PARTICIPATING INSTITUTION

South Ridge High School

LOCATION

Beaverton, OR, USA

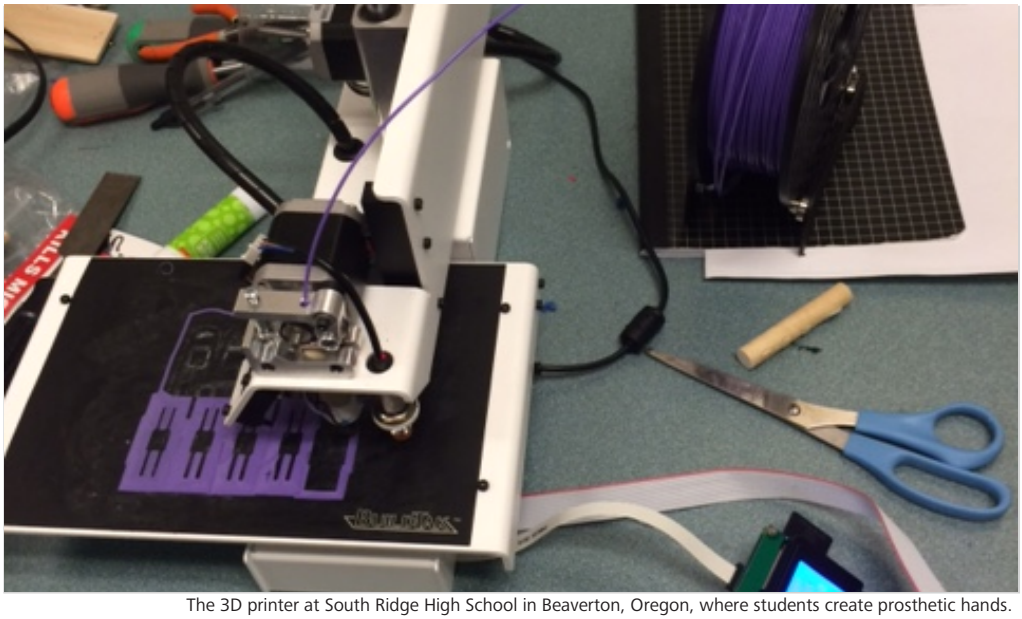
SOFTWARE

Autodesk® AutoCAD®
Autodesk® Inventor®

Autodesk design tools help students make prosthetic hands

Kids develop skills that have a lasting impact on the community

> It's been incredibly successful, and I think that's mostly due to the ease of access of the software and then the ability to integrate that with some pretty powerful hardware and get those prototypes in their hands almost immediately.
>
> **—Jacob Small**
> Engineering and Design Teacher
> South Ridge High School



The 3D printer at South Ridge High School in Beaverton, Oregon, where students create prosthetic hands. *(Image courtesy of Jacob Small)*

Engineering students use the same design tools as professionals

Students at South Ridge High School in Beaverton, Oregon, are using Autodesk® tools to design and create a variety of objects that would have been impossible to make just a few years ago. Using Autodesk® Inventor® software and a 3D printer, these students even manufactured custom-made prosthetic hands for a number of people in the community.

Jacob Small, an engineering and design teacher at South Ridge High, helps his students use Autodesk tools and 3D printers to go beyond design theory. Students are putting their classroom learning into practice by designing and prototyping various projects, including blades for a wind turbine, bridge brackets, even replacement parts for the school's plotters and printers. "We've basically created sort of a maker space," says Small. "We have a queue where we can get requests for individual pieces and components from different teachers and entities within the school. Then we produce a prototype."

The e-NABLE project

In addition to meeting needs within the school, the students are able to engage with their local community and find challenges outside the school. One project that Small says really generated a lot of enthusiasm among the students was the challenge to create prosthetic hands.

Small's engineering classes teamed up with the e-NABLE project, a global network of volunteers using 3D printers and collaboration technologies to make free prosthetic hands and arms, typically for children. "The larger goal of the e-NABLE community project," says founder Jon Schull, "is to prove this can work with 3D printed prosthetics, and then to show that there's nothing magical about 3D printed prosthetics."

The global e-NABLE community is about 6,500 people to date, including the students at South Ridge High. Those students created hands for four different clients. Each client's needs were unique, and each hand had to be designed specifically to meet those requirements. In the past, engineering and design students created untested designs that often had no real-world application. Now, these students were overseeing a project with significant implications for people with real needs.

