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STEM Academy's Reach Spans Illinois

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The prestigious Illinois Mathematics and Science Academy, a residential public high school here, serves a small slice of the state's students—650 carefully selected 10th through 12th graders who have demonstrated talent in math and science. However, the school's impact goes well beyond its contained, suburban campus.

The state-funded academy runs a growing number of outreach initiatives, including after-school, summer, and professional-development programs, which school leaders say reach more than 10,000 students across the state every year.

In fact, it now operates three field offices, in Chicago, Belleville, and Rock Island. The offices provide local support to schools administering the outreach programs, and hold workshops and summer programs themselves.

One of IMSA's best-known initiatives is the fusion after-school program, in which top-performing middle school students, mainly in underresourced areas, get a taste for the academy's hands-on approach to math and science.

Given that the Illinois academy's demographics skew heavily Asian and white—with only 14 percent of students from low-income families—IMSA administrators emphasize that a key goal of fusion and other outreach programs is to help make the campus more diverse.

The fusion classes are team taught by one math and one science teacher, who get training and mentoring, as well as a wealth of curricular materials, directly from IMSA.

Through the fusion program, students tend to get their hands dirty, building catapults or making electricity from jam and Jell-O. Math teacher Joe Matuch, from C.F. Simmons said fusion gives him a chance to introduce students to real-world problem-solving, which can be tough to incorporate into the regular school day.

"They learn by experimenting in the sense that they test their ideas and see what happens," he said.

Legislative Charges

The Illinois Mathematics and Science Academy was established nearly three decades ago as an independent, state-run agency with **two legislative charges**: to offer a challenging education for students gifted in stem and to "stimulate further excellence for all Illinois schools in mathematics and science." The goal was essentially an economic one—to prepare a workforce of engineers, researchers, and computer programmers

that could serve Illinois.

The academy relies largely on state aid to support the boarding school and outreach efforts, and received $17.7 million for the previous fiscal year. But it also gets money from private donors, including foundations, businesses, and individuals. A wall of plaques in the lobby shows six-figure-plus grants from the Grainger Foundation, at&t, and Toyota USA, among others.

In November, Youtube co-founder Steven Chen, an alumnus, donated $1 million to help the academy build an open-space startup incubator, which is intended to bring students and community members together for collaborative entrepreneurialism.

Eric R. Brown, a high school biology teacher from Evanston, Ill., who sits on the board of trustees at imsa, said the state aid and private gifts serve a larger goal for Illinois.

"Most people who know about IMSA respect and understand that it's not money going toward the gifted, it's money invested in stem education across the state," he said.

To walk into IMSA's main building is to face a slew of evidence that the school is meeting its first charge—providing a challenging education. Presentation posters from the 11th and 12th graders' independent research projects line the walls, describing studies of hyperbaric oxygen therapy and baseball sabermetrics. Schedules read as if pulled from a university coursebook, with classes like Organic Chemistry and Microbes and Disease.

On Wednesdays, the majority of students leave campus to conduct research or intern at places including the **Argonne National Laboratory** and the University of Chicago. Some students do their self-led work in a laboratory on the premises, equipped with a $100,000 DNA sequencer and several $30,000 microscopes.

