

Bringing Math to Life

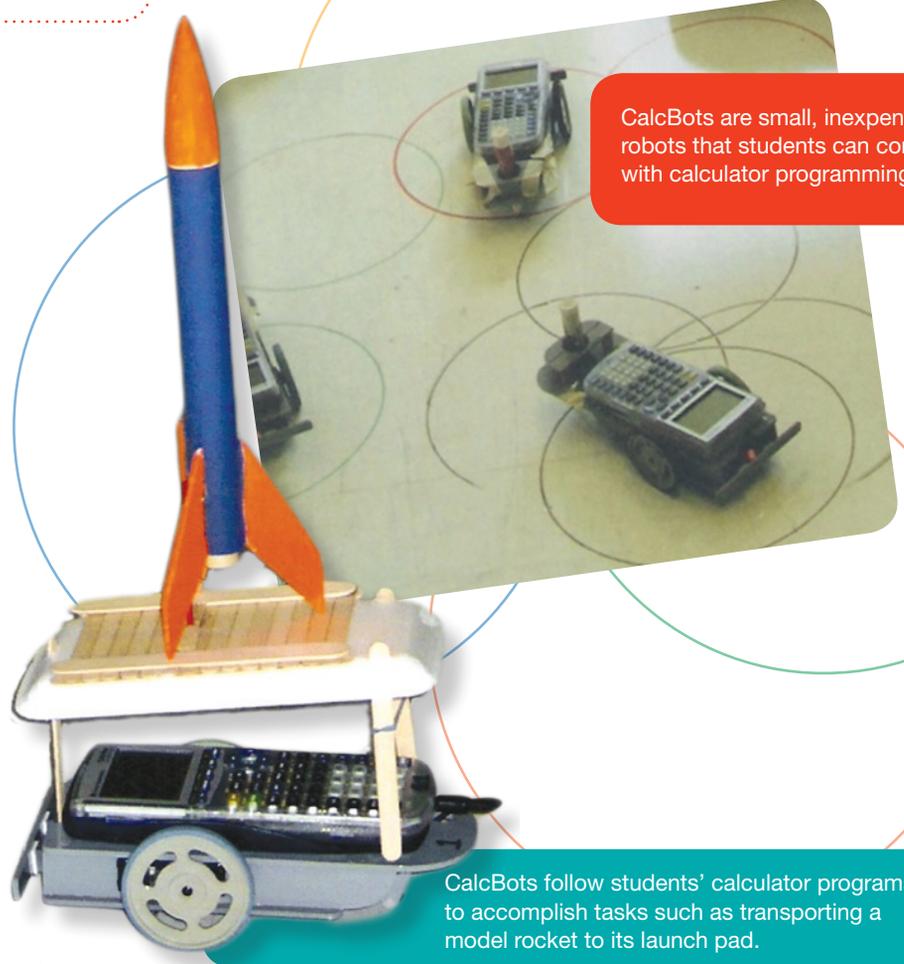
For the most part, educational technology and mathematics courses couldn't be more different. If you walk into an ed tech classroom, you're likely to see a lot of hands-on projects, whereas math courses tend to rely more on bookwork and paper-and-pencil problem solving. But when I worked on a dual assignment as both a math and ed tech teacher, I met two guys named Alfred and George who showed me how to blend these two teaching methods into one seamless approach that not only reflected the interrelationship between these two subjects, particularly in the field of engineering, but also induced a level of student enthusiasm I'd never seen before.

Kids Love CalcBots

Alfred and George are CalcBots—small, inexpensive robots controlled by calculator programming tools. My students were immediately captivated by their festively colored wheels, green “on” lights, and bumper switches that allowed them to move at a constant speed in multiple directions. What's more, the students could choose their own wheel and tire colors, name their robots, and dress them up with flags, stickers, and paint. As a result, they felt pride and affection for their own robots, which magnified their learning by tuning into their emotions and creativity.

Here are just a few of the many memorable moments I've had in my classroom with CalcBots:

- A boy who struggled with academic subjects widened his horizons when he mounted a temperature probe on his CalcBot and figured out how to



CalcBots are small, inexpensive robots that students can control with calculator programming tools.

CalcBots follow students' calculator programs to accomplish tasks such as transporting a model rocket to its launch pad.

“search and rescue” fellow students who were alive under “earthquake rubble” (toppled desks and chairs).

- A group of girls emitted shrieks of anticipation as they watched to see whether, by making a correct calculation, they prevented a balloon mounted on their “Popbot” from bursting loudly.
- A disengaged girl who had disciplinary problems used two robots to create a synchronized dance routine.
- A struggling math student pumped his fist in triumph when properly measuring distance with his CalcBot.

