

March 2012

Table of Contents

Cover Story

- 1 Teaching the Three R's:
Reading, Writing, and Robotics

In Brief

- 5 How to Build a High-Profile
Advisory Board
- 5 DARPA Watch
- 6 DealFlow

Features

- 8 Lights, Camera, Robots!
- 12 Bio-Inspiration in Robotic Design

Analyses

- 16 European Group Develops
Robotic Neurosurgical Device
- 18 Developers Square off on
HTML5 and Robotics

Thought Leader

- 20 Aethon's Aldo Zini
on the Automated Hospital

Editor
Mark Ingebretsen: mingebrt@ehpub.com

Executive Editor
Cecilia Galvin: cgalvin@ehpub.com

Copy Editor
Colleen Frye

Art Director
Dorian Gittlitz

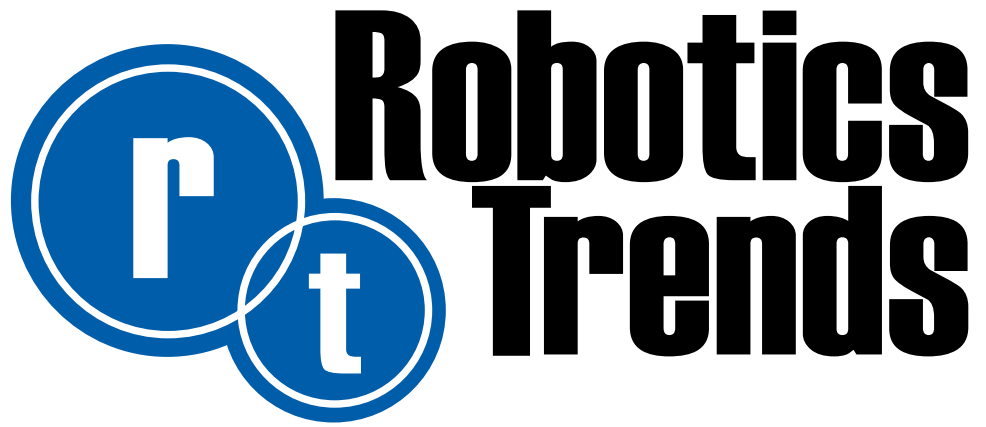
Contributing Designer
Jason Litchfield

Contributors
Emmet Cole, John Edwards,
Linda Rosencrance, Esther Shein

Publisher
Michael Siggins: msiggins@ehpub.com

Robotics Trends
111 Speen Street, Ste. 200
Framingham, MA 01701
508-663-1500

Copyright 2012 by Robotics Trends,
a division of EH Publishing, Inc.
All rights reserved



The business guide for professionals who use, manage, or create robots and intelligent systems

Teaching the Three R's: Reading, Writing, and Robotics

Leading middle and secondary schools are using robotics to provide enlightening demonstrations of how classroom lessons in math and science can be applied in the real world.

By Esther Shein

At Brockton High School, in Brockton, Mass., there is a waiting list to get into the introduction to robotics class. The high school, the largest in Massachusetts with some 4,200 students, has offered robotics for the past three years, and due to the overwhelming popularity, began offering a second-level course this year.

"This all evolved out of the district recognizing that many students lose interest in math and science, so what we did was try to figure out—using STEM [the Science, Technology, Engineering, and Mathematics Coalition] initially as catalyst—how we could make it more fun and interesting in those areas," says Donna Burrill, director of business technology and career education for the Brockton Public Schools. The district does not emphasize science as much as math, English, and reading skills, Burrill notes, and as a result, "fewer students tend to have an interest in finding out what's out there in science."

Robotics also fits in nicely with Brockton's Career Pathway for Engineering program, a series of courses high school students can take if they are interested in engineering, Burrill says. The administration has been very supportive of the robotics classes, she adds, and there have been discussions about adding a robotics class at one of their middle schools.

A new study, "Robots @ School," suggests that children's fascination with robots starts at an even younger age than middle school. The study, conducted by international research consultancy Latitude, along with the LEGO Learning Institute and Project Synthesis, a consultancy in Australia, asked 348 students ages 8 to 12 from Australia, France, Germany, South Africa, the United Kingdom, and the United States to write and illustrate a short story answering the question: "What would happen if robots were

Continued on next page

COVER STORY: ROBOTS IN SCHOOL



The VEX Protobot Robot Kit: The company is heavily involved in student robotics competitions and works closely with school systems to advance robotics education. (Photo courtesy VEX Robotics Inc.)