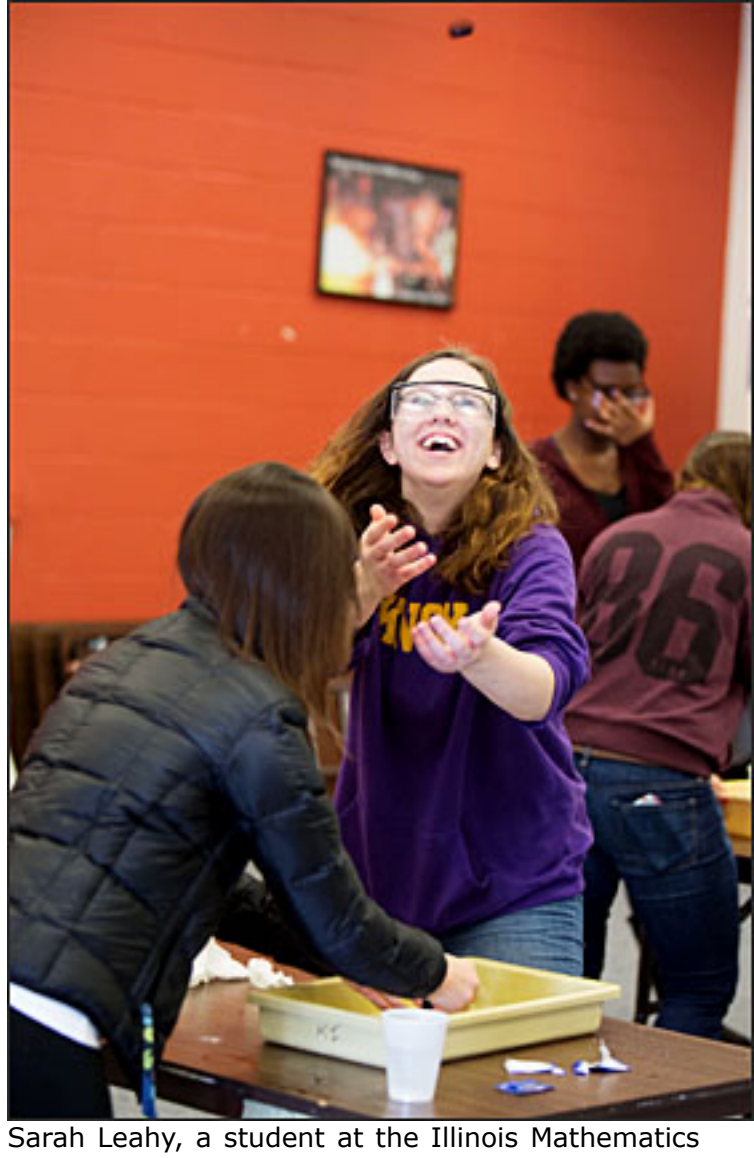
"It's better equipment than people see at 300-level college courses," said Judy Scheppler, the school's coordinator of student inquiry and research.

Self-direction and inquiry are at the heart of everything IMSA students do, said Catherine C. Veal, the academy's interim president.

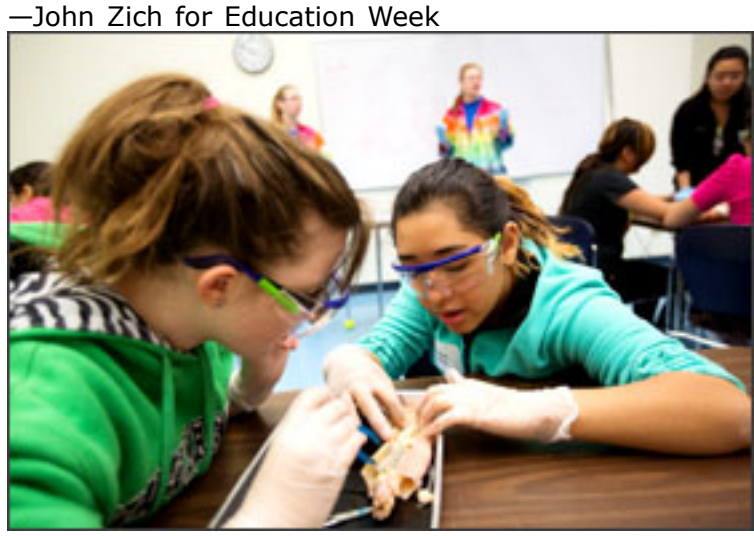
"We promote group work, collaboration, and problem-solving—like the real world," she said. "It's ultimately about [students] helping generate new knowledge, not about understanding knowledge that already exists. ... How do we break kids out of learning and into doing?"

During classes at IMSA, students typically sit at octagonal tables rather than desks, and the rooms do not have a clear front or back.

Jake Akstins, a senior, said students are encouraged to learn on their own and from each other, rather than



Sarah Leahy, a student at the Illinois Mathematics and Science Academy, is poised to catch the lid from an exploding film can after mixing water and Alka-Seltzer inside. The students are participating in a training program that prepares them to lead inquiry-based projects.
—John Zich for Education Week



Maysen Cahn, left, and Melissa Garcia dissect a squid in a lab at the academy. They were among a group of students from Cowherd Middle School in nearby East Aurora who participated in a series of hands-on lessons during a recent visit to the state-funded boarding school. The dissection lab was led by several IMSA students (in tie-dye smocks).
—John Zich for Education Week

waiting for the teacher to lead. For Donald Dosch, a biology teacher at IMSA, this kind of instruction is preferable to lecturing, which he said he'd be expected to do at a university.

