



High Tech

» Trinity High School junior Allie Pirrone works as a nurse's aide at her Marymount Hospital internship.

Schools are finding new and creative ways to raise the level of science, technology, engineering and math education.

BY HEIDE AUNGST

D

ressed in dark teal scrubs, Allie Pirrone rolls a digital blood pressure monitor into patient Sam Niro's room at Marymount Hospital. Pirrone's youthful face gives away that she is much younger than any other nurse or assistant who has come into his room today.

That's because Pirrone, a junior at Trinity High School, is participating in the school's 2-year-old pre-professional internship program, which helps pay part of her tuition. Pirrone and the rest of the Trinity sophomores, juniors — and next year — seniors, do internships in health care, animation and design, information technology or college and career readiness.

Niro spots the Trinity identification badge she's wearing and smiles. "My son went to Trinity," he tells her as she slips the cuff onto his forearm and presses the button.

They continue talking as she finishes taking his readings, and the two discover that they once were neighbors on the same street in Maple Heights before Pirrone's family moved to Sagamore Hills and Niro relocated to Broadview Heights.

"It's always nice to see a young person who wants to work," Niro says.

Pirrone, who plans to major in occupational therapy, says working as a nurse's aide at Marymount reinforces what she's learned in her medical terminology and medical science and technology classes and has prepared her for the field.

"If a patient has to go down for a test, you know what it is," she says. "I understand stuff more because I see how it works."

Indeed, seeing how science, technology, engineering and math learning can be applied in real-life situations will encourage more children to pursue careers in those fields, says Michael Foreman, chief of external programs at NASA Glenn Research Center. Foreman, who grew up in Wadsworth, flew on space shuttle missions in 2008 and 2009.

He was inspired by John Glenn and now speaks to students to try to create that same spark. "It's showing them what the people here get to do with their science, engineering, math backgrounds and having these kids take that back to the classroom and say, 'You know, if I study hard and get a degree in math, science, engineering, I can be out there working with the gee-whiz stuff those guys get to work with,'" Foreman says.

That's welcome news for those who, like President Barack Obama, are pushing to improve the showing of American high school students in math (25th) and science (17th) compared to the rest of the world.

It is, in fact, what Obama referred to in his January State of the Union address as "our generation's Sputnik moment," calling for investments in education and innovation, particularly in science, technology, engineering and math to move the country forward, much like what happened after the Soviets launched the first satellite, Sputnik, into space in 1957.

It reaffirmed his 2009 Educate to Innovate campaign to raise American students "from the middle to the top of the pack in science and math in the next decade."

In Ohio, officials were already moving on a strategy of their own.

"It's showing them what the people here get to do with their science, engineering, math backgrounds and having these kids take that back to the classroom." — Michael Foreman, NASA Glenn

In 2008, the state created the Ohio STEM Learning Network, which included schools devoted exclusively to science, technology, engineering and math education, including Cleveland Metropolitan School District's MC²STEM and Akron's National Inventors Hall of Fame School. And this year, Ohio's curriculum got an overhaul that required, for example, four years of math, including Algebra 2, for all students.

"I agree with President Obama's concern about this area," says Thomas Maher, special assistant to the president at Trinity and chairman of the board at Marymount. "I can't solve international problems, but as a lifelong Clevelander, I can make sure that talented kids, like here at Trinity, see that there are opportunities here in Cleveland."

STEM for All

To realize these opportunities, Stan Heffner wants us to start thinking of engineering as a verb.

As associate superintendent, Center for Curriculum and Assessment at the Ohio Department of Education, Heffner is pushing for an idea he calls "STEM for all." In other words, we need to raise standards for education in all schools by focusing on problem-solving and reasoning skills rather than rote memorization.

"How do I anticipate? How do I build on past knowledge? How do I know that there's good evidence and bad evidence and know the difference between the two?" Heffner asks. "Those are things you'll find in the new academic content standards."

And it's the kind of thinking that's already happening in places like St. Edward High School, Laurel School and others throughout Northeast Ohio.

St. Ed's offers three one-semester pre-engineering classes and plans to bolster its offerings with additional staff training in the International Baccalaureate Design Technology curriculum over the summer.

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The goal is a more integrated method that combines disciplines to give students a more rounded engineering experience, Falk says. "We try to incorporate everything into our classes."

Similarly, Laurel has grown its engineering offerings from one course to four in recent years, including a new computer science course this fall.

