



Outreach 101

McCormick students take science to Chicago-area schools

GROWING UP IN A RURAL COMMUNITY THREE HOURS OUTSIDE SEATTLE, TRAVIS JOHNSON DIDN'T HAVE THE BENEFIT OF A WELL-FUNDED HIGH SCHOOL SCIENCE PROGRAM. But he did have the benefit of an excellent science teacher. “Joyce Stark,” recalls Johnson, a third-year PhD student in applied mathematics at McCormick. “She really went above and beyond the call of duty, running a regional science fair that sent someone to internationals every year. It really set my life in a positive direction.”

Today, Johnson, the vice president of the McCormick chapter of the Institute of Electrical and Electronics Engineers, is passing on his love for science to a new generation of students. Johnson and his fellow IEEE members have performed demonstrations in several Chicago-area schools, showing students how to make “oobleck,” a non-Newtonian fluid made of cornstarch and water, and how to contact people thousands of miles away using a small tabletop radio and antenna. “The kids love it,” says Johnson. “It’s fun to see them excited about science.”

Johnson is one of many McCormick students who, through student groups, spend time in Chicago-area public schools doing volunteer work and class projects. By offering demonstrations at science fairs, organizing after-school activities, and mentoring up-and-coming young engineers, they are becoming the positive role models for the next generation of scientists and engineers.

STARTING EARLY

The task seemed simple: create an injection-molded plastic toy—a helicopter or action figure,

perhaps—that could fit in the palm of a hand. But there was a catch. The toy had to be made to the liking of an unusual set of clients: a class of fourth graders at Nettelhorst Elementary School in Chicago’s Lakeview neighborhood.

While short in stature, these clients were tall in demands—a fact that became clear during the first Northwestern-Nettelhorst brainstorming session, held in the elementary school’s activity room. A chipper, blonde fourth grader laid out her sketch for a pyramid-shaped toy patterned with intricate hieroglyphics. Another student decided his toy should be an iPhone, complete with an Angry Birds app on its screen. “Ridiculous,” shouted a third child between fidgets.

“A dog! A camera!” he insisted, overwhelmed by the possibilities. “No—a dog with a camera!”

“They have high expectations,” explained Andrew Scheffel (mechanical engineering ’12). “We’re going to do our best to get them everything they want.”

The McCormick students went to Nettelhorst as part of a senior capstone course in mechanical engineering, Computer-Integrated

Manufacturing, that exposes them to the design and manufacture of mass-produced goods. Students in the course take a project from “art to part,” using McCormick’s prototyping lab and injection-mold machinery to design and manufacture a plastic doodad of their own creation.

When the course’s lecturer and lab instructor, Michael Beltran, was approached by Nettelhorst parents about a partnership, he saw an opportunity for learning on both sides. “It’s like working with a real client, but your client is 10,” Beltran says. “That’s a fun challenge for McCormick students, and it also allows us to introduce Chicago Public Schools children to the basics of engineering. It’s a win-win.”

Under Beltran’s guidance a small group of former Computer-Integrated Manufacturing students started visiting the fourth-grade classroom

Above: Michelle Gunderson, a teacher at Nettelhorst Elementary School, watches a computer demonstration with her students.

Right: Michael Beltran (top) and Andrew Scheffel (bottom) brainstorm ideas with Nettelhorst fourth-graders.





last fall, making slide presentations and doing demonstrations, laying the groundwork for the project to come. They started with the basics—What is engineering? What is a solid? How does a mold work?—before moving on to specifics of their project: Will the plastic be thin or thick? What shapes work best in a mold?

When winter quarter arrived, a new class of McCormick students took the reins. Working in groups, Northwestern and Nettelhorst students agreed on their projects, and the McCormick students set to work designing them. In February, as the highlight of the project, the younger students visited McCormick for a tour of the Ford Motor Company Engineering Design Center, including the shop where their toys would be created. At the end of the quarter, the students returned to collect their toys.

While one of the goals of the Nettelhorst project was introducing elementary school students to science, it was just as valuable to introduce them to the idea of college, says their teacher, Michelle Gunderson. “Many students come from backgrounds where it’s not assumed they’ll go to college,” she says. “Just having this presence in our classroom is a wonderful learning opportunity for kids in an urban school.”

OUTREACH WHERE IT COUNTS

Bringing science into schools is fun and rewarding work for many McCormick students—especially when they are able to engage minority and underprivileged groups in science, technology, engineering, and math (STEM) fields.

That’s the mission one wintry Saturday afternoon as a group of Hispanic teenagers gather in a

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first-floor lecture hall in Tech. They chat over slices of pizza before tentatively taking their seats in the front row, where clean note-

pads and buzzers await them. Two Northwestern students take their spots at the front of the room and flip open their practice test books for the US Department of Energy Regional Science Bowl. “Toss-up. Chemistry. Multiple choice: Which of the following is not true?” reads Jesus Flores (mechanical engineering ’13).

