

MAKING THE DIFFERENCE

Can kids who are blind and visually impaired enjoy the digital makerspace experience? Carnegie Science Center says yes, and took its Mobile Fab Lab to Erie to prove it. BY BARBARA KLEIN



PHOTO: JON DOCTORICK

A workshop participant tries his hand at tactile-assisted design.

Jon Doctorick has been down this road before. As the education coordinator for Carnegie Science Center's Mobile Fab Lab, a digital fabrication workshop on wheels, he's the go-to guy. The one who loads the 20-foot trailer or van with all the cool stuff—3D printer, laser engraver, vinyl cutter, programmable robotic toys called spheros, laptops loaded with design software, and more—and then drives it to schools, vocational rehab centers, libraries, and camps. He takes some 20 treks a year—and often for days at a time—throughout Pennsylvania, Ohio, and West Virginia.

process of turning “bits” into “its,” or designs into 3D-printed realities. Since debuting in 2015, the Science Center's on-site and two mobile Fab Labs have done just that, inspiring students in grades three and up, as well as adults, all the while integrating STEM into these authentic—and fun—making experiences.

But as Sokol pointed out, if students can't see the computer screen, they can't participate. So she challenged the Carnegie Science Center Fab Lab team to return to Erie with a program tailored specifically to include kids who are blind and visually impaired.

Hong Kong, where it was featured in the Science Center's booth—one of the most popular at the convention. It's that willingness to share knowledge on a global level that Doctorick was hoping to tap into as he began looking for ways to adapt the Fab Lab's focus to include the blind and visually impaired.

So, he did what any self-respecting, 21st-century educator-researcher would do: He Googled it. But his searches came up empty.

“That's unacceptable,” he thought, and the pair got busy.

More conversations with more people led to an idea Whitewolf ultimately dubbed TAD,

“The kids now realize there are different ways to create and accomplish a task. They love it.”

—DAWN SOKOL, DISTRICT ADMINISTRATOR, OFFICE OF VOCATIONAL REHABILITATION'S BUREAU OF BLINDNESS AND VISUAL SERVICES IN ERIE

Last October, Doctorick made this same two-hour drive from Pittsburgh to the Office of Vocational Rehabilitation (OVR) in Erie; but today, nearly a year later, he's taking a different route.

Shortly after that 2016 visit, Doctorick got a call from Dawn Sokol, the district administrator for the Erie OVR's Bureau of Blindness and Visual Services. “I told Jon that we teach our students who are visually impaired that there's a lot they *can* do,” recalls Sokol. “We want them to be exposed to STEM [science, technology, engineering, and math] activities, but it seemed like they were left out.”

That's because they were.

Generally, Fab Labs rely on computer-aided design (CAD) software to engage kids in the

The challenge was accepted. “We don't say no,” says Liz Whitewolf, the Fab Lab's technical and education manager. That can-do spirit is a hallmark of the maker movement in general and the Science Center in particular. Last spring, for example, the Fab Lab, in partnership with a program called e-Nabling the Future, enlisted more than a dozen area high-school students to craft and assemble 3D-printed prosthetic hands. Looking like something a superhero might don, these functional limbs were then sent to children throughout the world who are missing all or part of their hands due to injuries from violent conflicts.

Whitewolf took the prosthetic hand-printing program with her to the 2017 Maker Faire

for tactile-assisted design. The premise is simple: Take the computer screen out of the equation and replace it with a hands-on, tactile-centered approach.

The initial iteration, Doctorick says, “failed miserably.”

Enter Tylik Griffin, one of the beta testers. The 20-year-old, who is blind, volunteered to help put Doctorick's pilot program into motion. “I started by making a 3D car out of clay,” Griffin explains. The plan was to take a photo of the finished artwork, input it into a CAD program, and then send that file to the 3D printer.

Although the concept was sound, the process itself was slow and cumbersome. But after some modifications, Griffin experienced

for himself how a concept is transformed from a design to a rendering to a tangible product. And that was the goal.

"I felt good about it," Griffin says.

With a few additional tweaks to the original concept, Doctorick was ready to introduce TAD version 1.0 to 11 kids ranging in age from 8 to 17 who were eagerly awaiting his arrival in Erie.

Along with the machinery, Doctorick packed lots of tactile-based art supplies including pipe cleaners, Play-Doh, and clay, as well as other essentials like construction paper, duct tape, and scissors. After about four hours of setup in an OVR classroom, he was ready.

As a warm-up on this humid June day, the kids craft airplanes using cardboard, duct tape, and a laser cutter, and take them for a spin in a field across the street. Andrew Achille, who is 13 and has an eye disease that causes retina damage, explains that he opted to put a lot of weight on the nose of his plane and was looking forward to testing it out and making any necessary adjustments. Eleven-year-old Darren Craig, who has a condition that causes his eyes to move rapidly and uncontrollably, took the opposite approach, weighing down the back of his plane with paperclips and adorning the aircraft with orange, green, and purple tape.

A short time later, the group hustles back to the classroom-turned-makerspace and Doctorick talks to them about creating something—virtually anything they can think of—using the materials provided. He explains how the process works and that they'll be able to take home a vinyl cutout or sticker of their artwork.

The chatter intensifies as the kids get down to business. Jazmin Chiemara, who is 11 and blind, thinks about a snowflake but opts instead to make a bird and a heart with some help from her aide. Andrew goes for the Batman logo as Darren turns his attention to fashioning a U.S. Army star emblem.

Soon, the constant whirl of the vinyl cutter serves notice that no one is being left out. And that's exactly the result Sokol was hoping for. "The kids realize there are different ways to create and accomplish a task," she says. "They love it."

And so does Doctorick. "It feels awesome to be able to impact students in this way," he says.

Another reward for the Fab Lab duo's ingenuity: Doctorick and Whitewolf were asked to present the TAD concept at a recent Fab Lab conference in Santiago, Chile. Their goal: share their progress and learn from their peers about how they might improve it, opening doors for even more future makers. ■

Mobile Fab Lab Carnegie Science Center is presented by Chevron in conjunction with the Appalachia Partnership Initiative, in partnership with BNY Mellon.



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