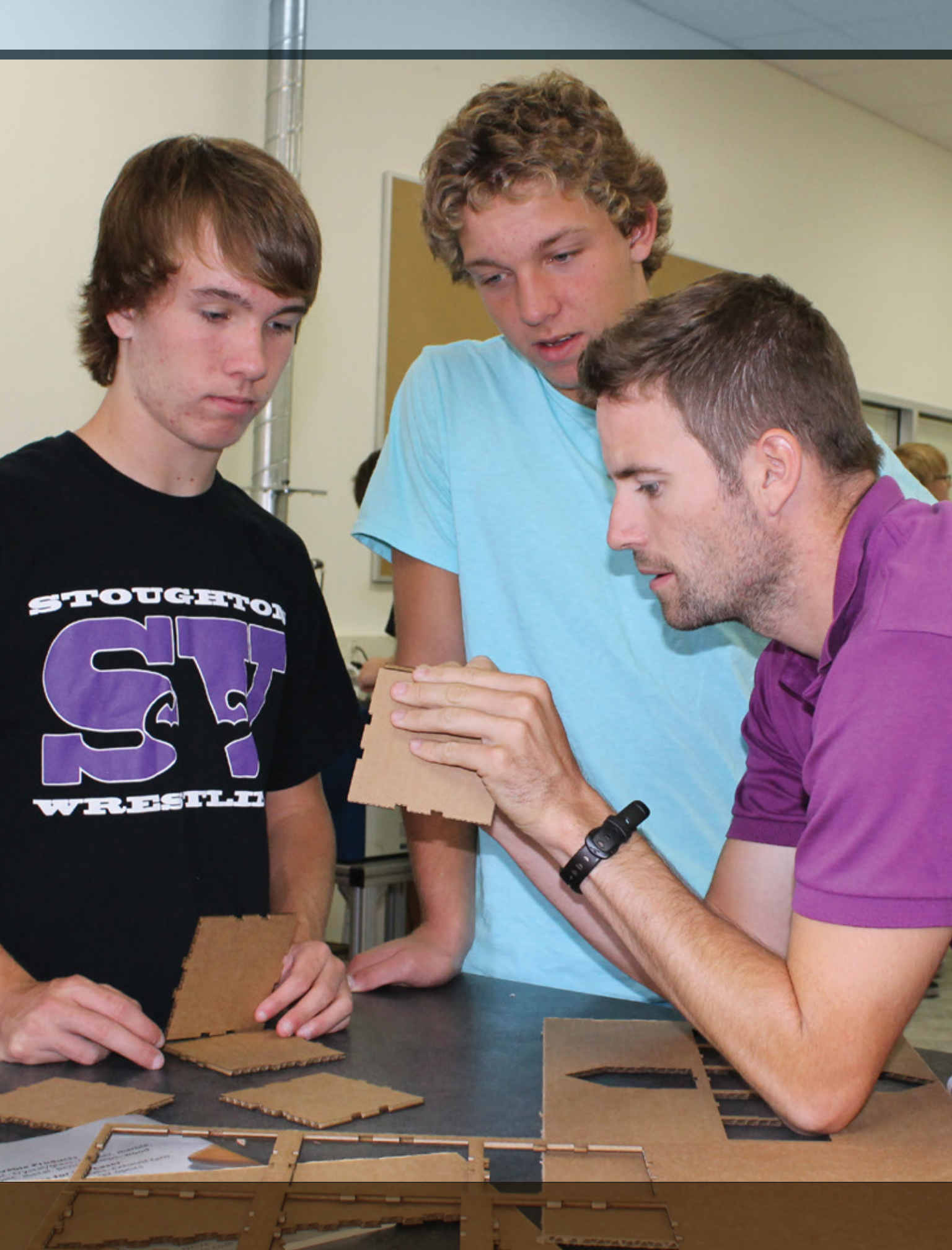
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# Game Changer

**Stoughton High School joins digital fabrication revolution with its Fab Lab** | *Shelby Anderson*

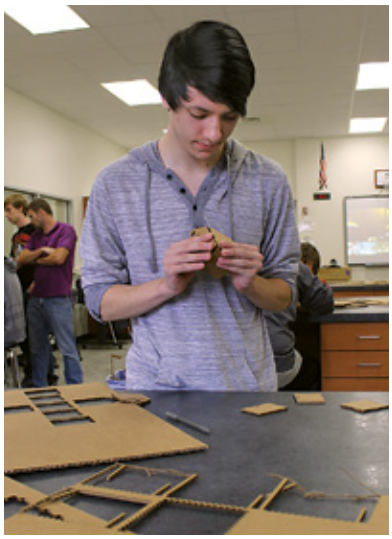
In Massachusetts a father made a prosthetic hand for his son using a 3D printer, a student in France used a 3D printer to build a digital camera, and NASA has used the technology to build components for rocket engines.