Consider the juniors in Licia Kovach's second-year engineering class, for example. They designed a playground with a traditional swing set, a tire swing and climbing rope for an orphanage in Tanzania as part of a service project with a group called the Olevolus Project. Laurel students have made three trips to Tanzania to help the people of Olevolus Village.

The engineering students built scale models and selected materials through research and Skype conferences with the director of the nonprofit orphanage in Olevolus Village.

And by conducting a cost analysis, the girls figured it would be cheaper to pack the heavy chains and swings as baggage on their commercial flight than ship it separately. So in June, 16 students and three chaperones made the 25-hour trip to the west coast of Africa with the playground

equipment packed in their suitcases.

There was only one problem: When they arrived, they discovered the available wood wasn't thick enough to build the project as designed.

"It was a matter of re-engineering right on the spot," Kovach says. "They hammered two pieces together and made it work."

Similarly, Laurel's Center for Research of Girls has added to the student experience by applying what it knows about STEM learning differences in boys and in girls.

Because girls have less spatial reasoning and don't tinker as much as boys in childhood, Laurel has created three stations throughout where students can play with Rubik's Cubes, circuitry or knots.

"Boys see technology as a toy; girls see it as a tool," says Larry Goodman, Laurel's director of strategic programming. "So if you focus your lesson on technology, boys love it. They think it's cool. Girls find it meaningless."



» Allie Pirrone plans to major in occupational therapy in college.

Make it applicable in the real world, however, like the Tanzania trip, and everything changes.

Laurel junior Kristen Nemeth, for example, created a computer program to determine the best arrival time to get a parking space in the school lot. She used sensors in the lot that would report the number of cars as they arrived and left to a Google Docs spreadsheet, generating a chart. The program was sophisticated enough to recognize a car, rather than a bicycle or dog that might pass the sensors.

"I really enjoyed this project," she says. "Not only did it have a real-world applica-

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-Adam Alaman, Science Teacher

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PAGE TURNER



Devonte Watkins, MC²STEM High School

DEVONTE WATKINS WALKS the halls of MC²STEM High School at GE Lighting's Nela Park campus talking about projects the students get to do: building robots, lamp prototypes, acrylic gears, biomes.

He says he once even built an artificial heart. "But I wouldn't want anyone to actually put it in a body," Watkins says, smiling. In that smile you can detect the next thing he's set to build: a political résumé.

Watkins, a junior from Collinwood, is only the second page for Sen. Sherrod Brown and the first Cleveland Metropolitan School District student to become a Senate page. In January, he moved to Washington, D.C., where he is living in the page dorms, attending school and working on Capitol Hill.

Watkins heard about the page program through a mentor and entered the competitive page selection process without even telling his MC²STEM teachers or having them look over his essay, a key component of the application.

Watkins wrote about obesity and health care, which he studied last year. It's also an issue that Brown is passionate about.

"DeVonte is a hard-working, driven and talented young man," Brown says, noting that MC²STEM's challenging curriculum and access to internships have prepared Watkins for his semester in Washington.

GE Lighting leaders sparked Watkins' interest in business. His team won the Sophomore Project,

creating a prototype LED lamp and business plan. The turn to politics seems divergent from the intense math, science and engineering curriculum that he has received during nearly three years at MC²STEM.

But principal Jeff McKellan says it's the style of learning that creates stand-out students like Watkins.

"If students want to leave here, and they want to be a lawyer, they're going to have a strong college prep education," McKellan says. "They're going to know how to solve problems. They're going to know how to think. They're going to know how to work with people."

"I know that DeVonte will represent Ohio and the city of Cleveland well over the course of his term on Capitol Hill," Brown adds. — HA

tion, but also my classmates and I were able to use prior knowledge from other classes to put our project together."

Few organizations in Northeast Ohio know the real-world applications of science, technology, engineering and math better than NASA, GE Lighting, Case West-

ern Reserve, University Hospitals and the National Inventors Hall of Fame.

That's why NASA Glenn partners with the Cleveland schools' MC²STEM High School, provides professional development for teachers and brings students to its research center for workshops and shadowing opportunities.

"We're inspiring the next generation of STEM workers," says Carolyn Hoover, NASA Glenn's STEM school coordinator. "NASA, and indeed the country, has a need to replenish our work force and inspire area youth of the nation to dream big."

Devonte Watkins, a junior at MC²STEM from Collinwood, is a prime example.

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» Joseph Tonich, Trinity High School

JOSEPH TONICH HAS A head-start on his bioengineering future. The Trinity High School junior already has an invention to his credit — a device to make laparoscopic kidney surgery easier — and two medical internships.

