Local Man Honored by Future City Competition



Stephen Canton, a Pitt Medical student, was recognized at the international Future City Competition.

Bioengineer and University of Pittsburgh medical student Stephen Canton was named the Future City 2018 Alumnus of the Year by the international Future City Competition.

He participated in Carnegie Science Center’s Pittsburgh Regional Future City Competition in 2004 and 2005 when he was a student at St. Benedict the Moor School. Regional Future City coordinators nominate former participants who have remained active in the program or whose lives have been positively affected by the program for the international alumni award. As this year’s honoree, Canton was a judge at the 2018 international Future City Competition in Washington, D.C., and gave a speech there.

Covestro PRSEF Participant Succeeds in National Competition



Meghna Behari won a major prize at a national STEM competition for her invention of AquaBot.

North Allegheny Intermediate High School student Meghna Behari was one of the top winners in the Broadcom MASTERS® — the nation’s most prestigious competition for middle school students in the fields of science, technology, engineering, and mathematics.

Meghna won the \$10,000 Marconi/Samueli Award for Innovation. After finding that current water-testing methods are inefficient, Meghna developed the Aquabot, an automated testing device that can wirelessly collect and transmit data on water quality. She was nominated for Broadcom MASTERS® after participating in the 2017 Covestro Pittsburgh Regional Science & Engineering Fair, presented by Carnegie Science Center, when she was an eighth-grader at Marshall Middle School.

Science Center Senior Director Selected as STEM Advocate



Jason Brown, Senior Director of Science and Education at Carnegie Science Center, was chosen as a PA STEM Ambassador.

Jason Brown, Senior Director of Science and Education at Carnegie Science Center, was named one of 36 Ambassadors in the 2018 Pennsylvania STEM Ambassadors Program, which aims to shape the future of STEM education in the commonwealth.

Ambassadors were chosen by the Pennsylvania Statewide Afterschool Youth Development Network. They are conducting vital policy conversations with legislative leaders in the areas of STEM learning ecosystems, computer science, state and federal policy for formal and informal education, and workforce needs. Brown oversees the Science Center’s Center for STEM Education and Career Development, which includes initiatives for students, teachers, school districts, and early-learner programs, as well as Fab Lab Carnegie Science Center.

Teaching Excellence Academy Enhances Educators' Skills

STEM stands for science, technology, engineering, and math, but Carnegie Science Center's Teaching Excellence Academy (TEA) is showing educators across the region and across the country that "STEM education" encompasses a lot more than those four words.



Teachers make paper circuits during a Teaching Excellence Academy Workshop.

"We believe all teachers are STEM education teachers," said Toni Stith, STEM Professional Development Manager for Carnegie Science Center. STEM education is more about how a curriculum is delivered rather than just those four subject areas, she said.

It involves:

- Project-based learning (PBL)—learning by doing or solving a problem.
- Inquiry-based education—having students generate their own questions and then investigating the answers using experiments of their own design.
- Career awareness—exposing students to the many opportunities that await them in the high-tech workforce.
- Integrated curriculum—encouraging cross-curricular teaching and learning, thereby removing the silos present in traditional education.

"These four pillars differentiate the Science Center's STEM education workshops," Stith said. "That's why there is so much interest in our STEM education programs."

With clients across the nation, the Science Center's TEA is establishing a name for itself in teacher education. As the Academy concludes its second school year, it has served nearly 2,600 educators locally and nationally. Workshop participants have included teachers, principals, superintendents, curriculum specialists, librarians, and educators at other science centers. In addition, TEA trains staff in nonprofit organizations who want to enrich the programming at their summer camps.

Heading into its next year, TEA educators are planning to offer their workshops exclusively off site. It often is easier for a district to host a workshop at its own location than to send educators to the Science Center. When factoring in the costs for substitute teachers, transportation, parking, and meals, professional development quickly can become prohibitively expensive.

Also, there is a unifying factor to having a cohort of trained teachers in the same district. "It helps to build a buy-in for STEM," Stith said.

TEA offers its clients opportunities for a single workshop or a thematic series. These series include: Best Practices in STEM Education, Early Learner, Maker Education, and STEM Integration.

The Best Practices in STEM Education Series includes workshops that define the characteristics of robust STEM education as well as how to facilitate PBL and inquiry-based education in the classroom. Educators learn how to develop STEM projects that address real-world problems and, in turn, maximize student engagement. In the "Learning Through Inquiry" workshop, they learn how to center their lessons around challenging, open-ended questions that students research and answer. Stith said educators are encouraged to use "juicy" questions, not those that can be answered through a Google search.