There is a revolution of sorts underway. It's a revolution of "making things" and its taking place across the world and in Wisconsin at Stoughton High School.

The high school is fitted with a "Fab Lab." Short for Fabrication Laboratory, the Fab Lab is a phenomenon started by Neil Gerschenfeld, director of MIT's Center for Bits and Atoms.

There are now more than a hundred Fab Labs around the world, however, Stoughton High School's is one of only five housed at a public school.

The Fab Lab is a collection of high-tech tools: a 3D printer produces plastic products; two laser cutters engrave or cut precise designs into wood, stone, plastic, or glass; a large milling machine, or ShopBot, cuts materials for large scale products such as furniture. There is also an electronics station where students can build and program microprocessors.



Unlike traditional shop classes where students create projects with handheld or power tools, these machines are controlled and operated through computer numerical control (CNC). Code is entered into a computer and then directions are sent to a machine, like a 3D printer or laser cutter, which produces the product or makes the cuts or incisions, based on the directions it receives from the computer.

Gerschenfeld says Fab Labs are a response to the third digital revolution currently taking place. The first digital revolution was communication, the second was computation and now the third is fabrication. Soon, through the use of computers and engineering machines, people will be able to basically design and make whatever they want.

"This is like the birth of the internet, but it's literally an internet of things." Gershenfeld said. "It's an internet where data becomes things

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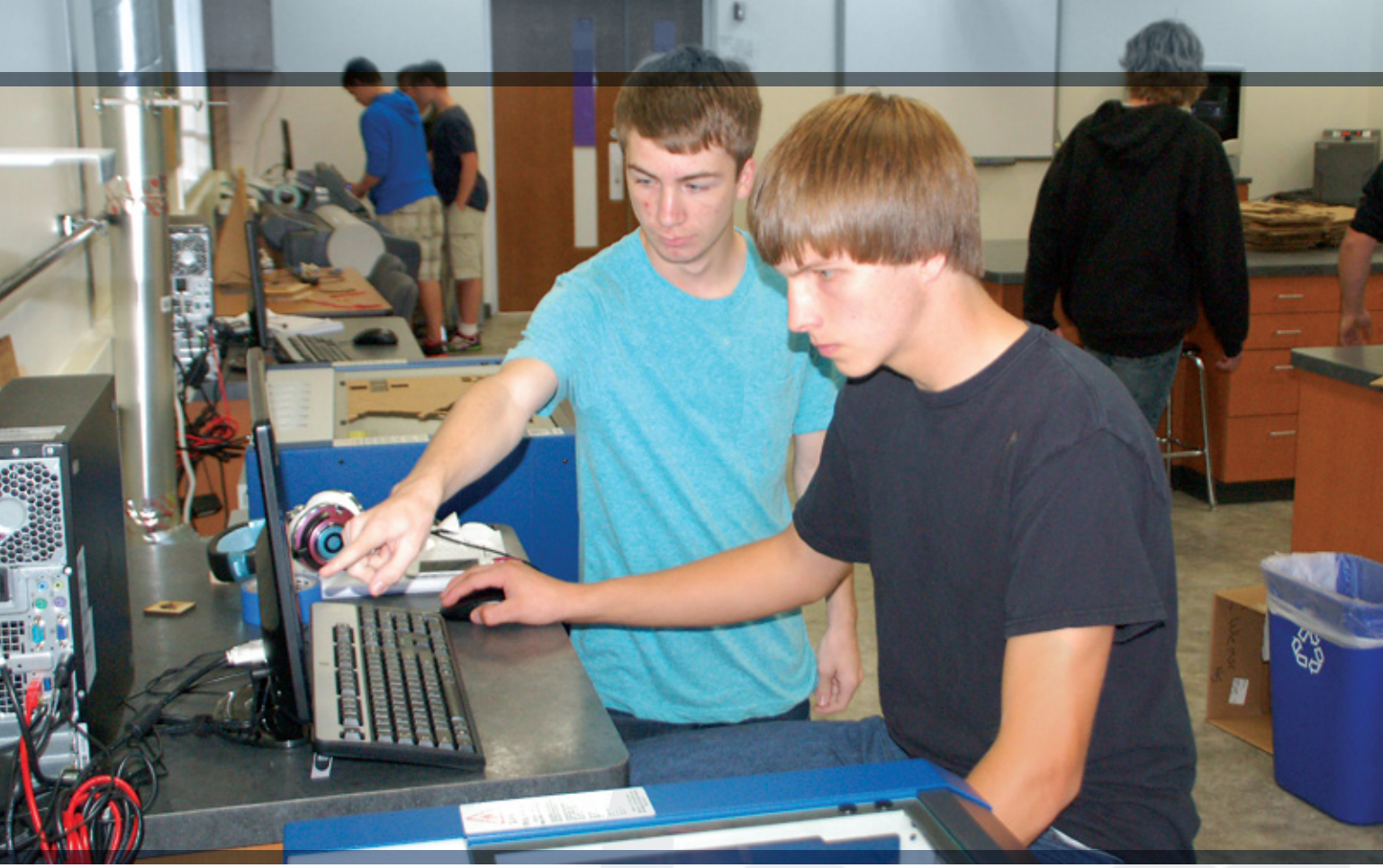