"Class time is not where I do my best teaching," he said. "It's when students come to my office and we can sit down" with a specific problem and have a discussion.

The fusion after-school program currently serves about 3,000 upper elementary and middle school students each year who've been selected for their talent and motivation. A "professional field services" team, housed in a wing of IMSA, is working to expand the program, and others, to even the state's most remote school communities.

In 2012, the program received national recognition, when Change the Equation, a coalition of business leaders promoting improved stem education, added fusion to its **selective database for potential funders**. The fusion curriculum and its more than 60 hours of material—based on the Common Core State Standards in math, and a recently developed set of common science standards—are written by dedicated IMSA staff members.

fusion schools pay $800 for the curriculum and teacher training and are responsible for the remaining costs, such as teacher pay, bus transportation, and snacks. Dora Phillips, the academy's director of statewide educator initiatives, estimates those costs total $8,000 per year.

After-School Inquiry

About four miles from IMSA, at C.F. Simmons Middle School, where a quarter of students are English-language learners and 90 percent come from low-income homes, 25 fusion students stay after school once a week for hands-on stem enrichment lessons.

On a recent winter day, participating students at the school were working on a lesson about "secret communications," learning the basics of computer coding and encryption.

The computer lab where they did the "Caesar's Cipher" activity had no heat that day—in fact, half the school hadn't had any during an historically frigid week—but students were immersed in figuring out the online game and seemed unfazed.

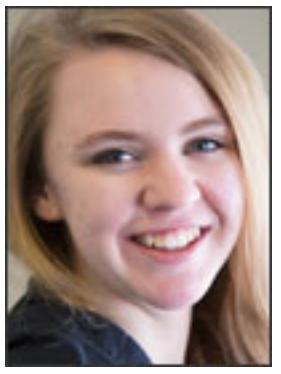
When asked why they participate in fusion, for which they had to apply, several Simmons students said they planned to eventually enroll at IMSA, the state's selective boarding school, which is tuition-free.

In truth, though, the requirements for entering the academy are steep, and only a third of those who have the credentials to apply—impressive sat scores, essays, recommendation letters, and parental support—will be accepted.

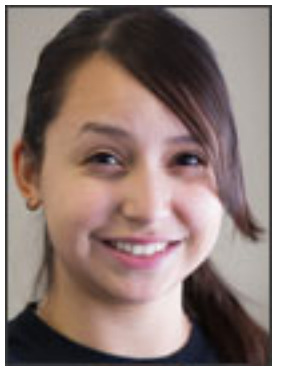
IMSA Students on Inquiry-Based STEM Learning

Al-Jalil Gault, a senior at IMSA, describes the experience of collaborating on an inquiry-based project with several classmates.

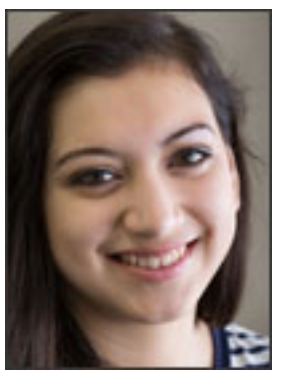
IMSA student Kristina Toman explains what inquiry-based learning means to her.



Yvette Ramirez, a senior, talks about a hands-on group quiz she took in a physics class at IMSA.



Jeanette Suarez, an underclassman, says IMSA teachers encourage students to ask questions and apply their learning to novel concepts.



Mr. Matuch, the school's fusion math instructor, has been involved with IMSA since he began teaching. While in college, he lived at the academy for summer trainings with the Golden Apple Scholars, a program that prepares Illinois candidates to teach in high-need schools. IMSA faculty periodically worked with the preservice teachers and led seminars.

When Simmons introduced fusion, Mr. Matuch jumped at the chance to work with IMSA again.