The Early Learner Series includes workshops designed for teachers working with children in prekindergarten through second grade. They cover grade-appropriate PBL, robotics, and engineering, along with how to teach critical thinking through storytelling and role-playing.

Workshops in the Maker Education Series include coding, launching a digital-fabrication maker space, and the ever-popular "Quadcopter Challenge." Educators taking workshops in the STEM Integration Series learn about instructional strategies that use hands-on activities, puzzles, and games to boost students' STEM skills.

This school year, 64 teachers and administrators from the Toronto City School District in Ohio participated in a customized

series of TEA workshops on STEM, PBL, and inquiry-based education.

"We decided to use the Teaching Excellence Academy because our district was looking for new and innovative instructional techniques that would fully engage our students," District Superintendent Maureen Taggart said. As a result, she said, "the staff has gained a whole new understanding of STEM and has identified PBL as a priority."

The superintendent said she appreciated the TEA staff's flexibility. "The staff for the Teaching Excellence Academy is willing to work with your district to customize workshops to fit the needs of your staff," she said.

Ritah Buhite, a curriculum specialist for Appalachia Intermediate Unit 8, participated in TEA's "STEM Up Your Library" workshop in April at the public library in Hollidaysburg, Blair County. Pennsylvania's Intermediate Units provide educational services for school districts in different regions, and this one

serves Bedford, Blair, Cambria, and Somerset counties.

Buhite said she liked the hands-on activities included in the workshop, which could be used by both librarians and teachers.

"There were so many valuable resources shared from both the presenters as well as participants," she said. □

"We decided to use the Teaching Excellence Academy because our district was looking for new and innovative instructional techniques that would fully engage our students."

The Teaching Excellence Academy is presented by:





Chip Dougherty, Board Member and Co-Chair of the Carnegie Science Awards Host Committee

"It is an organization that is completely in line with my personal and professional goals," he said. Although Dougherty is a lawyer, his job involves a lot of science. Dougherty, counsel with Vorys, Sater, Seymour and Pease LLP, focuses on intellectual property law that involves the licensing and protection of innovative scientific research and technology.

Dougherty recognizes the need to get kids excited about science.

"Going to Carnegie Science Center can have an enormous impact on young people because the hands-on activities can get them interested in science-related careers," he said, adding, "Students often get their first exposure to science at the Science Center."

Dougherty remains active in the annual Carnegie Science Awards Celebration—the Science Center's signature fundraising event for student programming—by serving as Co-Chair of the Host Committee. He said it is important that people understand the level and quality of scientific advancement taking place in the region.

"As Co-Chair of the Host Committee, Chip has been a fantastic ambassador for the awards by securing sponsorships and auction items, building awareness of the event, and inviting and hosting guests," said Ann Metzger, Henry Buhl, Jr., Co-Director of the Science Center. "As important, he is really great at motivating other Committee members to do the same."

Dougherty and his wife, Kathy, a veterinarian, live in Allison Park. They have two children, Rachel, 25, and Coleman, 22. When his children were young, they liked the Science Center's summer camps, robotics classes, and planetarium shows. The planetarium always

was exciting for them because their grandfather was a rocket scientist at NASA, Dougherty said. Dougherty's favorite things at the Science Center are the

planetarium and the Fab Lab, a high-tech maker space.

He said he hopes people in Pittsburgh recognize what a "world-class" asset Carnegie Science Center is. "Not only is it a great museum," Dougherty said, "its STEM programs for students and educators are outstanding. The curriculum development is cutting edge. It's exciting to see that Pittsburgh is a leader in that area because of Carnegie Science Center."

Another aspect of the Science Center's programming that Dougherty particularly values is its efforts to interest young women in science. "You see the need for a structure that supports women's involvement in science. I think the Science Center does that very well," he said. ■

"Going to Carnegie Science Center can have an enormous impact on young people because the hands-on activities can get them interested in science-related careers."



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Kenya Boswell, President of the BNY Mellon Foundation of Southwestern Pennsylvania

Kenya Boswell serves as President of the BNY Mellon Foundation of Southwestern Pennsylvania. Since joining the Foundation in 2008, Kenya has overseen investments that support the company's philanthropic and business objectives. She is a member of BNY Mellon's Pittsburgh Executive Council, which sets strategic priorities for the firm's single-largest employee location in the United States. Kenya was instrumental in creating UpPrize, a unique collaboration between BNY Mellon and The Forbes Funds that challenges multiple business models to solve important social problems.

