



# Grassroots Robotics

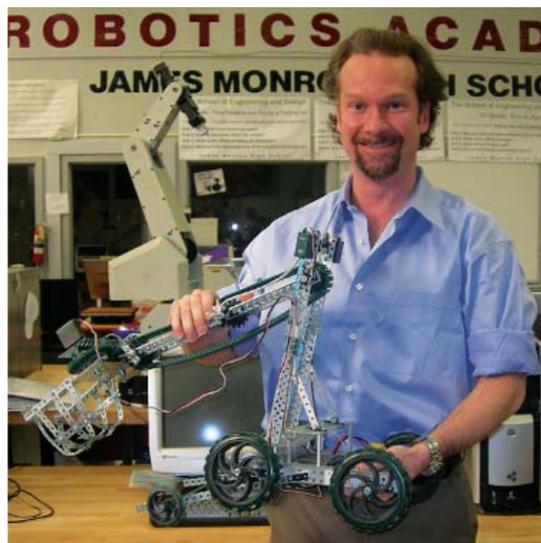
## VEX EDR Autodesk Curriculum spearheading education

by Tom Atwood toma@botmag.com

*Editor's note: Lewis Chappellear won the 2008 California Teacher of the Year award and was a 2008 National Teacher of the Year finalist. He has been one of the leaders in robotics education in California in recent years and has pioneered a robotics curriculum used in year-long courses at the James Monroe High School in North Hills, California—the fourth largest high school in the country. When we learned that hundreds of students were rushing to get into his robotics classes at James Monroe and that he has adopted a new VEX EDR Autodesk Curriculum in his teaching, we had to learn more. In this interview, you'll learn how VEX Robotics has become a part of a new educational model that involves growing interaction between students and local communities. And it all centers on the fun of designing and building robots.*

**Robot: How did you become involved in robotics education?**

**Lewis Chappellear:** I was an algebra teacher at James Monroe High School in North Hills, Los Angeles, in 2001. I was previously an engineer with a B.S. in Biomedical Engineering from Boston University, and I have a Masters in Mechanical Engineering from Columbia University. Frankly speaking, when I graduated, I wasn't sure what my career direction would be. I dabbled in engineering and then, in 2000, I moved from Toronto to Los Angeles. I was contemplating attending UCLA and getting another engineering degree, but first, I chose to teach high school algebra.



**Robot: Did teaching math lead to robotics?**

**LC:** Indirectly. I taught algebra at James Monroe High School, and classes were huge with as many as 43 students, and I was typically teaching juniors and seniors who had previously failed to pass Algebra 1—a requirement to graduate. I felt I was wandering, to some degree, trying to find the right connection to the real world to help these kids. I knew there was a way because of my previous career. I knew that giving them some sort of technical education would help them in their careers but did not yet see exactly how my courses fit into that.

As an engineer, I also had credentials to teach electronics and physics. After teaching algebra for a year, I asked the school if I might be more effective teaching electronics. They said give it a try, and I did, and it turned out to be very successful.

**Robot: Where did teaching electronics lead?**

**LC:** Word got out that the students were attracted to and really liked the electronics course. When I was still teaching Algebra 1 and also electronics, I was called to the front office and met with a number of school-district people who said that owing to my successes, they could offer about \$200,000 for a high-tech “manufacturing lab” and would I have any interest in pursuing that? That's how my robotics program started!

**Robot: How did they recognize your success?**

**LC:** Basically, nearly every kid wanted to be in the class. Kids were going to their counselors and saying “I want to get into that class.” It was word of mouth.

**Robot: What did you teach in the electronics course?**

**LC:** We did some CAD drawings. I had purchased through Gibson Tech Ed [www.gssteched.com/index.html], a bunch of electronics kits. We did soldering and built circuits with blink-

ing lights, beeping sounds and sirens. We learned about logic circuits and the difference between analog and digital sensors, and the students loved it. The district people asked me to develop a curriculum, create a list of supplies and define what I would need to create a manufacturing lab. And so I developed a “Manufacturing Academy.”

### ROBOTICS ACADEMY IS BORN

**Robot: Did the Manufacturing Academy inspire interest?**

**LC:** I went around the entire school; I talked to all the math classes. After much effort, I had about 30 to 40 kids signed up, but I needed about 300 students. Somebody came to me and introduced the FIRST robotics program and suggested that I change the name to the “Robotics Academy.” Soon, about 500 kids wanted to be part of the class. The same class! There is a marketing insight here; you can have the same subject matter, but with an attractive name that sounds a little more modern, you will attract many more students.

**Robot: Did the classroom curriculum pertain to the FIRST competition?**

**LC:** I was not then aware of any FIRST-related curriculum. This was in 2003, and the FIRST program was the FIRST Robotics Competition (FRC) and First LEGO League. I had developed a manufacturing kind of curriculum with mechanics (pneumatics and hydraulics) and an electronics station with circuits, and we had a LEGO station. We had Auto-CAD and a small CNC mill and lathe, and the kids learned to use them.

