

NEWS

Teachers and Students Expand Their Robotics Skills Together in New K-12 STEM Program

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Students from John Bowne High School work with their physics and robotics teacher, Ferzileta Gjika.

When imagining a typical high school classroom, one pictures a teacher at the head of the class teaching while the students are dutifully taking notes and (presumably) learning. Not the case at a new K-12 STEM education program at the NYU Tandon School of Engineering. Teachers and students learn alongside each other as they discover the exciting world of robotics and computer programming through a hands-on project-based curriculum.

Supported by the National Science Foundation as part of its commitment to preparing future generations for STEM-related careers and rapidly changing work environments, the **Innovative Technology Experiences for Students and Teachers (ITEST)** program at NYU Tandon centers on robotics and engineering design, as well as entrepreneurship, to help teachers develop their own technical skills and spearhead robotics curricula and after-school programs at their schools.

Led by [Vikram Kapila](#), Professor of Mechanical and Aerospace Engineering, the ITEST program brought together teachers and students from 12 high schools across New York. They spent their summer working with Arduino (an open-source electronics platform), mobile robots, sensors, motors, and electronics; participated in structured learning in subjects like mechatronics, physics, and electronics; and tested their design prowess in building a fully-functioning robotic vehicle.

Diving into Robotics

For Stanley Sinto, a physics and chemistry teacher at the S.T.A.R Early College High School in Brooklyn, the ITEST program offered an opportunity to expand his expertise in robotics with the ultimate goal of designing a program for his high school. “Robotics currently doesn’t exist at my school, and since our name

stands for science, technology, and research, we really want to incorporate robotics into our focus,” Sinto said. “We’d like to test it out as an after-school program first, and then transform it into a class and eventually have a robotics club that can compete.”

After participating last year in the NSF-funded Discovery Research (DR) K-12 program, which provides design-based robotics training to middle school teachers, Sinto joined the ITEST program with two students from his chemistry class, Trea St. Hillaire and Angelique Bailey. Alongside their teammates, the trio spent the first two weeks of the program learning the basics of assembling and programming necessary to build their robotic vehicle, under the guidance from Kapila and NYU Tandon graduate students.

“This is our first time working with Arduino, so it was a little intimidating,” said Bailey, a rising senior who plans to study chemistry in college. “But, I feel like we’re coming out with a better understanding.” St. Hillaire echoed her friend, adding that while they had limited mastery of robotics going into the program (“it was like jumping into uncharted waters”) working alongside their teacher on interactive projects fostered a unique learning environment. “Having different people on our team and Sinto was great because if we didn’t understand something, we could always ask him. Also, as the other students in our group have a robotics team at their school — which is something we want to do at S.T.A.R. — so we’re getting a lot of ideas from talking with them,” said St. Hillaire, who’s interested in robotics within the medical field.

Alyse Anderson, who teaches biology, forensics, and life sciences at Midwood High School, noted that while students and teachers possessed a diversity of expertise, the program offered guided training in the basics of robotics as well as more advanced challenges for her students, many of whom previously participated in NYU Tandon’s [CrEST \(Creativity in Engineering, Science, and Technology\)](#) program. While Midwood offers robotics course, Anderson shared that the ITEST program provided her with a new knowledge of coding and working with Arduino — skills she hopes to translate to her students.



Reyce Krause (second from left), a teacher at Ma’ayanot Yeshiva School for Girls, discusses the robotic vehicle with her fellow colleague at Ma’ayanot Aryeh Tiefenbrunn (second from right) and NYU Tandon graduate student Abhimanyu Dhawan (far right) as we

“The total immersion in this learning environment here at NYU is tremendous. It’s a balance of academic and hands-on learning, and it’s reinforced a lot of things I’ve been learning by myself,” said Reyce Krause, another ITEST participant and teacher at Ma’ayanot Yeshiva High School for Girls. A former math teacher,

Krause teaches within Ma'ayanot's STEAM program, which incorporates art into the typical STEM curriculum, and through the school's own Makerspace has exposed her students to 3D printing, laser cutting, circuitry, and wearable technology. "In working with motors and circuits, everything is stripped away and suddenly my students are no longer wondering how things work, but they can see how to make things work," said Krause, who joined the program with her colleague Aryeh Tiefenbrunn to discover more ways to integrate robotics and entrepreneurship into their courses.

This philosophy is one that Kapila views as instrumental to the program. "When students demonstrate that they're learning a concept, this motivates the teachers even more to continue teaching robotics to their students," explained Kapila, who has worked for over 20 years in K-12 STEM education and also leads the NSF-funded DR K-12 and Research Experience for Teachers (RET) programs at NYU Tandon.

Future Engineers



A high school student test drives the robotic vehicle, which use sensors to pick up and move obstacles

While the teachers are already planning their lessons and projects for the academic year, the students themselves are also realizing the ways technology and robotics can be part of their daily lives. Inspired by their two-day intensive entrepreneurship workshop where the teams met with tech entrepreneurs at the [Urban Future Labs](#), Bailey envisaged an idea for a new mobile app. "While we learned that starting a company can be risky, I'm definitely interested in pursuing the app," Bailey exclaimed.

"Exposing them to robotics as an opportunity, especially with the way our society is moving towards technology, can only help them to have this basic understanding of how computing and robots work," Sinto shared. "After DR K-12, I told my students that if I had this in high school, I would have gone down this path of robotics rather than chemistry. This [program] will open up that path for them."

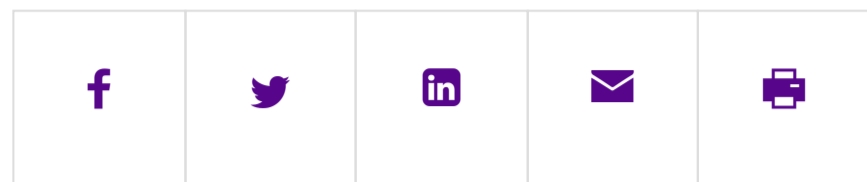
Faculty from NYU Tandon and NYU Steinhardt serve as co-principle investigators for the ITEST program, including [Oded Nov](#) from Technology, Management and Innovation, [Jin Montclare](#) of Chemical and Biomolecular Engineering, and [Catherine Milne](#), Department Chair of Steinhardt's Teaching and Learning

and Professor of Science Education. Additional program members include Department Chair and Professor of Civil and Urban Engineering [Magued Iskander](#) and Professor of Mechanical and Aerospace Engineering [Maurizio Porfiri](#), as well as Director of the K-12 STEM Education Center [Ben Esner](#).

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