Many schools around the country offer robotics as an extracurricular activity rather than as part of the curriculum.

a part of your everyday life?" The study concludes, "Nearly two-thirds of kids took for granted that robots could make excellent human friends in spite of their machine intelligence—blurring the line between technology and humanness." Another notable finding was that children view robots as "better versions of our teachers and parents, offering limitless time and patience, encouraging confidence and self-direction, and allowing us to make mistakes sans self-consciousness."

Extracurricular Robotics

Many schools around the country offer robotics as an extracurricular activity rather than as part of the curriculum. At Dickinson High School, in Dickinson, N.D., math teacher Desirae Tibor entered a team of middle and high school students into its first six-week regional competition last October and became the group's adviser. "Our junior high school has a technology course with a robotics unit where they learn to build a robot, and that's how my students became interested in it, because they were building robots back in seventh and eighth grade," Tibor explains. "I think we'll see a bigger influx of students [next year] because to accomplish everything this competition asks of us, we'll have to integrate it in the classroom."

Tibor learned about the competition from attending an in-service program sponsored by BEST (Boosting Engineering, Science, and Technology) Robotics Inc., which is headquartered at Auburn University in Alabama. She thought it would be appropriate to start out with a robotics competition to whet kids' appetites and grow the program from there. "They want us to be able to have ... a robotics building class," Tibor says. During

In-School Telepresence

Robots can allow students to keep up with class work while at home.

At Knox City High School, in Knox City, Texas, robotics is not yet part of the curriculum. But one robot *is* part of daily school life. That's because sophomore Lyndon Baty, 16, whose rare kidney disorder prevents him from attending school, goes to classes remotely with a robot avatar he has dubbed "Baty Bot."

Baty is using a robot from VGo Communications Inc., Nashua, N.H., that he operates from his bedroom using a laptop and a Wi-Fi connection. The robot cost about \$5,000, plus there is an annual service fee of \$1,200.

"It's really cool being able to go to school without going to school," he says. Baty started using the robot second semester of last year, and he says it made him feel good to be back in school again. "You really miss that social interaction. So really, the VGo gave me back the interaction for a full experience, he says. "School is more than just books and grades. I am part of the class and get on my laptop and guide the robot class to class; it's really like I'm there."

Baty says it took him about a week to get used to the controls. "That first day I was bumping into chairs, desktops, lockers, water fountains, anything in my path," he recalls.

The other students have gotten used to seeing Baty Bot travel down the hallways and they say "hi" to Lyndon, whose face can be seen on the robot's monitor. "It's just like I'm another person there. ... They could cover up my camera or carry me, but the kids are really good about giving me my freedom and treating me like I'm another kid there, instead of a robot."

one aspect of the competition, four participating schools competed with their robots on the floor with students controlling them in real time to complete a task. “Every year the game changes, and some years there may only be two robots on the floor or challenges where they have to steal from other robots,” she explains.

There’s also an aspect to the competition that requires the students to detail the entire engineering process of the prototype they created of their robot, along with what worked and how to make it better in the future. In addition, the competition has a marketing component where students have to stand up in front of three judges and discuss how they marketed their robot, including through news mediums. Dickinson received the award for the team that displays excellence in all five areas of the competition.

Still, Tibor says, there’s more that can be done. “We’ve got a lot of learning to do and need to integrate a little bit more.” But there are some things Dickinson simply can’t do that other schools are doing, Tibor adds, such as offering CAD engineering in the classroom, which “we don’t have the capacity to do.” Right now, the high school offers technology classes that teach CAD drawing, drafting, and design, Tibor says, which are related to robotics. But she speaks wistfully when saying she wishes they could offer more. “Money is the biggest issue, of course, and every school district has its problems. Ours is we’re building a new school ... I don’t know if I foresee [robotics courses] coming into our program. Our drafting and design teacher knows our designs are lacking, so we’re working on improving sketching so we can do our CAD designs better.”

Brent Grey, a computer science and math teacher at Masterman High School, a small magnet high school in Philadelphia, says he and his colleagues also felt that getting involved in robotics competitions would be one way to address a concern the department chair had about “a dearth of opportunities for kids interested in engineering, and in particular, applied mathematics.”