**Robot: What was your involvement in FIRST?**

**LC:** Midway through that school year, we joined the FIRST competition and received a NASA grant that sponsored us for two years. I had no local contacts with colleges or mentors, and we had this giant challenge and were on our own. This was 2005. We did FRC for two years. The grant paid the \$6,000 registration and covered the kit. All we had to do was fund getting to the competition.

### GETTING COMMUNITY SUPPORT

**Robot: How did that go?**

**LC:** We barely raised enough. I learned a lot that year. We sent out 250 letters to companies in the Yellow Pages and received a few letters and raised under \$200. We made more money selling food on campus. I learned that when you want the local community to help, you must ask for their passion and their time to come in and meet the kids and to be part of the process. When you just ask for money, they go running. Today, we work with over 40 local aerospace and technical companies, and they are extremely helpful. They provide time and resources, but they don't necessarily provide checks.



### VEX ROBOTICS—SUSTAINABILITY ON A BUDGET

**Robot: How did you come to be involved in VEX Robotics?**

**LC:** Doing FRC for two years, I was kind of a one-man show, and getting the community involved was not easy. Then I found out about VEX robotics through Ralph Mills and Marty Mechsner, who run the Small Manufacturers Institute in California [see “Grassroots Robotics,” *Robot* magazine, issue 12]. Through Ralph and Marty, I found out about VEX. I was funded by the Perkins program—a federal grant program that pays for equipment for the classroom, including robotics kits. I ordered a bunch of kits. The nice thing I learned was that the VEX robotics kits are inexpensive and reusable year after year. With FRC, I had about 230 kids coming through my class. It's very difficult to have that many working on one robot. That first year with VEX I, ordered 20 kits that I still use today. All the kids participate.

**Robot: Were your students competitive in the VEX-based FIRST Tech Challenges?**

**LC:** We had competitions within James Monroe, and we competed against other schools, did well, and went to the World Championship in Atlanta, Georgia, in 2008.

**Robot: Did you create your student robotics initiatives on your own?**

**LC:** I was kind of leading change in the LA area. Some other schools were doing miscellaneous after-school and part-time robotics programs, but I didn't find any model programs that would fit the environment at James Monroe and certainly not as a full-time curriculum during the school day as a year-long class. So I had developed my own robotics curriculum earlier, and I continued.

**Robot: How did you do that?**

**LC:** In order to get funding for the classroom, you have to have a



curriculum, it has to be matched to the standards, and it must be an academically worthy project. Federal tech education funds won't be available otherwise, and it's a real challenge pulling it all together. When VEX came out in 2005, I integrated it into my classroom curriculum layered on top of the electronics curriculum I had already developed. This became part of the Robotics Academy. And today, we are still designing and building VEX robots and competing in the classroom.

### VEX EDR AUTODESK ROBOTICS CURRICULUM

**Robot:** What has your experience been with the new VEX EDR Autodesk Curriculum?

**LC:** I am just beginning to use this in my classes, and this curriculum will be a major part of the coming year. My students will use Autodesk



Inventor to virtually build a robot. This entails learning the mechanical modeling skills and then actually building the robot and, finally, taking it to competitions. Looking back, ever since I've been part of the robotics education process, I've seen that Autodesk has been part of it. I saw their Design Studio two years ago, and I think this latest curriculum package is one of the most effective ever for use in the classroom.

**Robot:** How has VEX EDR Autodesk Curriculum helped you?

**LC:** Technology changes significantly every year, and I've learned you cannot necessarily do everything yourself for your classroom. To do the CAD modeling and develop curriculum and build competitive robots was challenging. Now that VEX EDR Autodesk is providing this kind of program to all teachers, I will say it makes the whole process easier.

### IMPORTANCE OF ROBOTICS EDUCATION

**Robot:** What is the most important thing you have learned by teaching robotics?

**LC:** In a school in which not all the kids are there to become engineers, doctors and lawyers, robotics nonetheless brings absolute relevance to the classroom. Robotics gets all of the kids excited about learning, and it also teaches the "soft skills" they will need in life and to keep jobs—working as a team, problem solving, working with the community. A lot of jobs out there require these skills—machining and manufacturing jobs, technician positions and more. Everything is interconnected.

I've learned something teaching Inventor: I've found that many of the local companies use this software or similar programs, and I did not even know this before I dived into the new curriculum. Just by using this package in the classroom, our students are becoming more "career ready."

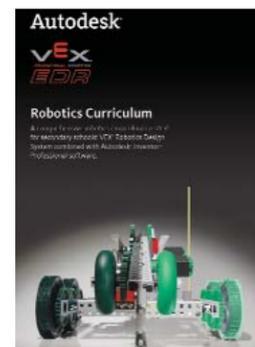
### CURRICULUM SPECIFICS

**Robot:** Can you give us some specifics on what the new curriculum offers?

**LC:** It provides a resource for high school teachers who want to teach robotics in the classroom. It also offers guidance to teachers who want to secure funding. I get calls from teachers seeking more information on this all the time. In a nutshell, teachers need the whole year planned out; everything must relate to the standards, and they have to be able to tell their schools that they want to do this and how. The VEX EDR Autodesk Curriculum links building robots to a sustainable, full-year classroom program. It starts with using a robot kit that can be purchased from VEXrobotics.com; I have not found a more affordable option.