Why is a STEM-prepared workforce important to the BNY Mellon Foundation?

According to the Allegheny Conference on Community Development's Inflection Report 2017-18, if this region does not prepare for new people and new technology, we stand to face a shortfall of 80,000 workers over the next decade. To ensure the success of our next generation, we work closely with our nonprofit partners and invest in education, including STEM (science, technology, engineering, and math) education and technical training. We also support the expansion of innovative delivery models and the scaling of adaptive and mobile technologies. Our ultimate goal is to help build students' business and technology skills so they're able to contribute to society and be successful in a digital world.

In what ways has the BNY Mellon Foundation supported the Science Center?

Support from the BNY Mellon Foundation of Southwestern Pennsylvania helped Carnegie Science Center launch the Mobile Fab Lab, which provides hands-on, project-based STEM education to underserved schools, community organizations, and students. We're delighted that the Mobile Fab Lab has increased Fab Lab Carnegie Science Center's reach while reducing the cost and barriers to access.

Our support also enabled Carnegie Science Center to co-design a new STEM Challenge Toolkit in collaboration with Girl Up, an initiative of the United Nations Foundation. This comprehensive curriculum will be accessible to all girls in the Girl Up online club community and provide support for Girl Up's national yearlong STEM Challenge during the 2018-19 school year. Girl Up chapters will be able to integrate STEM competencies, such as design thinking and problem solving, into exercises directly tied to Girl Up's service pillars, including education, health, safety, and leadership.

Why does the BNY Mellon Foundation value its support of Carnegie Science Center?

We appreciate that throughout its history, Carnegie Science Center's programs often are targeted to those typically underrepresented in the sciences. Not only is the Science Center invested in developing the workforce of the future, it is also very intentional about building a more inclusive, empowered, and innovative STEM community.

Do you have any personal favorite exhibits/activities at the Science Center?

I really like the VGo robot! It essentially offers a virtual tour of the museum via a robot that moves around—as if I were physically there! I also love that the purpose of the robot is to allow visitors, particularly those who are physically unable to make on-site visits, to tour the museum and interact with exhibits and staff. ▣

Grants & Awards

- NOVA Chemicals has renewed its status as a Founding Partner of the Center for STEM Education and Career Development and a sponsor of Carnegie Science Awards for three years with a gift of \$150,000.
- With a combined gift of \$100,000, PNC Foundation and The Heinz Endowments have funded two more years of Buzzword Pittsburgh programming in Homewood. The Buzzword Pittsburgh collaborative—made up of several Pittsburgh nonprofits—provides vocabulary-acquisition programming for families of early learners.
- Eaton has provided \$100,000 as the Presenting Sponsor of the Carnegie Science Awards and to support Carnegie STEM Girls, SciTech Days, and the Covestro Pittsburgh Regional Science & Engineering Fair.
- The Pittsburgh Steelers donated \$100,000 to support general operations at the Science Center.
- The Jack Buncher Foundation awarded \$50,000 to support Carnegie Science Center's ongoing educational programming.
- The Buhl Foundation gave a \$40,000 grant to support the collaborative development and delivery of Mobile Fab Lab programming to 400 fourth-graders in schools on Pittsburgh's North Side.



Tour Your Future, a Carnegie STEMS Girls career-exploration program, visited Eaton in January.

Photo Essay: STEM Field Trips



January 23: Storybook STEM

While any field trip to Carnegie Science Center exposes students to science, technology, engineering, and math, the Science Center also offers themed field trips with special STEM-related activities. Among those field trips are Storybook STEM, with programming inspired by popular children's books; SciTech Days, which focuses on high-growth fields in the local economy; and Comp Sci Adventure with Alice and Cozmo, in which students create animated stories with Alice software and learn how to program a Cozmo® robot.

An elementary school student blows on his boat's sail to move it forward during a boat race. During Storybook STEM, students made boats powered by the "wind," an activity inspired by "Lost Treasure of the Emerald Eye," a book in the Geronimo Stilton series.



March 6–9: SciTech Days

High school students take on the roles of different medical professionals involved in brain surgery during the SciTech Days workshop "What Is This ... Brain Surgery? 2.0."



April 6: Adventures with Alice and Cozmo

Middle schoolers work with a Cozmo® robot while taking a Comp Sci Adventure with Alice and Cozmo.





More than 1,000 students representing schools throughout the region competed in Carnegie Science Center's 79th annual Covestro Pittsburgh Regional Science & Engineering Fair—one of the oldest and largest science fairs in the nation.

