MIT's biggest contributions of the past 25 years? They aren't what you think.

By **Scott Kirsner** Globe Correspondent, Updated September 10, 2024, 2:53 p.m.

More than 3.2 million kids have participated in a FIRST-organized robotics competition, where teams design a bot that needs to collaborate with others to prevail against an opposing team. TAYLOR COESTER

If you asked me to compile a list of the four most influential things to come out of MIT in the past 25 years — things that have truly changed the world — it wouldn't include any drugs, software, patents, or startups.

Instead, the list would consist of four programs that get kids excited about, and more proficient in, STEM — science, technology, engineering, and math. All of them have global reach. And they were started or shaped

by three MIT professors: Mitchel Resnick, Neil Gershenfeld, and Woodie Flowers, [who died in 2019](#).

If you have kids or grandkids, the odds are good that their education has involved at least one of these four things: the Scratch programming language, the Computer Clubhouse Network, the Fab Lab network of makerspaces, and the FIRST robotics competitions.

More than 120 million people have created accounts to use Scratch, a visually oriented programming language that makes it easy for kids to create their own animations and interactive games. More than 3.2 million kids have participated in a FIRST-organized robotics competition, where teams design a bot that needs to collaborate with others to prevail against an opposing team. This month, the FIRST Global Challenge will bring robotics teams from nearly 200 countries together in Athens, Greece.

At the MIT Media Lab, professors Mitch Resnick (left) and Neil Gershenfeld launched initiatives that have changed the way many kids learn about technology. DAVID L. RYAN/GLOBE STAFF

FIRST, founded in 1989, was patterned after a robot-building course at MIT that was overseen by Flowers, a mechanical engineering professor. Inventor and entrepreneur Dean Kamen says that he was working to scale up a local engineering competition he'd been running in Manchester, N.H. Kamen had as employees several MIT alumni who'd taken the course, and pointed him to Flowers. Kamen wanted to create a sport — not a science fair — and Flowers was a key contributor.

Like the MIT course, FIRST gives every team a standard set of components and a set of tasks their robot must perform. The tasks typically involve manipulating colorful inflated balls — putting them in bins, for instance — balancing the robot on teeter totter-like elements or grabbing a bar and doing a pull-up.

For many years, Flowers served as an emcee at many of the national FIRST competitions, usually wearing a vest festooned with buttons that had been given to him by the student teams. FIRST still gives out an award named for Flowers each year, to the teacher or adult mentor who has the biggest impact on the kids who participate.
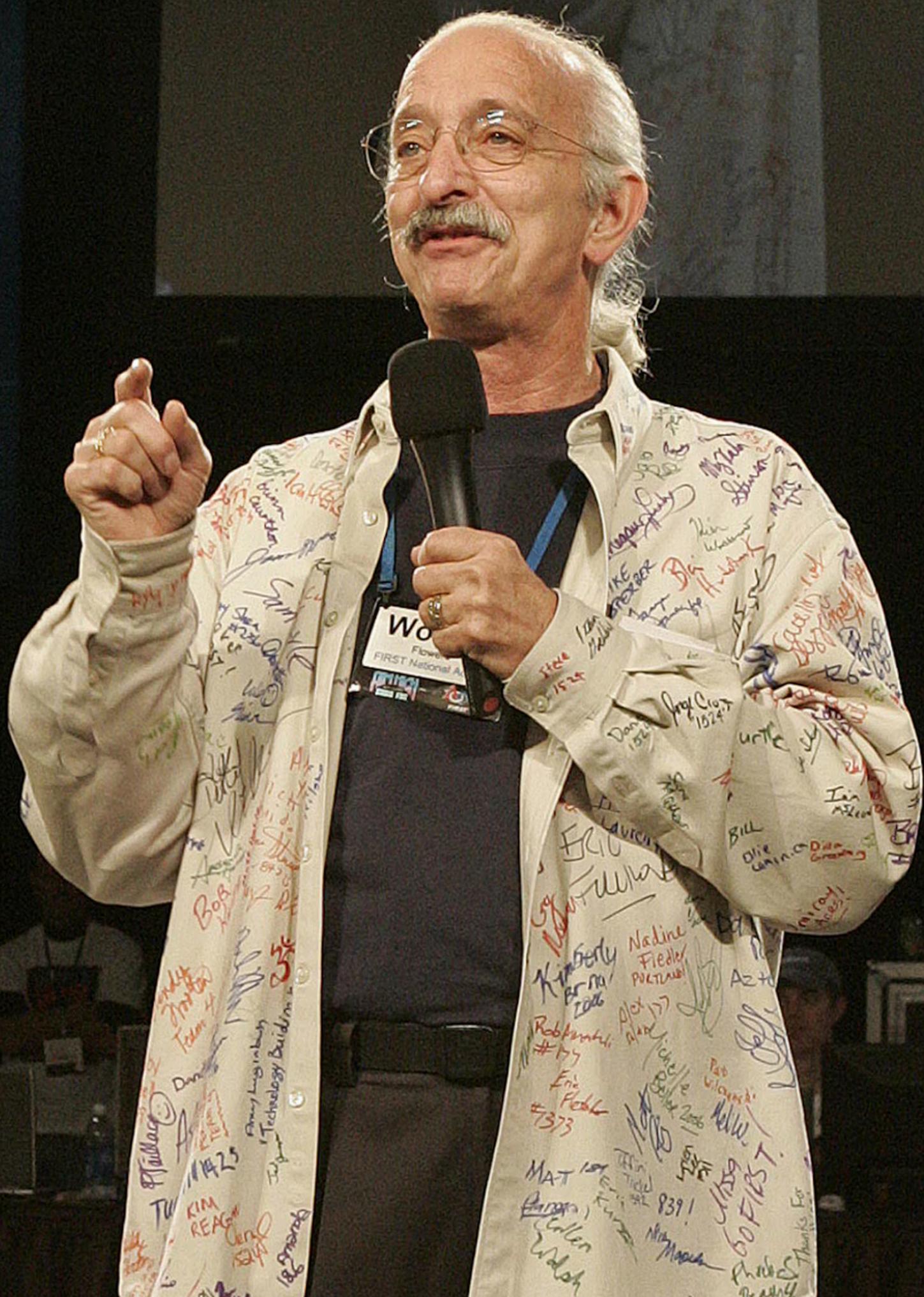
FIRST, founded in 1989, was patterned after a robot-building course at MIT that was overseen by Woodie Flowers, a mechanical engineering professor. RIZER, GEORGE GLOBE STAFF