Teachers get a lot out of the CalcBots, too, as they can team-teach diverse subjects or use robot “missions” as a “Friday break” from traditional lesson plans. Tech, math, and science teachers can partner by combining robotics, basic programming, and math applications into one course using CalcBots. You could even use the robots for social studies and language arts by having students practice their oral presentation skills in CalcBot-inspired projects and solve important social problems. Alfred and George and their kin can even help teachers develop their own skills as learners—an important advantage for technology teachers who strive to present increasing levels of knowledge.

By Tyson Tuchscherer

Mathematics

Missions in Math

After my wildly successful experiences with Alfred and George, I convinced Texas Instruments to donate 30 calculators and robots to the middle school where I worked in Lakeview, Oregon. In return, they asked me to develop classroom activities using the CalcBots. I came up with 10 “missions” that ran the gamut from a simple measuring exercise in which students learn how to program their calculators to use time and speed to calculate distance, to more advanced mathematical concepts such as graphing and predicting, statistics and probability, integers, pi, relativity, and parallel universes. Some missions also teach complex programming maneuvers such as turns and mazes, circles, drawing, navigation, and task performance. To keep the learning compelling, I also instituted a “Game Day” in my class just for fun and “Cool Stuff” that explores robot functions while encouraging artistic design.

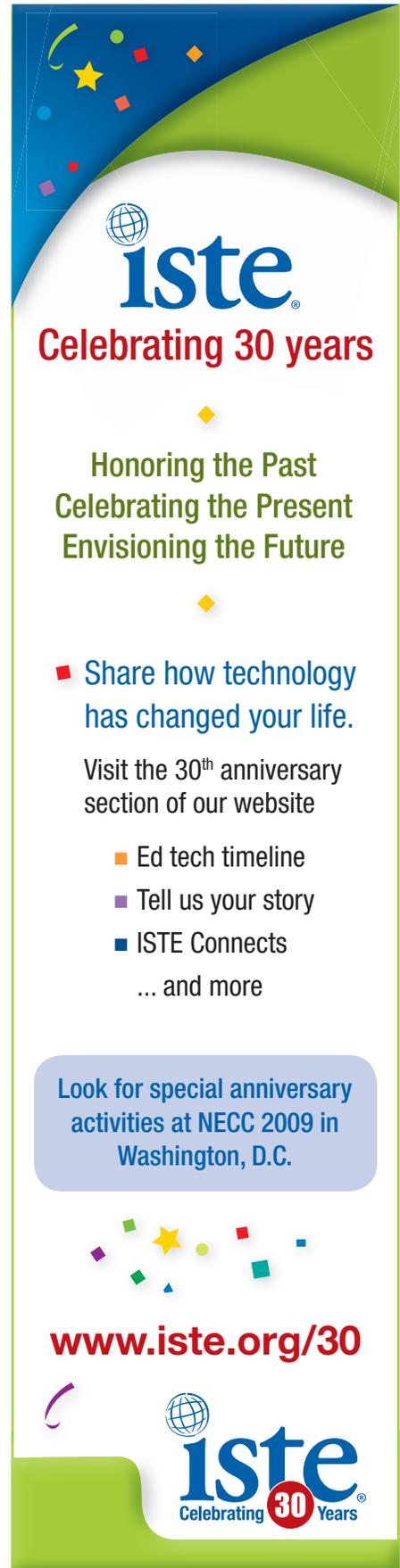
During a 10-month Albert Einstein Distinguished Educator Fellowship as a math specialist in the National Aeronautics and Space Administration (NASA) Explorer Schools Program, I refined and refocused these missions to reflect NASA content and provide a curriculum resource for math, science, and technology teachers throughout the country. The curriculum provides activities, programming instructions, and teacher notes for 10 missions plus three “exploration extensions” that encompass additional tasks and more advanced concepts related to space travel.

One mission was a remote-control “Mission to Mars.” Students separate the calculators from their robots to simulate the Mars Rover vehicle. They can control their robot, tethered to

the calculator by a long USB cable, from behind a screen. Their mission is to program their CalcBots to operate outside their field of vision to find fuzzy “planetary rock samples,” attach them to Velcro strips on the robots’ bumpers, and bring them back to Earth. Extension topics include using a laser altimeter, using a CalcBot as a crawler-transporter to carry a model rocket to a launch pad, creating space mission patches, and performing demonstrations.

These opportunities for enrichment are designed to encourage future scientists, engineers, mathematicians, and computer programmers to push the envelope when probing their fields of interest. They also meet a number of national content and process standards for middle school mathematics and science, four of the National Educational Technology Standards, and seven national standards for English language arts. The official curriculum, “Calculator-Controlled Robots: Hands-On Math and Science Discovery,” is available for free download on NASA’s Web site (www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Calculator-Controlled_Robots.html). And if you want to start your own classroom family of CalcBots, you can order the chassis, wheels, and accessories and download my original classroom activities for free from the Norland Research Web site (www.smallrobot.com).

—Tyson Tuchscherer has been a teacher for 18 years. He is also a research fellow at LMI Government Consulting and special assistant to the director of the National Defense Education Program, a Defense Department project that promotes STEM education.



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