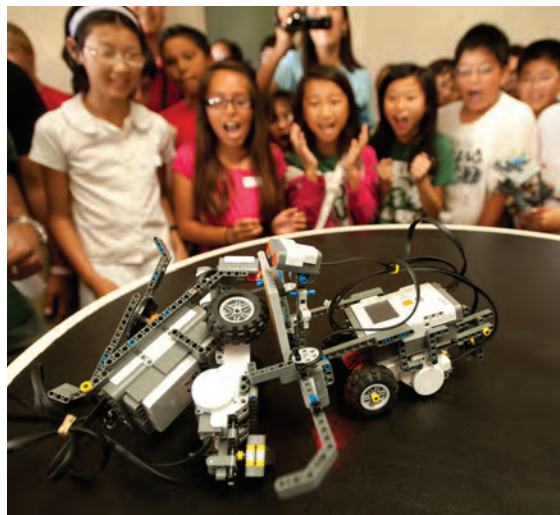




In 2010, Matthew Kuykendall (yellow circle) learned about coding and robotics. His fifth-grade teacher, Shelley Andros (green circle) brought her class to Cal Poly Pomona's Robot Rally at the end of the school year.



Elementary students watch their Lego robots compete in the Robot Rally in 2011.

Real Inspiration

STEM Education Begins with Fun and Games

BY MONICA RODRIGUEZ

Matthew Kuykendall was a fifth-grader at Whittier Christian School when he and his classmates were introduced to robotics.

Using Lego kits, they built robots and learned to write computer code that put their creations in motion. The experience had a lasting impact on Kuykendall and influenced his choice of high school, college and, ultimately, his academic major.

"I was challenged in a way I never had been in school. It was kind of mind blowing," he says. "By the end of the robotics class, there was a seed planted in me."

That was in 2010. Kuykendall, now an engineering student at Cal Poly Pomona, is one of thousands of kids who learned about robotics and developed an interest in STEM through mechanical engineering **Professor Mariappan "Jawa" Jawaharlal** and his program **Robotics Education through Active Learning**, or REAL.

The program launched in 2007, but the genesis for its concept dates back to the late 1990s.

"It started with a simple, selfish motivation," Jawa says.

The father of three girls saw that his children were good students but noticed something in the two younger ones who were in middle and elementary school at the time.

"They did well in all subjects, but there was no real



excitement when it came to math and science," he says.

They found the subjects dull, a sentiment he too shared when he was a schoolboy.

However, the professor who holds a doctorate in mechanical engineering and whose wife has a master's degree in the same field, wanted to spark his daughters' enthusiasm in the subjects.

Children, as well as adults, need to have a grasp of such subjects if they are to be "well-informed people," Jawa says.

With the help of a kit, Jawa built a toy robot. As he tinkered with it, he attracted his daughters' attention and sparked their curiosity in math, science and other related subjects.

"You have to make the experience enjoyable — not easy — enjoyable," he says.

The success with his daughters, who are now 26 and 24 and both mechanical engineers, inspired Jawa to share his discovery with other parents and other educators. It wasn't until 2004 that someone was interested; Pomona Unified School District administrators contacted him and asked if he would work with a handful of at-risk youth.

Jawa accepted the invitation and found that the children channeled their energy in building and programming robots, often overcoming behavioral issues, he says. That started a long relationship with Pomona Unified schools that continues today.

REAL formally launched in 2007, offering training for teachers who wished to bring robotics to their students, along with curriculum and classroom support from Cal Poly Pomona faculty and university students.

The annual Robot Rally was the program's culminating event for children to put their robots through a series of competitive exercises.

What started out as an opportunity to work with 10 children has grown into an annual program involving 1,500 youth interested in STEM and having fun, Jawa says.

The robotics program has also inspired teachers like **Shelley Andros**, who reached out to Jawa after reading about the Robot Rally in her local newspaper.

"I want to do that!" Andros recalls thinking.

Andros ('89, horticulture) knew that REAL could benefit her students and she learned from Jawa's weekly visits to her classroom at Whittier Christian. She also watched her fifth-grade students, one of whom was Kuykendall, grow as learners, set and achieve goals, work in teams and use critical thinking skills.

"I realized they weren't ever working for a grade. They were working to learn," she says.

Ernesto de Santiago, a sixth-grade teacher at Barfield Elementary School in Pomona, also trained with Jawa and has been teaching robotics to his students for more than 10 years. To prepare himself to teach, de Santiago built and programmed a robot himself. The experience wasn't easy.

"You're going to want to throw your robot against the wall," de Santiago tells his students.

But he also tells them they must not give up when they encounter challenges.

"It's teaching them perseverance," he says.

Robotics is also opening the door to new career paths in STEM that students had never considered. It could very well help increase the number of people of color and women who enter engineering in the years to come, de Santiago says.

Andros, now the robotics teacher at Buena Park Junior High School, says the program has been

particularly valuable for girls who become more confident as they work with the robots.

Girls, she says, are often good troubleshooters adept at identifying and solving problems. They are also skilled at creating and programming robots. In 2011, several of her all-girl teams participated in the Robot Rally and took home most of the awards.

Barfield's de Santiago, who teaches fourth- through sixth-graders, says girls take to the program enthusiastically, although they don't always start out that way.

Girls often think of Legos as a toy for boys, he says, but as they begin to use the kits, they start to see things differently. They also come to realize careers in engineering are not off limits.

"They see it's doable," he says. "This isn't just a guy thing."

Recently, de Santiago ran into one of his former students at a district-organized robot competition leading up to Cal Poly Pomona's annual Robot Rally. The girl, a high school junior, continues to be involved in robotics, he says.

Jawa has many similar stories, from playing with robots with his daughters to teaching elementary students, many of whom have gone on to college engineering programs, including Cal Poly Pomona, UC Berkeley and UC San Diego.

"That was the purpose, to get girls inspired," he says. "I have gone through these experiences and it's rewarding."

Matthew Kuykendall's experience with robotics as a fifth-grader influenced his decision to attend Troy High School, a Fullerton public school with a strong science and technology program. Although the school didn't have a robotics program, Kuykendall was active in the school's robotics club.

As a high school student, he knew he wanted to be an engineer and chose to enroll in Cal Poly Pomona's mechanical engineering program to pursue his interest in robotics. He also works on the Formula SAE car.

Kuykendall says he would like to work with Elon Musk's SpaceX and maybe even play a role in sending humans to Mars.

"He's a pretty big leader of innovation in many fields," he says of Musk.

Kuykendall also sees himself becoming the head of his own company.

"Maybe further on, I'll make my own product," he says.