FIRST and Brandeis University are conducting a longitudinal study of participants, to understand the program's long-term impact. One finding after nine years of gathering data: FIRST alumni are 17 percent more likely to declare a major in a STEM-related field in college than their high school peers who took math and science courses, but didn't participate in the competition. And female FIRST alumni were three times as likely as their peers to declare a major in engineering or computer science.

The Computer Clubhouse, meanwhile, sprang from a research group at the MIT Media Lab focused on learning, and led by Resnick. Its goal was to teach kids how to use computers by making their own projects — music, websites, games, videos — and learning about software and hardware along the way. The first one opened in 1993 at the Computer Museum in Fort Point Channel, and more than 90 percent of the kids who showed up in the early years were from underserved communities.

While that museum no longer exists, today there are 151 Clubhouses in 20 countries, along with an annual summit that brings teens together. Research done with kids who have spent time at the Clubhouse has found that 93 percent want to continue their education after high school, and 73 percent say that their experiences at the Clubhouse have influenced that decision.

Tommy Romero (left) worked with a computer as Alfredo Borges and Joe Sturniolo worked together in a Computer Clubhouse in Framingham in 2001. ELLEMENT, JUSTINE GLOBE STAFF

In the early 2000s, Resnick saw that kids at some of the Clubhouses in India wanted to write software, but existing languages were too hard to learn, or couldn't easily do what they aimed to do. So he and colleagues, including Natalie Rusk, created the Scratch programming language. The name references how DJs scratch records and remix music made by others. With Scratch, you can start with a blank screen or you can take something that another person has created, see how it works, and use elements of it in your own program. (You can look at a game like "Moving About," where players get points for loading a moving truck, click "see inside" to see how it works, and remix the game to be about moving paintings in a museum instead of furniture from a house.)

The Scratch platform has been translated into more than 70 languages, and more than a billion projects have been created on the Scratch website. Both Scratch and the Clubhouse "enable kids to work on projects based on their passions, in collaboration with peers, in a playful spirit," Resnick said. A recent endeavor has been rebuilding Scratch for Android smartphones, so students can build and share projects for mobile phones.

The newest of the MIT-spawned initiatives is the Fab Lab Network, run by a nonprofit called the Fab Foundation. It began by bringing prototyping machinery into that first Computer Clubhouse in the late 1990s, and now its network of 2,700 makerspaces in 150 countries let students develop their own project ideas. Later, Gershenfeld worked with Mel King, the late civil rights activist, to set up the first permanent Fab Lab in the South End in 2003.

Shameya Bass of Mattapan showed off a project she made in the Fab Lab at the South End Technology Center @ Tent City in 2013. JOSH REYNOLDS

Compared with FIRST, and its emphasis on competition, Gershenfeld said the Fab Labs attract "people who are less interested in doing the assigned task and competing to win it, but have visions of what they want to create."

While Scratch may be used in many classrooms, the other three initiatives largely take place outside of the classroom, as extracurricular activities. But they reinforce each other; a student may discover one — and later participate in another. Laura Peters, who coaches the FIRST robotics team at Somerville High School, says that "a lot of my students got interested in computer science and robotics by learning Scratch as

elementary or middle school students, so I definitely think that Scratch can be an amazing catalyst in that way."

Each of the initiatives brings some of the hands-on problem solving, messiness, and collaborative prototyping elements of MIT's culture into the wider world. And they've all had a big impact on the way kids learn about technology.

Scott Kirsner can be reached at kirsner@pobox.com. Follow him @ScottKirsner.

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