and things become data. And we're seeing the births of entirely new businesses where you go to market by shipping data and you produce on-demand where you consume."

Students at Stoughton High School are being trained how to operate the equipment and are beginning to see that the possibilities to design and produce innovative products are endless.

"They have the opportunity to create something that doesn't exist, something that they've always wanted, and they can create it here," said Brian Shimon, Stoughton High School associate principal.

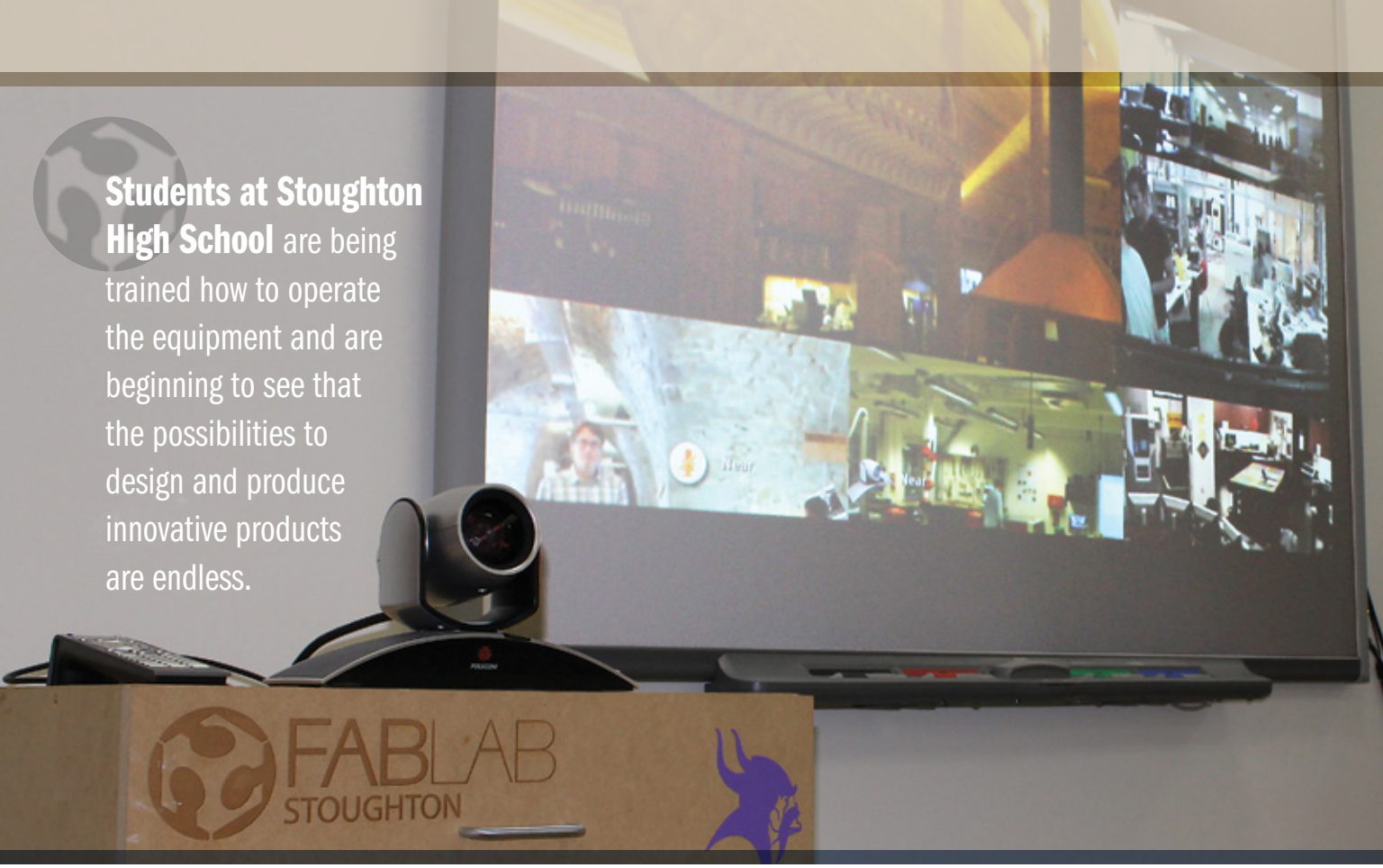
## Building Partnerships

The Stoughton High School Fab Lab got its start when Mike Connor, a retired engineer and now a member of the grant committee at Cummins, a company that designs and manufactures power generation equipment and engines, visited a Minnesota high school that is fitted with a Fab Lab. Connor was impressed and brought the idea to the district. Shimon said the district thought about the idea and realized it fit perfectly with the district's vision.

That vision was created not only by the district but the entire community. In the fall of 2011, the school board hosted a two-day strategic planning conference, called Stoughton 21C, that included more than 95 individuals from the community including business leaders, teachers, parents, students and other community members. Liz Menzer, school board president, said an outcome of the conference was an overwhelming amount of community stakeholders that wanted to help support the schools.

"It was really just finding the right match," Menzer said.

With the help of Connor, Cummins stepped up and offered a $100,000 matching grant to build a Fab Lab at Stoughton High School. With the matching grant from Cummins, the district had to raise $100,000. The district was able to collect $106,000. The money is part of a three-year grant that allowed the district to purchase and set-up the equipment such as the 3D printer, laser cutters, and large router. The district still has money in its coffers to cover supplies and upkeep of the equipment.

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## Opening the Lab

With the equipment in place, the district needed qualified staff to run the lab. Three teachers at Stoughton High School — Brad Seehafer, technology teacher, Chris Wiemer, calculus teacher, and Francis Kelley, science teacher — stepped forward and took a semester-long MIT course through live videoconferencing with other Fab Lab leaders from around the world. For the course, the teachers made a wood cabinet with a light inside that turns on when the cabinet doors are opened, a wooden box that only opens if buttons are pushed in the correct sequence, and a device that turns sound into light and back into sound.

At the start of this school year, the first Stoughton students officially began classes in the Fab Lab — learning how to use the equipment and getting familiarized with the philosophies and teaching styles.

Wiemer said students working in the Fab Lab are not only learning how to use the high-tech equipment, they're also learning how to apply concepts from math, science and technology classes to their projects.

