

# School of Engineering brings math and science alive for students

by Holly Dolezalek

Since the dawning of classroom instruction, there have been students who ask, “Why do we have to learn this?”

At Coppell High School in Coppell ISD, there is a program that shows students the answer to that question quite clearly. It’s the retooled and totally cool School of Engineering, and it’s helping kids see the relevancy of math and science in their everyday lives. The program is geared toward students who want to be engineers or who have expressed an interest in engineering.

Career and technical education mandates passed during the 2005 legislative session prompted Coppell ISD to transform an existing engineering class into a full-fledged School of Engineering. The state wanted to see CTE programs do a better job of helping students prepare for the 21st century workplace. That just so happened to fit neatly with the priorities of the Coppell community, says Superintendent Jeff Turner.

“We have an educated community, and we have a lot of engineers who are parents. In fact, one of our board members is an engineer,” he says. “We already had a great math and science department, and so we decided to seize the opportunity to use the resources of that department to create a program that would give students a chance to really get their hands dirty.”

Coppell ISD’s School of Engineering became a calculated component of the district’s five-year strategic plan underscoring the state’s CTE focus and an increased national emphasis on math and science. Infinity, the original class that served as the starting point for the expanded program, simply didn’t possess the appeal or programmatic consistency that the district wanted, officials say.

“We started looking at a program from Southern Methodist University, because although we had a couple of sections of the class, we were

still looking for the right mix from a curriculum standpoint,” says Turner.

That’s when a teacher named Mike Yakubovsky, who had been working at one of the district’s middle schools, came to the high school to take over the Infinity course.

“His personality and passion just blew up the model, and we suddenly had more kids interested than we could deal with,” says Turner, who describes Yakubovsky as a “kid magnet.”

Yakubovsky, now the lead engineering instructor for the School of Engineering, says he knew immediately upon arriving at the high school that the Infinity class wasn’t enough — and not only in terms of class capacity.

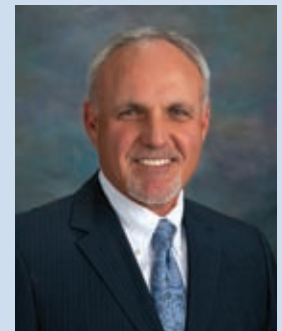
“We realized we had a lot of kids with different abilities, interests and needs, and so we decided to split the program into two tracks,” he says.

One track remains as the Infinity class, but it has been reconfigured into a two-year engineering design course for juniors and seniors. Seniors must complete a capstone project, and the sequence consists of multiple practical applications of engineering, particularly rocketry.

“In their junior year, they design and build a rocket with a one-pound payload that goes up a mile, and eventually they work their way up to a rocket with a 35-pound payload that goes up 100,000 feet,” says Yakubovsky.

The newer track that sprung out of Infinity acts as a precursor to the original course. It is designed for at-risk and special-needs students to help them improve their math and science skills through principles learned during hands-on projects.

“I’ve walked through and overheard students saying, ‘So *this* is why you have to be able to figure



Superintendent  
Jeff Turner

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out the cosine!” says Donna Carpenter, CTE coordinator for Coppell ISD.

The School of Engineering also now offers a four-year program called EXCITE for students who know they want to be engineers and who have demonstrated strong math skills. The first year focuses on necessary skills for engineers, such as communication and problem solving. In the second year, students learn how to analyze data, run tests and use engineering software to complete tasks that real engineers have to do regularly. In the third year, they learn about specific applications, like wind generators. Their project that year is to build a small wind farm. Finally, the fourth year focuses on a singular engineering project from start to finish.

This past year, the fourth-year students designed a bridge, measuring 15 feet long by 4 feet wide, which eventually will be constructed at a community park. Students worked alongside a professional contractor to complete the design.

As it stands, the School of Engineering’s curriculum is only available to Coppell High School students. However, students at New Tech High @ Coppell, a 21st century, project-based learning environment, are encouraged to enroll in an engineering-focused competitions course that meets after school, on weekends and during the summer. In this course, students work on projects to compete in the same contests in which EXCITE and Infinity students participate.

Yakubovsky and the School of Engineering’s other two instructors — Grant Garner and Bill Montana — constantly encourage students to participate in outside engineering competitions. In the summer of 2008, Coppell students participated in the Hunt-Winston School Solar Car Challenge, in which participants built single-driver, solar-powered vehicles and raced them at Texas Motor Speedway. The Coppell team finished in eighth place. This summer, as part of the Hunt-Winston challenge, Coppell ISD students are planning to race their competition car from Dallas to Golden, Colo.

Yakubovsky now has his mind set on forming a team to compete in a college-level, steel bridge-building competition sponsored by the American Society of Civil Engineers. Carpenter agrees with Yakubovsky’s competition-focused strategy.