Two years ago, Tonich, of Parma Heights, was on a team of Trinity students who designed a device that won the Cleveland Clinic Youth Medical Innovation Award. The competition challenged high school teams to research renal cell carcinoma (a type of kidney cancer), the instruments used in minimally invasive and robotic surgeries, and one of the pioneers in the field, Dr. Andrew Novick, chair of the Glickman Urological and Kidney

Institute at Cleveland Clinic until his death in 2008.

“Part of STEM is stimulating creativity and looking at problem-solving and critical and analytical thinking,” says Rosalind Strickland, senior director of the Office of Civic Education Initiatives at Cleveland Clinic. “So all of those 21st-century skills were embedded, and that is the focal point of any type of innovation.”

In kidney surgery, Tonich says, it’s often hard to get other organs, such as the liver, out of the way. So Trinity’s device added pressure sensors. “We added a second camera so you see inside the body much better,” he says.

Tonich came to Trinity because he knew he wanted the medi-

cal background provided by the school’s Pre-Professional Internship program. Tonich spent his sophomore year in the pharmacy at Marymount Hospital, and this year he is a direct patient care intern at Southpoint Hospital.

While working at the pharmacy, the supervisor asked him to brainstorm how to improve workflow on the pharmacists’ desks.

“He took it home. ... He came back with a detailed drawing with measurements,” says pharmacy supervisor Margaret Morgenstern. “We went to the furniture place with the drawing he prepared for us. He would become really interested in something and then take the initiative to take it further.” — HA

When he learned he’d be attending school year-round, 10 weeks on, three weeks off, he wondered if he could handle it. But Watkins has thrived at MC²STEM, even becoming the Cleveland Metropolitan School District’s first Senate page. (See “Page Turner,” page 127.)

“We talk about the sacrifices that you make in order to be successful,” says principal Jeff McKellan. “And, for the most part, they’re willing to make them.”

MC²STEM freshmen attend school at the Great Lakes Science Center with frequent visits to NASA Glenn headquarters; sopho-

mores are at GE Lighting’s Nela Park; and, next year when renovations are completed, juniors and seniors will attend classes at the former Jewish Community Federation building, though most seniors will be on internships or taking college classes at Cleveland State University or Tri-C.

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BRAIN TEASER

RESEARCHER GARY LANDRETH thought Patty Hunt was a little nuts when she called him four years ago with an idea: The director of research at Hathaway Brown wanted to put 14-year-old Adriana Zinn into a research laboratory.

"This just doesn't happen," recalls Landreth, director of the Alzheimer's research lab at Case Western Reserve University's School of Medicine. "I was seriously skeptical."

Now he says, much to his surprise, it's been "utterly fantastic."

As a result of her research in Landreth's lab, Zinn was a co-author on a paper submitted to medical research journals and a Siemens semifinalist in the 2010 Siemens Competition in Math, Science & Technology.

By knowing she would have almost four years and three complete summers in the lab, she started slowly, reading papers

and learning the basics of slide and petri dish preparation. Now, she has her own bench in the lab, and it can be tough for the average person to understand much about her complex research.

"I have my own cell lines of astrocytes, which is a cellular body that have these prostheses that extend out to the brain," she explains. "We target these cell lines in a petri dish with the drug of interest. ... We can splice open the cells, and we can see what types of protein levels are there."

In other words, she is studying a drug's impact on cells to see if it will help clear the plaques from the brain that cause Alzheimer's.

Zinn's achievements extend beyond the lab. She is a policy debater, ranked 12th in the state. And she participates in Hathaway Brown's Global Scholars program, which will culminate in a project on "The Economics of Discrimina-

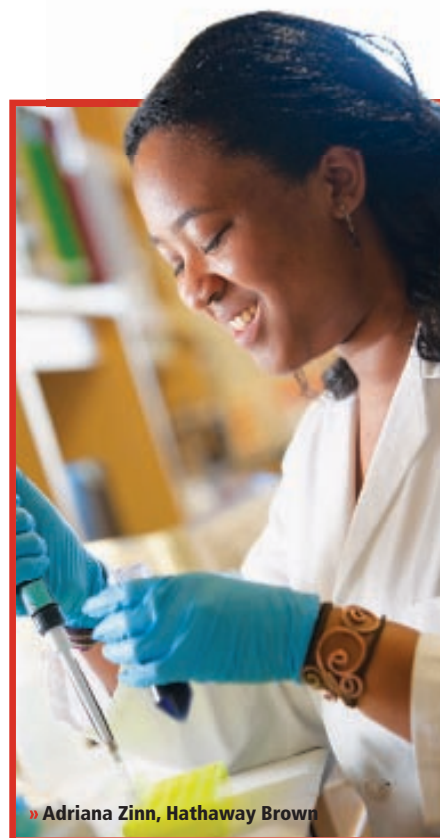
tion in Kurdistan." She also traveled to India to investigate the developing role of women there.

