



## Educator Case Study

# FROM WOODSHOP TO INVENTION MAKERSPACE: HOW ONE CAREER TECHNICAL EDUCATOR BUILT AN INVENTION PATHWAY FOR HIS STUDENTS

In the early 2000s, the wood shop at Colfax High School in Colfax, California, was facing a shut-down. The instructor was retiring and the shop was deemed too expensive to run. Jonathan Schwartz, a math and pre-engineering instructor, saw something in the shop that others didn't – a place for invention – and offered to take it over and bring it back to life.

**“ There is no better place for invention out there than the traditional wood shop. Craftsmen are always innovating new tools and inventing new products. ”** – Jonathan Schwartz

He wanted to introduce high school students to that world and offer them a pathway to invention. “I think the idea of invention can be hard to get your head around when you're young. I knew I wanted to invent things, but I never met an inventor until I was older so I didn't know that was a career option,” he says.

Now in his 23rd year of teaching, Schwartz has dozens of inventions under his belt, including

the patented tool, TopSaw, which is considered a standard in chainsaw tools. Schwartz makes it a point to invent something new every year, letting his students in on the process – even the failures.

But those early years of getting the shop up and running weren't easy. The program had minimal funding. He applied for grants and was turned down. His first attempt at applying for a Lemelson-MIT InvenTeam grant in 2003 ended in rejection.

In 2004, he got his first big break when he shared with the Lemelson-MIT Program, his students' idea for a storm drain trash remover. He was awarded a 2005 \$10,000 InvenTeam grant, which he used “to buy things for his students' invention prototype, including tools that would turn the shop into a new workspace with invention as the cornerstone,” he says.

The visibility and publicity that came from receiving an InvenTeam grant from the Lemelson-MIT Program put the shop program into another stratosphere, according to Schwartz. “It's no longer just crazy Mr. Schwartz in the shop trying to

invent something. The grant we received provided acknowledgment to the school, district, and even county that what we were doing was worthwhile," he says.

Over the years, Schwartz has applied for and received nearly \$1 million in grant funding, including \$100,000 for the 2017 Teaching Excellence Award from Harbor Freight (\$30,000 for him and \$70,000 for the school) and a second \$10,000 InvenTeam grant from the Lemelson-MIT Program in 2012. The Colfax High School InvenTeam won for their Tri-Metric tool, a mechanical trigonometric calculator that combines residential construction design and layout into a single process. He also won Placer County's High School Teacher of the Year for 2018 and the 2015 California School Boards Association Golden Bell Award for Innovation. He was recognized as a California Teacher of the Year Finalist for 2019.



Thanks to the numerous grants, the shop now has a lumber mill, a full computer-aided design/computer-aided manufacturing lab, 3D printers, and a full suite of woodworking tools (including a CNC router for surfacing wood and creating digital inlays) to facilitate what he calls "forest to furniture," where students see their materials in their natural form, mill them, and then use the resulting wood to create prototypes of their inventions. "Wood, more than any other material, is optimal for prototyping," he says.

One student built more than 20 prototypes of a prosthetic leg for her invention of an app-controlled inflatable air bag that reduces friction between an amputee's limb and prosthetic. The

designs made from wood, plastic, fabric, and 3D molds still hang in the shop. The student used her four years with Schwartz – taking his class all through high school – to work on her invention. She continued innovating after graduation in Schwartz's "Rapid Prototyping for Design" class at Sierra College's Centers for Applied Competitive Technologies (CACT). Sierra College, a nearby community college, partnered with Schwartz two years ago to foster a pathway to invention among college students. Carol Pepper-Kittredge, who heads up the CACT, was a mentor for the 2012 Colfax High School InvenTeam and, from that, was inspired to bring Schwartz's program to the college.



Schwartz believes invention is an opportunity necessary for students heading out into the world after high school as well as those going on to a four-year college. "Whether you are college-bound or not, you could benefit from learning to design and build things," he says.

He's also grateful for having all four years with students to build up their interest in invention. "It's difficult to have a kid come into class and immediately ask them to build a new piece of furniture," he says. Instead, the four years let him start with having the student build a jewelry box to specification. "Then, I can say, okay, build one on your own. Now, build one with a unique aspect. And now, do something completely new."

He has students disinterested in invention work as assemblers, manufacturers, or Web site developers, believing everyone can contribute to the process of invention. He created an on-

line store called [treetransformation.com](http://treetransformation.com) to sell student products and to teach them about the role of commerce in invention. Whatever products have the highest sales or profitability stay on the site and those that don't drop off. He likens it to Kickstarter and other crowdsourcing sites.

**“ My first invention – another chain-saw tool – went to market when I was just out of undergraduate school. It was a complete flop for a lot of reasons. But I loved all parts of the process and learned a tremendous amount from it. ”** – Jonathan Schwartz

Schwartz hopes to continue to foster a pathway to invention for his students with what he calls “the most beautiful shop around.” And aims to inspire his fellow career technical education instructors to do the same.

#### ABOUT LEMELSON-MIT INVENTEAMS™

Lemelson-MIT InvenTeams are teams of high school students, educators, and mentors that receive grants up to \$10,000 each to invent technological solutions to real-world problems. The InvenTeam initiative is administered by the Lemelson-MIT Program, a sponsored program under the School of Engineering at the Massachusetts Institute of Technology. The Lemelson-MIT Program is funded by The Lemelson Foundation. Learn more at [lemelson.mit.edu](http://lemelson.mit.edu)

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