"We don't do a lot of experiments here unfortunately," he said. However, with IMSA fusion, he added in an email, "there are many topics, such as cryptography, that I get to teach that I otherwise would not, and it's fun to teach these large units on important, interesting topics."

Fusion students take two field trips to IMSA each year, during which they learn from students at the academy and participate in an experiment—most recently a squid dissection.

The high school students who teach during the fusion field trip are part of another outreach program, known as Allies. Through that peer-teaching program, IMSA students learn how to deliver hands-on stem lessons to children in the younger grades, and hone their leadership and presentation skills. In addition to leading incoming field trips, the Allies act as guest teachers at public schools and teacher professional-development sessions.

Claus von Zastrow, the research director at Change the Equation, said programs like fusion and Allies that promote hands-on learning are of keen interest to the business community. "That's what business leaders want and need—people who are prepared to address real-world challenges," he said.

Mr. von Zastrow also noted that an independent review of the fusion program conducted by WestEd (and paid for by Change the Equation) found that "IMSA fusion students generally took much more advanced, rigorous courses in high school after going through [the program], and were more successful in them," including students from typically disadvantaged backgrounds.

ILLINOIS MATHEMATICS AND SCIENCE ACADEMY

SOURCE: Illinois Mathematics and Science Academy; *Education Week*

The sheer number of outreach initiatives led by IMSA is striking. Aside from fusion and Allies, there are summer camps, pre-admission programs, science nights, preview days for parents and potential students, individual online mentoring, and workshops for outside students and teachers. Some programs come with a fee, though students can often receive need-based scholarships to attend.

The three IMSA field offices now help the academy administer and provide support for these programs across more Illinois territory.

North Carolina Outreach

The Illinois Math and Science Academy is just one of nearly 100 selective, stem-focused schools around the country that belong to the National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology. The North Carolina School of Science and Mathematics in Durham is another such residential school that's similar in size and philosophy to IMSA. But the Durham school's outreach efforts look somewhat different.

Melissa Thibault, a vice chancellor at the school, said one of the main ways it reaches students beyond its campus is through video-conferencing classes. Students who live in remote areas without access to certain advanced stem courses can take video classes for free that are taught by the staff at the North Carolina

school.

About 550 students take classes this way, and another 200 students who were accepted to the school but are unable live on campus take a full courseload online, she said.

The school works directly with about 1,500 students across the state each year, said Ms. Thibault. The school also provides its integrated stem lessons for free on the state education department's website—a form of outreach not done at IMSA.

"What we do belongs to the state," Ms. Thibault said. "As much as we can make it available, it's our desire to disseminate it as broadly as possible."

Students at all of these specialized schools tend to test well—many take the sat for entry—and nearly all go to college. They receive national awards, win competitions, and publish research in academic journals. But one of the most common ways for the schools to tout their worth is by pointing to accomplished alumni.

At IMSA, educators and students consistently remind visitors that Sam Yagan—the creator of the free dating website OKCupid and now the chief executive officer at Match.com—went to the academy. So did Rob and Mike McCool, who helped start the Internet browser Netscape, and Russel Simmons, who co-founded both PayPal and Yelp.

This pattern of producing alumni who've been successful in digital innovation has not gone unnoticed. Now, school leaders at IMSA are working to capitalize—and improve—on efforts to prepare young entrepreneurs.

Innovation Hub

With the recent $1 million gift from Mr. Chen of YouTube, a 6,400-square-foot "innovation hub" will be built at IMSA. The goal is for entrepreneurs, students within and outside IMSA, faculty members, and the business community to work together on projects, said Ms. Veal, the academy's president. The hub will be modeled after **Chicago's 1871**, an incubator for digital startups where IMSA students already work.

Ms. Veal views the innovation hub as both a new form of community outreach and a way to take self-directed learning to a new level.

"We're thinking about what the next leap is, and it's the digital learner," she said. "Schools are not structured for that kind of kid."

Mr. Dosch, the science teacher at IMSA, agreed that the hub could be a force for change, but suggested it will require more than just a new space to motivate entrepreneurialism. Students often "have an idea but they tend to not understand what it takes to reach that goal," he said. "They don't know how to get to the end. That's what our job can be here."

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