

# Preparing for the future, a school builds a robotics center for the children of Taiwan

This article is fourth in a four-part series, Taiwan in Transition, about Taiwan's economic evolution from manufacturing to innovation. For access to the entire series, click [here](#).

**By Michael Sedwick**

TAIPEI, Taiwan---In the middle of a brightly lit classroom, a square, 2-foot-tall robot is sweeping the ground and looking for a tennis ball to scoop up, much like how a combine harvester reaps wheat.

Controlled by two middle school students, the robot turns left, hesitates, and abruptly turns right before it finally finds what it was looking for. It quickly scoots another several feet, starting up its rotor to prepare the ball's launch at a nearby target.

Bull's-eye!

While this robot may merely be useful at Wimbledon or the U.S. Open, robotics in the future will evoke incredible progress in burgeoning technologies such as medicine and space exploration. Taipei American School (TAS) faculty and staff want to make sure that its students, some of whom might live into the 22nd century, are prepared for the challenges of the future.

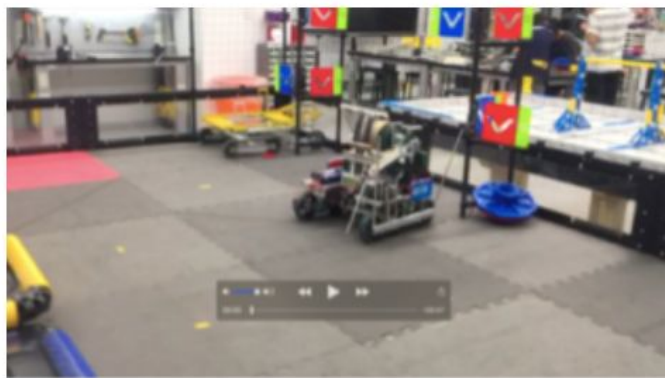
The school has invested its resources by constructing a state-of-the-art classroom space dedicated to developing tech projects like the robot that might replace John Deere in the fields.

“Our new Tech Cube is an exceptional building. What can be done in it is unique within schools,” said TAS Head of School Dr. Sharon Hennessy.

On Nov. 5, 2018, Taipei American School [dedicated](#) the Solomon Wong Tech Cube, a 4,380 square meter facility created for teaching design, technology, and robotics skills to its K-12 students. Hennessy said she foresaw this facility as essential for keeping up with international education standards.

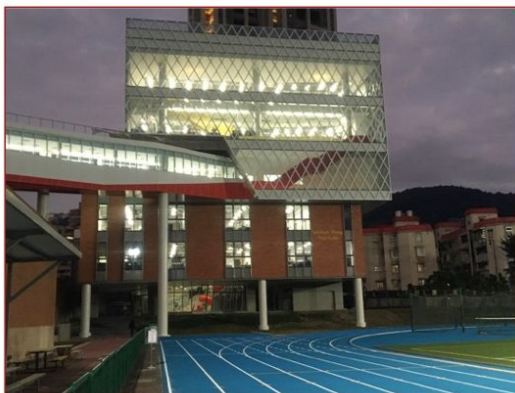
“We knew that we had to have a robotics program due to our previous experiences at private schools in America,” Hennessy said. “It is the application of math, science, and computer programming in a manner that requires kids to work cooperatively as a team and use strong communication skills.”

Taipei American School provides an English-speaking curriculum that conforms to American and international standards, yet the student body comprises of a significant amount of local residents. Approximately [69 percent](#) of students have American passports, yet 80 percent of lower school students do not speak English as a [first language](#).



TAS middle school students test out a robot.  
Video Credit: Michael Sedwick  
(Click on picture to view video)

The entrance to the 15-acre campus, a guard post in front of a four-story rectangular brick building, makes TAS seem more intimidating than visionary. Security guards refuse access to any visitor without a government-issued ID and a previously scheduled appointment. Just in case an unwelcome visitor sneaks past this first line of defense, a second uniformed guard, whose stern visage is partially obscured by a hat and sunglasses, stands watch about 10 feet behind the campus gate.



The Tech Cube, dedicated in Nov. 2018, overlooks the TAS Athletic Field  
Photo Credit: Michael Sedwick

Once one passes through the campus’s main building and onto the athletic field, however, a towering figure catches the left corner of the eye. The Tech Cube reaches six stories into the sky and has a diagonal lattice exterior, maximizing transparency from the inside and light from the outside. A sky bridge on the fourth floor connects it to an adjacent campus building.

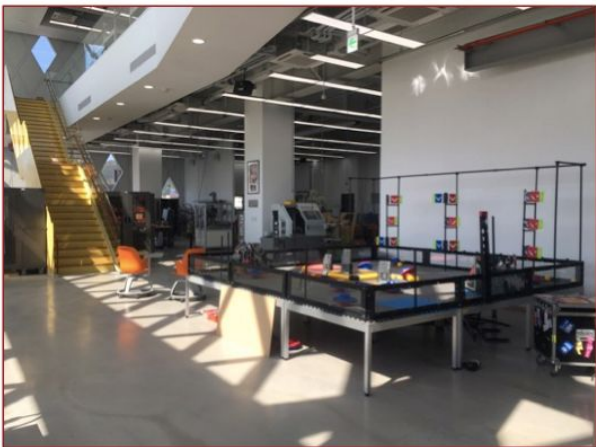
TAS Corning Chair in Robotics and Innovation Matt Fagen is in charge of operating everything about the Tech Cube. Fagen said that the Tech Cube enables students to learn and master material at a much higher level.

“We help students become more comfortable being creators of science instead of consumers of science. They learn that everything comes from trial and errors, not platonic ideals,” Fagen said.

