



Children Learn Thrills of Applied Science

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When it comes to getting children interested in science, robots and LEGOs work like magic. Few know that better than Vikram Kapila and Ben Esner. They collaborate in NYU-Poly's Central Brooklyn STEM Initiative (CBSI). STEM stands for Science, Technology, Engineering and Mathematics.

Kapila is professor of mechanical and aerospace engineering at NYU-Poly and Esner directs the Institute's Center for K-12 STEM Education. They spoke with kids and watched them interact with robots on a large scale at the September 17-18 Maker Faire at the New York Hall of Science. The event celebrates the DIY (Do-It-Yourself) philosophy and showcases hundreds of projects.



1A young girl uses an iPhone to control a robot.

Jared Frank, a mechanical engineering graduate researcher for Kapila, built an iPhone-controlled robot on display at the event. Frank said his creation has many potential iPhone-controlled applications, including for home automation and the military. At the Maker's Faire, children took turns waiting for a demonstration by Frank, who showed them how to touch the phone's screen to make the robot move.

Kapila was delighted to see children lining up to interact with Frank's robot and another one developed by his graduate students, which incorporated LEGOs. "Our graduate Fellows would simply hand an iPhone to a kid who looked curious about how a robot was being controlled," he said. "With the iPhone in hand, the kid would self-discover the actions needed to command the robot, then show it to other kids in the crowd. It was fun and gratifying to watch children engage in learning on their own."

That's just what Kapila hopes for. He developed the CBSI in response to the national education-policy discussion about how to get young children interested in STEM subjects. CBSI places graduate Fellows in local schools with the aim of using robotics and mechatronics to interest children in STEM disciplines.

"Children's lives today are immersed in modern technology," Kapila said. "Even as they interact with high-tech gadgets – some even have to teach their parents how to use them – they often do not know or understand all the science, math and engineering that go into devising these technological tools and toys. We use these tools as a hook to get children to learn science and math. If they have fun learning this way, they might even consider careers in engineering."

Kapila said his graduate students appreciate the opportunity to interact with young students who are not yet scientists or engineers: "When the graduate students explain their mechatronics or robotics research, they can use everyday English without relying on technical jargon." That helps the graduate students, too. "Having to explain their work to others helps them develop a better conceptual understanding of their research. Also, they report that they are amazed how some young students seem to naturally grasp technical details and ask for even deeper explanations."

"Another word for 'maker' is engineer," Esner said, "so the Maker Faire was a perfect place to showcase several types of robotic devices and demonstrate how our Fellows use

mechatronics principles to teach STEM concepts in the classroom. These initiatives not only inspire the next generation of engineers and makers, but also teach the science, engineering and math needed to succeed in STEM careers.”

This is the first year NYU-Poly students, who were exhibiting among several hundred like-minded inventors, participated in the Maker Faire. They showed off their engineering skills in an exhibit called “Mechatronics Mania.” Their inventions included a robot built to bowl, which fit in perfectly with the fair’s unique element of whimsy. Other exhibits varied from a demonstration by lock-pickers who showed how physical security operates and how it can be compromised, to 3-D printers that make jewelry on the spot, to fountains fueled by Mentos and Diet Coke that shoot more than 20 feet in the air.

The full name of Kapila and Esner’s program is the Applying Mechatronics to Promote Science/Central Brooklyn STEM Initiative. This year, 14 NYU-Poly Fellows are working in 22 schools (mostly in central Brooklyn), both in the classroom and after school, as mentors for competitions. Kapila said the NYU-Poly exhibit at the Maker Faire was another way to educate the community about the initiative. “We were there to showcase what we do with robotics to engage students,” he said.

Rezwana Uddin, an NYU-Poly graduate fellow working toward a master’s degree in computer science, works at P.S. 270 with students in grades 3-5. Uddin, who built a robot that balances on two wheels like a Segway, incorporates classroom activities using LEGO kits based on what the children are studying in math and science. “They’re very excited,” she said of the projects the students work on. “They like the idea of being in control. While they’re doing that, we’re explaining the math and science concepts behind (the technology).”

Esner was excited that NYU-Poly’s K-12 STEM education program – and the graduate students who work as instructors in the Brooklyn public schools – featured their work at the Maker Faire. “Robotics is very engaging and incredibly effective at drawing in children and adults in public settings,” he said. Graduate students, who also serve as expert resources for K-12 teachers, demonstrated the creativity they bring to classrooms by building robotic devices they use to teach fundamental concepts in math, physics, engineering and other STEM disciplines.

“Improving K-12 STEM education is, for very good reasons, at the top of the agenda for teachers, principals, parents and policy makers,” Esner said, “and NYU-Poly is contributing significantly to making that happen.”