UC SANTA BARBARA

THE Current

June 26, 2018
Sonia Fernandez

Dancing Machines

They dab. They floss. They spin. They do not, however, do the robot. The dancing denizens of UC Santa Barbara mechanical engineering lecturer Tyler Susko's freshman class, however, *are* robots, and they're the latest collaboration between his students and kids at Isla Vista Elementary School.

"This class is titled Conceptual Engineering and Computer-Aided Design, but I think that you learn this kind of stuff better if you do real things," said Susko, a recent winner of the Northrop Grumman Excellence in Teaching Award. "We think it's a good little mentorship program, but it also gets our students to feel like real engineers pretty quickly. When you build something real you run into things that are practical problems that you can't learn in class." And when you add a purpose or social benefit to a project, he added, studies show that students from underrepresented populations — who often are new to the field of engineering — are more likely to pursue it further.

A combination of project-based learning and educational outreach, Susko's class takes students into a scenario that would be commonplace in the life of a mechanical engineer: designing and building a custom machine for a client.

In this case, the "clients" are the Isla Vista fifth-graders, and the product is a stuffed unicorn DJ hyping it up, or a DeLorean replica burning up the floor, or maybe a half-elephant-half-cat bopping along to the beat. Or whatever else the kids cook up in their wild imaginations.

“So the idea is in design you also want to stress the fact that you’re designing for a customer,” Susko said. And fifth-graders are particularly suited to the role of customer, he added, because not only are they imaginative, they also are interested and willing to collaborate. In fact, they add their own touches to each robot.

In addition to computer-aided drafting, embedded in the project are regular discussions with the schoolkids and deadlines. And then there are the multitude of tiny things that can go wrong.

And wrong they do go. Over the 10 weeks of the class, the 16 or so teams encounter issues that can’t be studied in a pure design course, such as parts that look great on the screen but don’t join up in real life, unexpectedly time-consuming processes, designs of impractical dimensions, projects that don’t look quite right, traffic jams in the lab … or robots that just won’t dance.

And those are just the machines.

“I think teamwork is really the biggest thing that you learn, because at first I thought everyone was going to cooperate and everything was going to go smoothly, but then you start seeing that some people have their own ideas,” said freshman Onofre Jaureguia, who with his colleagues is behind the lit up and spinning DeLorean. Another aspect of the project is coming to terms with the feasibility of the design and managing expectations, he said.

“People think, ‘Oh! We want this!’ and automatically it’s going to happen,” Jaureguia said. “But you’ve got to realize that for us there’s budget, and time, so we can’t really make everything exactly the way they want.”

To get from design to finished product, Susko found it necessary to add to the mix basic electronics and other skills that beginning mechanical engineers will find handy.

“If you don’t have this very basic practical understanding of something like how to turn on an Arduino (microcontroller), it’s going to be something that’s scary to you,” Susko said. The engineering students also learn to use the laser cutter, basic wiring and soldering techniques, as well as the importance of choosing the right construction material, such as glue versus screws.

“I think it’s definitely a lot harder than we thought it would be,” said Isabel Matamoros, whose team created the DJ unicorn. Throughout the nine or 10 different versions of “DJ Rider,” she and her collaborators encountered various challenges, eventually learning the value of anticipating future problems.

“We started having to take into account future steps,” Matamoros said. “For instance, if the wiring isn’t working, we need to make sure that when we assemble it that we’re able to open up the box and fix the mistakes that we make later on.”

Beneath all the CAD-designing, the laser cutting, coding, programming and assembly that are part of this robot project lies another purpose: empowerment. Not just for the older students, who need the skills to pursue a future profession in industry, but also the younger ones, who might be open to the notion that they, too, can be engineers.

“What happens if we introduce young children to the fact that women are engineers?” Susko asked.

This year, in the class’ third iteration, Susko teamed up with Mandy McLean, a doctoral student in UCSB’s Gevirtz Graduate School of Education, to see how perceptions of engineers might change for the schoolkids involved. In the beginning, the children were asked to draw their idea of an engineer and their depictions, Susko said, often included some combination of a male figure with pocket protector. “The idea is that we have women working with them the whole 10 weeks, so maybe they’ll start drawing women, and maybe the girls start seeing themselves in this role,” he said. “We don’t know if it will have any effect, but it’s kind of cool.”

Whether or not the fifth-graders start drawing female engineers, or if the older students decide to pursue engineering in their futures, the project has rewards that are immediate and tangible. The tiny robotic dance crew — having already strutted their stuff at the College of Engineering capstone project presentations and at Isla Vista Elementary School — eventually made the rounds on campus, much to the delight of their audiences.

“We’ve been having these things dance at the daycare on (the UCSB) campus too, for kids from zero to 3,” Susko said. “The kids get jazzed; it’s adorable.”

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.