“It’s a chance for them to really explore engineering, to take what they’ve learned in class and go



Two judges observe Coppell ISD students and their teacher Mike Yakubovsky (red shirt) at an underwater robot competition.

a lot further with it,” Carpenter says.

Coppell ISD’s School of Engineering attracts more than the usual suspects. Engineering has traditionally been a male-dominated profession, but about 15 percent of the program’s students are girls. That’s largely because of Camp G.I.G.A.W.O.T. (Girls Inspired Greatly About the World of Technology), a weeklong camp for middle school girls. Sponsored by IBM, the four-day event is in its second year at the IBM sales center in Coppell. At camp, Coppell ISD “tweenage” girls learn to create bridges, robots, race cars and other engineering projects.

“We even have girls who have decided to start their own club through the Society of Women Engineers,” Carpenter says, noting that engineering clubs and other small learning communities in engineering have cropped up at nearly every elementary and middle school.

Coppell ISD’s School of Engineering is primarily funded through the budget for Coppell High School, but parents raise funds and volunteer their time so that their children can participate in engineering competitions. Those funds mostly go toward the materials students use to build rockets or underwater robots, and also to compensate for staff hours during evenings, weekends and the summer.

One hundred students have graduated from Coppell High School’s engineering program; this year, 200 students in nine different sections are participating. The engineering instructors follow a curriculum that prepares graduates for the rigors of college-level instruction. Yakubovsky says his team worked with nearby universities, such as The University of Texas-Dallas, Texas Christian University and Southern Methodist University, to develop the curriculum beyond state requirements.

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All of the students who were with the program for more than two years before they graduated from Coppell High School have gone on to select majors in science-related fields for their post-secondary education.

"We keep getting emails and letters from our graduates who tell us they're seeing what we told them they would see in their college courses," Yakubovsky says.

Perhaps even more noteworthy, the universities are recognizing the quality of the students' education — and they're doing so with dollars. Last year, 16 School of Engineering graduates were awarded a total of \$800,000 in college scholarships. Also, a number of former Coppell students have been awarded teaching assistant appointments in their freshman and sophomore years at college.

Enthusiasm about Coppell ISD's School of Engineering rivals that of some athletics programs. It even has its own booster club: the Pre-Engineering Parent Booster Club.

"It's great to see something academic getting the same kind of engagement and excitement as athletics," Carpenter says.

The club hosted its second Engineering Fair and Expo in November, in hopes of raising awareness about engineering and to connect students, universities and companies with each other. The first expo, in March 2009, drew 1,500 attendees, 22 universities with engineering programs and 20 engineering companies. The second expo attracted 25 colleges, from the Massachusetts Institute of Technology to Georgia Tech, as well as 23 engineering companies.

Parents are taking notice.

"We're getting calls from parents whose kids are still in elementary or middle school, asking, 'What do I have to do to get my kid into this program?'" Yakubovsky says.

Students who want to be in EXCITE must start with Algebra 1 and stay on track to take calculus their senior year. For Infinity, Algebra 2 is the gateway course.

"Any student can get into the program, and we haven't had any dropouts yet," Yakubovsky says. "Our most recent records show that everyone who has been in the program has graduated from high school. We had one student take summer school in order to get ready for the EXCITE track."

As enthused as he is about engineering, Yakubovsky acknowledges the importance of other disciplines — in particular, the importance of strong communications skills.

"Engineers don't work in cells by themselves anymore, and they have to work with a lot of different people," he says. "So when we're approaching companies to ask them for resources to do different projects, the kids have to go and do it. When they do their senior design project, they're required to find the city engineers and members of the city board and then go talk to them about the project."

In furtherance of that principle, Coppell ISD is piloting a full-blown engineering academy, organized so that the students' engineering courses are integrated with their other courses, such as English and social studies.

There are 44 freshman EXCITE students in the pilot. Their English and social studies classes will cover the same requirements as other classes, but they will have an engineering focus. For example, a student engaged in a project about engineering disasters in an engineering course will write a persuasive paper in his or her English class discussing the ethical and social issues raised by those disasters.

"The idea is to show the interrelation among disciplines and how engineers fit in society," says Carpenter. "But it's all through the lens of an engineer."

"Once you get these kids engaged and excited about learning, you can't get them to go home," says Turner. "We've learned that it doesn't matter what classroom or subject you're talking about: If you can find a way to engage the kids in something they can get their hands on, they will not only take it further than you imagined, you better get out of their way."

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Teacher Mike Yakubovsky (right) and students review their model of a bridge that soon will be built in a Coppell park. (Due to excessive rain this fall, construction has been delayed.)