**Robot:** Is the curriculum keyed to competition or education?

**LC:** Autodesk is more Science, Technology, Engineering and Math (STEM)-related than robot competition-related, which is what I think it should be. There are different things the students' robots must do, and while they are designing their robots, they are learning about team-building skills, science standards and math standards, and there's a variety of different components



**Robot:** How many classes and kids this last year and today?

**Lewis:** The past year was somewhat complicated because I was pulled out at times owing to winning the California 2008 Teacher of the Year Award and because I was among the top four national candidates. But we are continuing our robotics curriculum.

With the new VEX EDR Autodesk curriculum, I am changing the classrooms from the modular engineering approach to exclusively doing Autodesk Inventor in the classroom. We will be building VEX robots using Inventor and also building the robot



built into it. Without realizing it, the kids are part of an interdisciplinary program.

**Robot:** What do you call your course, and how many hours do you teach?

**LC:** My class is "CAD" because I am focusing on both Inventor specifically and computer-aided, generally, design this year. All of the details of robot design are exclusively done in Autodesk Inventor, which is a bundled part of the new VEX EDR Autodesk Curriculum.

**Robot:** What is your ultimate goal in teaching robotics?

**LC:** Building the robot is the tool to teach; the purpose of the class is to make kids career ready and to prepare them for the rest of their lives. We want kids, when they graduate, be able to make an informed decision as to which career to pursue and to be equipped to perform. Robotics education enables this.

### JOB GROWTH FOR ROBOTICS-TRAINED

**Robot:** What is the significance of robotics education?

**LC:** It's about planting a seed and letting it grow. More than ever, today I see colleges and universities getting involved with high school robotics programs. The competitions are often held at places like Cal State University Northridge [CSUN], where the high school and university kids and faculty have direct contact. I never saw that before, and it's a rising trend. Local colleges are now offering robotics classes and resources to high school kids who want to go into technology and engineering.

Before, I saw companies in the local community sponsoring a program or writing a check or putting their logo on a T-shirt. Now, I see local engineers working side by side with kids and local companies coming to talk to kids in classrooms. I see kids going into the community and touring local industries. Last year, I had 60 kids in internships with local companies. There is a huge surge of interest in working with the schools to ensure the flow of technically trained graduates to industry. Many tens of thousands of new jobs will be available in the next five to 10 years.

**Robot:** Does "outsourcing" of engineering jobs concern you?

**LC:** When you look at the jobs that are being outsourced, you see it's the non-creative jobs. Local companies are looking for trained CNC programmers, trained technicians and, number one, candidates who have the soft skills, who can work with others, solve problems, responsibly show up on time and complete projects. For the tiers of kids who go on to become engineers, programmers and scientists, the same skills apply—and the same dynamics.

**Robot:** What are your next plans for your class programs?

**LC:** Next, I want to work on "mentorship," whereby I have local

engineers and technicians work side by side even more with groups of students who are working on robots.

**Robot:** Can you comment on why you were you chosen as Teacher of the Year?

**LC:** Somebody is chosen not simply to represent all teachers but to represent the future of education. I think that when they chose me, they were seeking somebody whose work embodies the future of education because that future is not going to look anything like it does today. For our educational system to be effective and relevant, we will need connections to the outside community and interaction with people and companies. That's an important part of the future of education.

**Robot:** Did you have any significant mentors?

**LC:** Everybody needs mentors and help from the community. I've taught some of Marty and Ralph's Small Manufacturers Institute training programs that they teach in teacher workshops. Without these leaders, our robotics community in California would be much smaller. I could never have done this without their help. Without them, I still may not have found out about VEX robotics. They are an invaluable resource for our local robotics community.

**Robot:** Congratulations on being teacher of the year and on being a national finalist. When did you know that you wanted to pursue physics and engineering?

**LC:** I've had an interest in engineering my entire life. When I was little, my favorite toys were LEGOs and Lincoln Logs. I'm a little artistic and have always wanted to combine the artistic with the math and science sides, and I think that's how I got

involved with engineering. Engineers use math and science creatively. I love school and the educational environment and teaching, and it's kind of funny and strange how I instinctively fell away from engineering and into teaching. I went so far away from engineering, but I've completely gone full circle, and now I teach engineering by teaching robotics.

**Robot:** Thank you for this interview.

**LC:** My pleasure.

### Links

Gibson Tech Ed, [www.gssteched.com/index.html](http://www.gssteched.com/index.html), (800) 314-3843  
Lewis Chappelle with President Bush, [www.](http://www.)

VEX Robotics, [www.vexrobotics.com](http://www.vexrobotics.com)

For more information, please see our source guide on page \_\_\_\_.