Fagen said that the Tech Cube has dedicated floors for the lower, middle, and upper schools; the curricula and facilities are tuned accordingly. Lower school students start by learning to program small basic robots called Bee-Bots, and upper school students have opportunities to compete at international robotics competitions, Fagen said.

The top floors of the Tech Cube display the opportunities that TAS upper school students have. Fagen narrated the available tools as he offered a tour of the facilities. The fourth floor houses the High Performance Computer Lab and the school’s virtual reality classrooms, Fagen said.

“The students designed and built each of these computers,” Fagen said, counting around 10 of them in the lab. “Student laptops don’t have enough power on their own for a lot of our programs. Now, they can use link these computers’ processing power to conduct advanced work on their own laptops.”



The fifth floor of the Tech Cube hosts the fabrication shop, where the most intensive robot construction occurs.  
**Photo Credit: Michael Sedwick**

The crown jewel of the Tech Cube is the fabrication shop on the fifth floor. Its lofty, open floor plan contains tools and machines that enable students to construct robots that weigh hundreds of pounds and can move at 10 miles per hour, Fagen said. The shop includes heavy machinery such as welding tools, 3-D printers, and a water cutter that exerts up to 50,000 PSI of pressure. On the perimeter of the shop, black cabinets contain red tubs holding myriad robotic parts and tools.

The school included a permanent crane in the Tech Cube so that the school can install new fabrication machinery as robotics technology advances. Rapunzel, nickname of the giant red crane, hangs from the fifth floor ceiling and can extend outside of the building in order to drop

down and reach the ground, where the next generation of robot-making machinery will one day wait to be lifted up into the fabrication shop.

“This is a living building. Maybe in 20 years different equipment will be necessary, so we built the infrastructure and an open plan to allow for that. We always want to make the equipment match the students’ interests and capabilities,” Fagen said.

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**---TAS Robotics Chair Matt Fagen**

One semester of either mechanical engineering, software design, or electrical engineering is required for all upper school students, and 42 percent of students continue their studies for additional semesters, said Fagen. When a student continues beyond the required course, he or she works on a project that demands collaboration with students from the two other tracks that the student has not studied, Fagen said.

“It teaches teamwork and collaboration, as well as humility. The other two experts know something you don’t, and vice versa,” Fagen said.

As an example of collaboration, a mechanical engineer could create a physical design for a robot’s skeleton but would not know how to use software and coding to make the robot move. The electrical engineer would design the system that sends the software’s signals to the robot’s skeleton.

The academic and collaborative benefits of the Tech Cube will benefit local Taiwanese and even students from other countries. Elizabeth Wang, vice chair of the TAS Board of Directors and chair of the Tech Cube Task Force, said that the school planned from the very beginning to ensure that the greater Taiwan community could access the building’s resources.

“Up until now, most kids would have to go to the U.S. to have access to these types of resources. Now, they can come to Taipei American School,” Wang said. Hennessy, the head of school, said she agreed.

“We expect to be the robotics training center for the southeast Asian region,” Hennessy said. “We’ll do weekend workshops for teachers who want to build robotics programs.”

Some TAS students already have taken their own initiative to help Taiwanese high schools build their own robots, and the government has taken notice, Hennessy said.

“We are about to formalize this cooperation with a meeting with the mayor. The city is very interested in seeing how TAS can help with robotics,” Hennessy said.



Matt Fagen, the TAS robotics chair, giving a tour of the Tech Cube. Rapunzel, the building’s crane, watches from the upper left corner.  
**Photo Credit: Michael Sedwick**

Fagen, the robotics chair, said that one TAS alumna who now studies at MIT cold called 60 local high schools, encouraging them to start their own robotics programs.

“We shared the blueprints of a robot we built with easily attainable parts. The government bought 22 robots’ worth of parts, and our students taught a course to 22 local high schools on how to build this robot,” Fagen said.

That alumna, Angel Huang, said that her personal frustrations with the public education system motivated her to help bring robotics to the local community.

“I went to local elementary school, and I hated memorizing and sitting down in classrooms without doing things. When I transferred to TAS, I realized the importance of hands-on education,” Huang said in a telephone interview.

Huang said that she is ecstatic that TAS is helping to train local teachers, because training was one of the biggest concerns that local schools highlighted when she cold called them.

“A lot of the local teachers are only physics or computer science teachers. The schools aren’t sure how to combine those skills to teach robotics,” Huang said. Huang said that the struggle to spread robotics programs across Taiwan is worth it, however.

“Machine learning and robotics can shape the student into a better active learner. Even if they’re not interested in robotics in general, it would help them in the future with important life skills,” Huang said.

Whereas Huang has graduated from TAS and openly shared her experience, TAS did not provide permission for access to current students for interviews.

Fagen stressed the importance of the knowledge and skill sets that the Tech Cube aims to provide.



TAS middle school students work on building a robot in the Tech Cube  
**Photo Credit: Michael Sedwick**

“The world will become more ‘makery’ as time goes on,” Fagen said, referring to the concept of building robots and creating code to control and instruct those robots for specific tasks.

Paul Miao, a parent of two TAS students and engineer by trade who was also on the tour, said he agreed with Fagen’s assessment.

“Automation and robotics will take up a greater and greater part of our lives in the future,” Miao said.

“The kids need to start early and be ready.”

After the robot hit its bull’s-eye, the two middle school students ordered it to scoot around again, searching for the next ball. Today, their robot is playing a game. Ten years from now, their robots might conduct microscopic medical procedures or explore massive new galaxies. The possibilities are endless, because the Tech Cube marks just the beginning of the next generation’s long journey towards building the technology that will push humanity beyond the bounds of the unknown.