About three years ago, Grey says, he began putting out feelers for external resources. The University of Pennsylvania sent computer science and engineering professors to his classes to give lessons on real-life applications of computer science, he says. The students were also invited to tour their labs, including one devoted to robotics, thus introducing them to the nexus of mathematics and electrical engineering and showing them what they could do. Math department Chairman Kate Smith also put Grey in touch with the Northeast representative of FIRST (For Inspiration and Recognition of Science and Technology) Robotics, a Manchester, N.H.-based organization that seeks to encourage students’ interest in math and technology. They started a club at Masterman last summer called Atomic Robotics. The club is mentored by JJ Biel-Goebel, an engineering lead at Boeing, which is sponsoring the Atomic team.

“The intensity of this activity has taken us by surprise, and we haven’t had time to sit down and figure out how it dovetails into what else we’re doing,” says Grey. But they have come up with two ways to integrate robotics into their math and science curriculum: increase problem solving and real-world team building through robotics. For example, Grey says one of the classes he teaches is Advanced Placement (AP) calculus for 11th and 12th graders. In that class, since the beginning of the school year, he has been trying to introduce control systems and teach the students how to program some of the sensors that go on the robot.

Since some of the students from the robotics team are in Grey’s classes, “we’re using the real, actual stuff we’re doing in robotics to enhance and illuminate some of the topics we’re already covering in calculus.”

But, he says, Masterman has loftier goals; namely, to bring robotics into the school’s



The VGo telepresence robot can attend school for students who can’t. See sidebar, previous page. (Photo courtesy VGo Communications Inc.)

For Masterman High School in Philadelphia, getting involved in robotics competitions was one way to address a lack of opportunities for students interested in engineering and applied mathematics.

COVER STORY: ROBOTS IN SCHOOL



The popular Danish toymaker has created a successful niche for its robotics products within middle and secondary schools. (Photo courtesy The LEGO Group.)

The introductory robotics course at Brockton teaches students the basics of how to build a VEX robot as well as how to program it to manipulate the robot through a series of challenges, first with a handheld controller.

curriculum “in a formal fashion.” However, due to budget woes, Grey says it’s more realistic for the immediate future that they will develop “a series of units that we can use in the standard curriculum that use robotics in a larger problem-solving sense,” since right now he is only bringing in examples where appropriate.

“My computer science class uses an immersion unit that is based on a robot simulation. It’s a well-known curriculum,” Grey says. “I’ve adapted it over the years so in this class we’re talking about doing the same types of things the programming team on the robotics team is doing, which is object-oriented modeling in software. I could see myself adapting that first immersion unit and using those APIs and the robot code we’re developing this year in Java for the first six weeks next year.”

Brockton High School has taken the opposite approach from Masterman and Dickinson, offering robotics courses first. It is only just now starting a robotics club because of the high interest level. At the first meeting, held recently, Burrill says 35 kids showed up.

The introductory robotics course at Brockton teaches students the basics of how to build a VEX robot as well as how to program it to manipulate the robot through a series of challenges, first with a handheld controller. As the students get more advanced, they learn to program in Easy C, Burrill says. What she likes about the VEX robot, from VEX Robotics Inc., Greenville, Texas, is the fact that “the kids can drag and drop modules into the programming sequence and not have to have a lot of programming knowledge.”

The robot uses modular programming, meaning that if a student wants to get the robot to turn left, the programming language to do that is already built into a subroutine, she says. “They have to understand the basic concepts first, then they add to that and get the robot to go autonomously and program it without the controller—just through Easy C.”

By starting the students with the modular program, “they understand the logic and then they can go on to the autonomous program, which is more difficult.” The progression from modular to autonomous helps them be successful, giving them a sense of accomplishment, she says. The students also work in teams, so they learn about team building.

The courses are electives, and Burrill says she has a waiting list. “I would love to grow [the program] but I don’t have the staff. Also, the robots are expensive,” she adds. One VEX robot costs about \$800 and they have about 10 robots per class with one teacher. Some high schools use LEGO kits instead, she says, “but I feel [our students] are beyond that and need the next challenge of the VEX-level programming.”

As the students get more comfortable using the robots, they send them down the hall to visit Burrill in her office. “I tell the more advanced kids I’ll buy them lunch if they can get their robot to go down the hall and turn into the principal’s office autonomously.” Each semester, she says, at least one team usually does it. “Last year it was brilliant—the kids hooked up their iPod to the controller and put Christmas lights on the robot, turned on the music, and had it dancing with the lights on.”

There has been talk about offering robotics classes at the middle school level, Burrill says. Right now, there are plans to start a class at the school that has been deemed the city’s STEM school. Robotics, she says, is critical for students at all grade levels. “These are the engineers of the future.” **RT**