The teens stare anxiously at their notebooks, pens tapping, as the possible answers are read. “Don’t get overwhelmed,” says Tonantzin Carmona (political science ’12). “Focus on the key words. If you have to take a guess, answer with confidence. It will intimidate the other team.”

Carmona and fellow members of the Society of Hispanic Professional Engineers (SHPE) meet regularly with this group, the society’s junior chapter from Evanston Township High School (ETHS). Most of the year they organize events, plan for conferences, and help the high schoolers navigate their way to college. But in January and February their focus turns to the Science Bowl, a *Jeopardy*-like competition in which kids are quizzed on biology, math, energy, and other topics.

With more than 10,000 students nationwide participating in the Science Bowl, the ETHS team is up against some stiff competition. But these weekend practice sessions seem to be making a difference: Last year the team placed first in the regionals and went on to compete in the National Science Bowl in Washington, DC. More important, high school students are becoming engaged in the sciences. “Science was never something

Above: Members of Northwestern’s Society of Hispanic Professional Engineers prep Evanston Township High School students for the Science Bowl. Right: Eliza Bifano (mechanical engineering ’12) demonstrates a milling machine for elementary school students during a tour of the Ford Motor Company Engineering Design Center.

I thought about doing outside of school,” says ETHS junior Brenda Martinez. “But SHPE made it more interesting to me. It’s nice to have mentors from Northwestern who help us.”

Through such outreach activities student groups like SHPE and the National Society of Black Engineers are trying to reach students like Martinez—with good reason. According to the National Action Council for Minorities in Engineering, just over 6 percent of engineers in the United States are of Hispanic descent; only 5 percent are African American. To increase these numbers, these national student organizations encourage members to partner with local high schools, creating a web of support that gets kids engaged early and keeps them on track through college.

Many McCormick students see this as a powerful connection, particularly because they lacked similar mentorship during their high school years. Engineering was never presented as an option at the public high school Lamar Richards (mechanical engineering ’14) attended on Chicago’s South Side. He knew he wanted to work with cars but came upon engineering only by chance, while searching the Internet for jobs. “When I was in elementary school I used to think engineers were people who worked on trains,” Richards says. “There weren’t engineering courses at my high school. It was something I had to seek out on my own.”

Now, as NSBE’s precollege initiative chair, Richards works to find ways to introduce young



African Americans to STEM careers. The student group has hosted open-campus events for middle and high school students and has gone door to door passing out information about college and financial aid. SHPE also hosts several daylong events where dozens of middle and high school students experience engineering-related fields through tours, demonstrations, and talks with faculty members.

SCIENCE DAYS

McCormick student groups have found other opportunities to bring science into elementary schools, sometimes finding inspiration in surprising places. In one case, a children's book was the impetus for what has become a long-standing outreach program. *Boing-Boing the Bionic Cat* tells the story of Daniel, a young boy who loves cats but is allergic to them, and his neighbor, a kindly engineering professor who builds Daniel a bionic cat with fiber-optic fur, computer-controlled joints, electronic eyes, and ceramic-sensor whiskers.

More than a decade ago, Leah (Lucas) Lavery (materials science '01) read the book and was

inspired. She raised money, put together an outreach kit, and began making arrangements for her student organization, the Materials Science Club, to visit local elementary schools. After each visit classes would receive copies of *Boing-Boing the Bionic Cat*. "I wanted to start a tradition," says Lavery, who now works in product development at PARC. "I really enjoyed those visits."

The tradition has continued: Through its MatSci Exposing Students to Science (MESS) program, the Materials Science Club continues to conduct outreach in Evanston and Skokie elementary schools. In November the group presented demonstrations at Dawes Science Saturday, a science event for families at Evanston's Dawes Elementary School. In front of dozens of wide, safety-goggled eyes, the McCormick team dipped flowers in liquid nitrogen and shattered them. "They loved it," says Danni Jin (materials science '13), chair of the MESS program. "It's great to see the kids asking questions and being curious about science."

The Materials Science Club wasn't the only McCormick student group at Dawes Science Saturday. Just down the hall students from

Northwestern's SHPE chapter impressed the elementary schoolers with a do-it-yourself project involving glue, detergent, and food coloring. "None of the kids had ever attempted to make something like Silly Putty," says SHPE president Cecilia Silvestre (manufacturing and design engineering '12). "They had all heard of it, but they thought it was some chemical thing you could make only in a factory."

To a 6- or 10-year-old, these activities might seem more like playtime than education. But that's partly why they are so successful, says Johnson. "Growing up, I took part in science fairs every year," he says. "It's what got me started on my path into the sciences. I really enjoy what I do, and I like sharing it."

And the take-away message is powerful, even if the students don't choose a future in science. "We want to expose them to what college is and what engineers do," says Beltran. "The point is to get them excited, to let them see they can do anything they want in life." **M** Sarah Ostman

Watch a video about McCormick's outreach programs at www.mccormick.northwestern.edu/magazine.