She hopes to work in international health. "Science has really helped me change the way I think," Zinn says. "I can take a more practical approach to things. I can reason my way through. I think I'm a little calmer under pressure. It also makes me more aware that I can challenge myself to understand things that are way outside my realm."

For his part, Landreth says Zinn has achieved far beyond what he ever expected from a high school student.

"Adriana is very smart. She's very ambitious, and she's very talented," Landreth says. "Over the period of years Adriana's skill set got larger and larger. Right now, she is better than many of my incoming graduate students."

— HA



» Adriana Zinn, Hathaway Brown

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MC²STEM emphasizes understanding across disciplines and requires students to receive a 90 percent or better in a unit before moving on. "There are tests, there are essays, but it's more," says McKellan. "You need to know how to solve this problem."

For example, on a sound project, students worked together to build speakers, using math and engineering skills. Then in art, they developed a brand and logo for their speaker company. In English class, they looked at the poetry of song lyrics and wrote a technical manual. Finally, they tested out the speakers at the Rock Hall.

"We work in teams because we know that successful leaders in the 21st century don't work in isolation very often," McKellan says.

For the sophomores at GE Lighting, that translates into a buddy system where MC²STEM students are paired with a GE employee for a meeting or lunch twice a month. To further this experience, students are given 25 days to create a business plan and working prototype of a lighting product, says Andrea Timan, STEM/community programs manager for GE Lighting.

These methods aren't limited to high schools either.

In Akron, the National Inventors Hall of Fame School opened with fifth-graders and sixth-graders in fall 2009 and by next fall will serve fifth through eighth grade.

"Kids really start to make decisions once they get into that middle school range about whether or not they're good at something, like 'I'm great at math' or 'I'm no good at math,'" says principal Traci Buckner. "We really wanted to catch the kids before they got to that point."

And being surrounded by the work of inventors certainly has its advantages. When too much noise was rising from the school's Great Hall to the Learning Commons above it, the librarian asked a group of fifth-graders to come up with a way to dampen the sound. One of the students suggested calling Jim West, the inventor of the electret microphone to help them learn about sound-absorbing materials.

"They realize that there may be many possible solutions," says Buckner. "It's not about being right or wrong. It's being able to think critically."

Jonathan Short, a senior from the Cleveland School of Science and Medicine, can point to the moment he wanted to become a cardiologist.

Short was in the catheterization lab at University Hospitals Case Medical Center watching Dr. Sahil Parikh snake a catheter through the neck of a patient who had a

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NUMBERS GAME

KATIE JAGUSCH CAUGHT THE BUG WHEN SHE took an engineering class at Mayfield High School.

Unfortunately, she says, that course is no longer offered.

In fact, schools are so varied in their approaches to science, technology, engineering and math education that she decided to take it out of the classroom and into the community. Jagusch, a mechanical engineer, started STEMout a nonprofit that has the mission of STEM outreach.

STEMout brings a STEM Squad program to Cleveland State University the third Saturday of every month for sixth- through eighth-graders. The hour-long programs include a hands-on activity and a talk from a professional that works in a STEM field.

"We're trying to create an extracurricular activity for students who do not have access to these STEM schools so they can still learn about these STEM career paths," says Jagusch, a project engineer for URS Corp.

In the future, Jagusch plans to expand the program to high schoolers. Next year, several schools and the Girl Scouts will participate in a pilot Girls Design Challenge with teams competing to engineer a beauty product that also has humanitarian aspects to it.

— HA

[➔ MORE INFO](#) stemout.org

metal fragment pierce his heart. Parikh lasoed the metal piece that had broken off of an inferior vena cava filter — a device implanted in a vein to prevent blood clots from reaching the heart — and pulled it out, saving the patient from riskier and more difficult open-heart surgery.

The procedure was so rare, and performed with such finesse, that the technicians applauded.

"It was pretty clear the minute Jonathan came into the cath lab with us that the lights went on, and you could see right away that he had really caught fire," Parikh says. "That's a moment we all live for as educators. We have the unique privilege of working with medical residents and fellows who are in their last days of training, but it's relatively unusual to work with high school students."

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