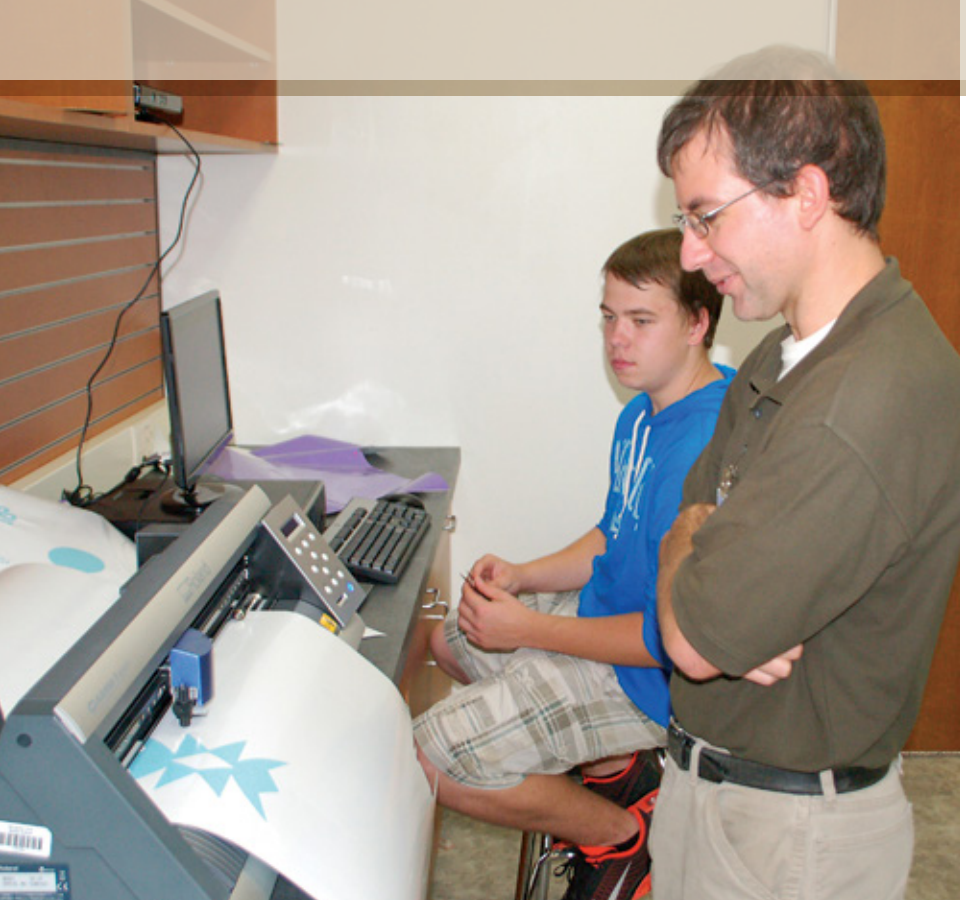
"We're teaching the design process, which is useful in a lot of things," Wiemer said. "If students create something and it doesn't work, they don't get docked for it, they just go back and work on it some more."

Education researchers such as Tony Wagner, emphasize that students should have opportunities to fail in school because it is simply a part of learning and improving.

Another tenet of the Fab Lab philosophy is collaboration, not only amongst other students in the Stoughton Fab Lab but in Fab Labs across the world. Each Fab Lab in the world is connected to the other Labs via a web camera. Through this way, great ideas and projects are shared all over the world and may provide solutions for projects that other people are working on in their Fab Labs.

### Learn More about the Fab Lab at Convention

**Stoughton Area School District** leaders will be presenting a session, "Developing School-Community Partnerships — and a Fab Lab" at the State Education Convention on **Thursday, Jan. 23**.



## Creating Innovators

When asked why the district would want to take on a big project such as the building and development of a Fab Lab, Shimon said it all goes back to the students. Shimon recalled that Project Lead The Way, a hands-on, project-based national STEM curriculum, was created because the U.S. wasn't developing enough quality engineers.

"The Fab Lab is another way to get students excited about learning and to get them to take high-level math and science courses," Shimon said.

The good thing about the Fab Lab is that it is attracts all students — not just the students with strong math and science grades.

"We want to make sure that we're building access to all students," Menzer said. "We have about 25 percent enrolled who would be considered non-traditional Fab Lab users. There is an opportunity to really excite and ignite kids in a field where they are eager to learn more."

Additionally, projects in the Fab Lab use skills and disciplines from across the curriculum. Students are using science, art, math, and computer programming skills.

"It's been really exciting, even if science isn't your thing," Menzer said. "There is a lot of enthusiasm among students and it keeps growing into other areas. This is something that can be a game changer for a school district like Stoughton."

## Endless Possibilities

The new Fab Lab at Stoughton wouldn't have been possible without the help of Cummins and other community sponsors. Menzer says the Fab Lab project has encouraged and excited the school district about other partnerships.

"It's opened our eyes to more possibilities about how we can partner with other organizations and businesses in Stoughton and around our greater Dane county area to provide real world learning to our students," she said. "The possibilities are really endless." ■

*Anderson is editor of* Wisconsin School News.