

Deer Isle-Stonington Elementary School students used computer software and laser cutters to design cardboard automata, gear-driven moving mechanical devices which helped them understand the transfer of energy between components. PHOTO BY DAVID ROZA

(Printed from [url=http://www.ellsworthamerican.com/living/haystack-mit-empower-kids-design-make-almost-anything/](http://www.ellsworthamerican.com/living/haystack-mit-empower-kids-design-make-almost-anything/))

Haystack, MIT empower kids to design and make almost anything

February 16, 2017 by David Roza on Arts & living, Lifestyle



DEER ISLE — Ennis Marshall is a big fan of model trains. The Deer Isle-Stonington High School student puts together extensive railroads of his own and decorates them with a backdrop of hand-cut wooden scenery. But a few years ago, Marshall picked up the skills of laser-cutting and three-dimensional printing, which allow him to quickly turn his ideas into reality.

“I can just think of something and instead of saying ‘How can I make that?’ I can just draw it on the computer and it comes out,” the 16-year-old junior said.

Marshall first learned laser-cutting four years ago, when he took a workshop held at the winter office of Haystack Mountain School of Crafts, where artists hone their skills in craft media such as glass, wood, blacksmithing, fiber, graphics, clay and paper-making. Of course, the new workshop, which was part of a program called Fab Lab, didn't involve any of those traditional media.

“For Haystack it was kind of a radical move to bring this technology into a place that was so devoted to analog and hand-based,” said Paul Sacaridiz, who became director of Haystack in 2015.

Sacaridiz explained that the idea for Fab Lab was hatched by Massachusetts Institute of Technology professor Neil Gershenfeld, who imagined distributing 3D printers, laser-cutters and other equipment around the world through an international network of Fab Labs.

“Neil was sitting in this multimillion-dollar facility at MIT and realized that very few people will ever have access to this,” Sacaridiz said. “The question was what would happen if you figured out a way to package and scale the lab down in size and price, then scale it up by populating them around the world.”

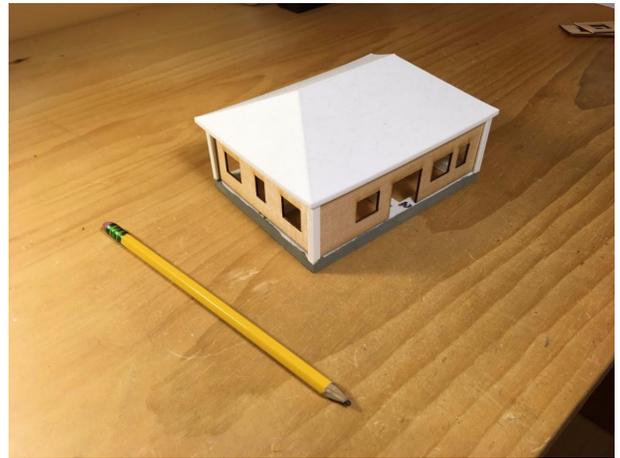
Haystack, with its unique rural setting and craft tradition, was a perfect spot for such a lab. MIT guided Haystack through the process of purchasing all the equipment, which in total cost about \$50,000. But artists are not the only ones playing with the new toys.

“It's critical as an organization that we bring our resources to the local community,” Sacaridiz said.

That's how Marshall got involved. After the laser-cutting workshop, he took a 3D printing workshop which allowed him to start making train engines, train cars and even small model houses. He even started making convenient inventions of his own, such as a pocket case to protect his earbuds from getting broken, and a tiny device to squeeze the last dollops of toothpaste out of a tube.

The precision of the laser cutter and the speed of the 3D printer made the process of manufacturing these ideas much easier.

“I used to cut little individual pieces and stick them together, but that would be limited to the level of precision of me with an X-acto knife,” Marshall said, specifically about the model railroad scenery. The new technology at Haystack's Fab Lab “really opened up a whole door of extra stuff I could do.”



16-year-old Ennis Marshall used the Fab Lab laser cutter to build the walls of a model house, and the 3D printer to build the roof.

PHOTO COURTESY ENNIS MARSHALL

Of course Marshall wasn't the only Deer Isle student messing with the stuff. Earlier this year, Haystack staff brought Fab Lab equipment into Deer Isle-Stonington Elementary School and used it to help seventh- and eighth-graders learn their physics lessons.

"We learned how to design gears, ratchets and cams," said Mickie Flores, who teaches math and science at Deer Isle-Stonington Elementary School. Under Flores and the Fab Lab staff's supervision, her students created gear-driven mechanical devices, called automata, entirely out of cardboard. "We're thinking about a transfer of energy from one component to the next as it turns."

The students first plotted their automata designs on a computer software program called Fusion360. Then, the Fab Lab staff cut the students' designs out of cardboard using a laser cutter. Once the designs were cut out, the students glued them together and used the Fab Lab's vinyl cutter to make bright-colored stickers for the gears. A kinetic artist and University of Maine graduate student named Wade Warman was there to help explain the process to students, but he soon discovered that they had a few things to teach him, too.

"I said they couldn't make two green little army men spin in opposite directions, but they said, 'OK, that's cool dude,' and they came back with a design and I was like, 'Oh my God, that's going to work,'" Warman said. "Kids have this weird perspective where they haven't been told no enough. They're like, 'Let's do this'; they're not afraid of failing."

That innovation shined throughout the Fab Lab workshop, where no two automatons were exactly alike. For the school and for Haystack, it was a three-in-one where students could learn new scientific concepts while engaging with a new technology, all while stretching their creative muscles.

"I always like seeing the kids' creativity overlaid on the technology," Flores said. For an example, she recalled a student at another workshop who created a dollhouse castle out of cardboard using a laser cutter. "She just designed this whole laser-cut jigsaw castle with towers that fit together beautifully. All of a sudden out of cardboard she had this 3D castle."

The next lesson will take students into the Fab Lab itself, where the class will learn about balance and weight distribution by using the 3D printer to



"It's all about letting kids be kids while they're using 21st-century technology," said science and math teacher Micki Flores (left) as she helps out a student.

PHOTO COURTESY HAYSTACK MOUNTAIN FAB LAB



Deer Isle-Stonington Elementary school students assembled cardboard automata, which are gear-driven moving mechanical devices, designed on

produce sculptures and shapes for a mobile. The students also will Skype with an artist at MIT about how to make beautiful contraptions themselves.

computer software and cut out using a laser cutter.

PHOTO COURTESY HAYSTACK MOUNTAIN FAB LAB

“Part of what turns me on about Fab Labs is the democratization of manufacturing,” Warman said. “It’s not like a table saw where you can be too young to use it. With a laser cutter, if the file on the computer looks great, we just press the start button.”

Hancock County isn’t the most affluent area in the world, which is why having the Fab Lab on Deer Isle is potentially a big leap forward for the students who utilize it.

“It’s not tomorrow technology, it’s today’s technology,” Flores said. For example, 3D printers have already been installed in hundreds of libraries across the country for members to use. “When they go to college in a year or two and the opportunity exists to further those skills, I think our kids will say ‘Oh! I know what a laser cutter is! I know how to use a 3D printer.’”

Ennis Marshall might be one of those kids soon.

“I’m considering going into engineering after college,” he said. “Knowing how to use a 3D printer or the computer-aided design programs would be helpful.”

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