While the clients' physical differences presented unique challenges for the student makers, aesthetic factors were also important design considerations for the recipients. One four-year-old had a particular request: he wanted a Spiderman hand.

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Students in Oregon use Autodesk tools and 3D printers to create custom prosthetic hands

The solution

Using Autodesk Inventor, students were able to take the open-source designs from The e-NABLE Project and customize them for that four-year-old Spiderman fan and for the other clients. The ease of use of Inventor is a key to the success of the project. Small says many of his students have little or no experience with computer-aided design before entering the program, but with Inventor they are able to become proficient quickly on the same tools professional designers use. “This is the largest number of people I’ve seen get good with software and be able to produce things quickly and really buy in and be excited about it," says Small. While many factors contribute to this success, Inventor's user-friendliness is undeniable. “It works for them, and that's just about the best thing you can say about a piece of software.“ Student Kylie Russell agrees, saying, “I like using Autodesk software because it is simple enough for me to understand quickly, but complex enough to do higher-level designing.”

More than with previous projects, Small really wanted the students to work independently on the prosthetic hands. That meant being in charge of design and customization using Inventor, and prototyping with the 3D printer. It also meant communicating with the clients and their families to assess needs, and incorporate those requests into the designs. Working from photos of the limbs, students customized their designs for the individuals. Prototypes were made and fitted, and feedback from the fitting was used to refine the designs. Small says he made sure the students knew they were expected to take charge of the project. “Then I just stepped back and let them do it and they just knocked it out of the park, they really did an incredible job.”

In a video, the four-year-old boy who wanted the Spiderman hand is seen wearing the prosthetic for the first time. The hand nicely matches the Spiderman T-shirt he’s wearing as he inspects the new device with a wide grin. He goes over to a table, picks up an object with his new right hand, and gives it to his father. He then proceeds to give his dad a high-five, first with his left hand, then with his new Spiderman hand.

Since the designers are high school students, says Small, they're inclined to play it cool most of the time. Even so, they let him know the prosthetic hand project was a powerful experience. “I think they really felt like they were able to get outside their own head, their own building, their own community and do something better for the world in general.”

The result

South Ridge High School engineering students are using Autodesk software to take design projects out of the classroom and manufacture items with real-world applications. This extends their involvement beyond traditional engineering projects, giving them valuable personal experiences while advancing their education and developing skills that future employers value.

> They're willing to help their classmates, they're willing to help me learn new tricks and tips and little ways to make things just go easier. It's very communal then, and that's really great. I think it speaks to the user-friendliness of the software.
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> **—Jacob Small**
> Engineering and Design Teacher
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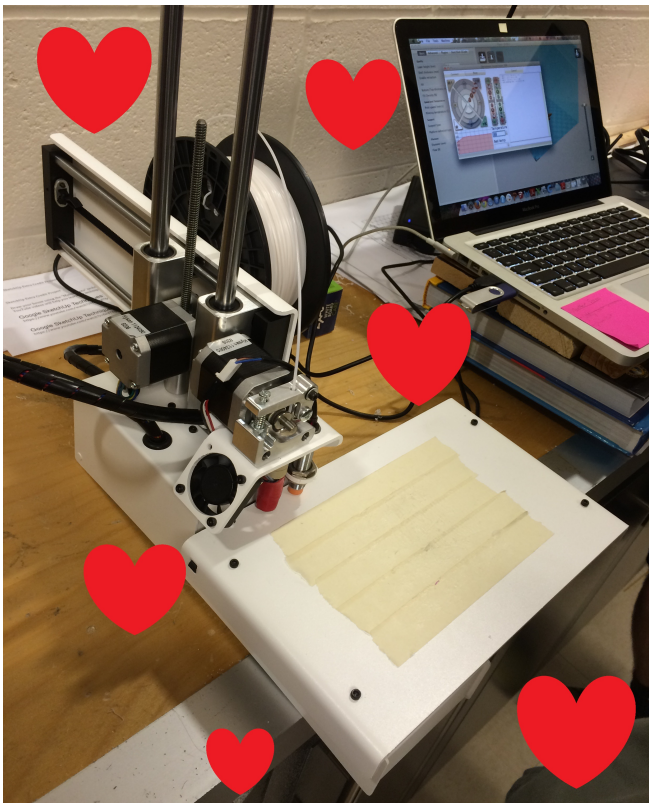
A student-made prosthetic hand designed with open-source plans from the e-NABLE project. *(Image courtesy of Jacob Small)*



South Ridge High School Engineering students love their 3D printer. *(Image courtesy of Jacob Small)*

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