

UW-Stout's Discovery Center
Fab Lab puts advanced
technology in the hands of
innovators and educators like
Jennifer Astwood, UW-Stout
Associate Professor of
industrial design,
and Philipp Egorov of
Moscow's MISiS Fab Lab.

PROBLEM SOLVED

University of Wisconsin–Stout
empowers Wisconsin students,
teachers, and lifelong learners
with digital fabrication.

by Tonia J. Johnson

It's late June, a relaxing stretch of Wisconsin summer when most K-12 teachers and students welcome the opportunity to close the books, power off computers and turn their attention to things outside the classroom. Yet at University of Wisconsin–Stout's Discovery Center Fab Lab, 11 elementary and secondary teachers have opted to become students for a week, taking advantage of a professional development opportunity offered for the first time in 2016.

What compels these instructors to “stay after class” to participate in R3 Innovative Digital Technologies Retreat?

HIGH ENERGY

They're here to “revive, refocus, and retool,” so says the event brochure. Working in small groups at the 3D printer, laser engraver, CNC router, CNC plasma cutter and more, the teachers



familiarize themselves with the array of advanced digital equipment that outfits UW–Stout's makerspace. Their skills grow steadily with practice, as does their enthusiasm to use these machines as teaching tools in the northwestern Wisconsin communities where they work.

“R3 Retreat gives you experience with world-class facilities and engages you with world-class professors all within an environment of advanced technology and design... plus the networking,” said Dan Kovach, one of two Ashland High School instructors participating this summer. “It's hard not to be stung by the energy in the room.”

It's a tool less tangible, however, with the power to energize Kovach and his colleagues long after the retreat ends. Learning to solve problems the fab lab way – applying the engineering design process – is the intellectual tool that lies at the heart of R3 Retreat and invites lifelong opportunities to use it.

A TOOL FOR ALL TASKS

Studies in music, art, drama, history, sociology, geography, science, engineering, math, and literally all curriculums, can benefit from a problem solving approach that integrates engineering design. It's the kind of thinking that's sparked by hands-on experience in school-based fab labs. And it doesn't stop there.

“The manufacturing sector wants problem solvers, well equipped people who can come in, critically look at a situation and come up with a solution,” observed Randy Hulke, executive director of the UW–Stout Discovery Center. “Fab labs are in a position to prepare these remarkable employees, to empower individuals and launch independent thinkers in an evolving economy.”

Hulke, along with UW–Stout Teaching, Learning and Leadership professor Ken Welty, PhD, will present R3 Retreat’s results and educational value at FabLearn 2016, a conference hosted by Stanford University this fall. The conference theme is “Diversity in Making: People, Projects, & Powerful Ideas.”

L to R: Instructors Laurence Charlier, Ken Welty and David Stricker led the initial R3 Retreat for K-12 educators and administrators. UW-Stout plans to offer the program again in 2017.



TAKING THE LEAD

R3 Retreat is one of several UW–Stout efforts to foster fab lab independent thinkers throughout Wisconsin. Bolstered by a recent partnership with Wisconsin Economic Development Corporation (WEDC), UW–Stout has taken the lead on projects that lay groundwork toward a statewide fab lab support network. “There’s a lot of work going on behind the scenes,” said Hulke, citing projects like development of a web portal anticipated to go online in 2017 and a statewide assessment of Wisconsin school-based fab labs completed earlier this year.

PUTTING WISCONSIN FAB LABS ON THE MAP

To begin the 2016 assessment, the university established several teams comprised of UW–Stout researchers as well as representatives from WEDC, Fab Foundation and local school districts. The teams evaluated seven Wisconsin school-based fab labs that met criteria during the 2015–2016 academic year, categorizing each as fully operational, start-up, or exploratory. The fab labs were then inventoried for equipment and software and diagramed using a quality management tool called “process mapping.”

The maps reflect a wide variety of influencing factors including equipment, students and staff, parents, community support, vendors, volunteers, local business and industry, universities, and more. Local focus groups were also conducted at several sites.

The assessment ultimately found that programs with the most impact were moving beyond just simple machine operation into problem solving and the design process.

“It’s really about leveraging students’ ability to be innovators,” said Terese Wentworth, assessment co-lead and project manager at UW–Stout Discovery Center. “It’s these kinds of skills – the ability to weigh ideas, problem solve, work in teams – that fab labs teach kids and digital technology allows them to prototype and test. Their solutions can be quickly reiterated again and again. The fab lab is amazing for that and the learning that happens is exponential.”

According to Wentworth, several Wisconsin schools were noted for outstanding digital fabrication spaces and innovative teaching models. Brillion High School and Stoughton High School were among those that caught the teams’ attention, with good reason.

FRESH SOLUTIONS

The Ariens Technology and Engineering Education Center, launched in 2007, has gained national attention for effectively integrating STEM (science, technology, engineering, and mathematics) across the breadth of the Brillion High School curriculum.



R3 Retreat participants Kay McLain (left) and Mackenzie Bennin “retooled” with engineering design concepts and digital technology to help them teach business education and art, respectively.

UW–Stout alumnus Steve Meyer is the district’s lead STEM instructor and an advocate for utilizing engineering design to teach all subjects. “I believe STEM is a method of teaching and includes all subject areas,” Meyer said. “In the real world, we don’t do all of these things separately to solve problems. It’s very important to have young people apply what they’ve learned to real life situations and see the connections. It reinforces the individual disciplines when they do.”

The high school center is the result of an outstanding partnership between Brillion School District, Ariens Foundation and business partners throughout the Fox Valley area.

That STEM philosophy recently expanded to the elementary school as all Brillion students, kindergarten through 5th grade, take STEM classes. The Ariens Foundation, Bob and Pat Endries Foundation,

and many other donors are supporting elementary STEM by funding construction of a dedicated STEM learning center.

The new Exploration Station STEM Center at Brillion Elementary School is anticipated to be complete by the end of 2016. Meyer said he expects the \$1.7 million facility will eventually set an example for many. "...we want to serve as a model across Wisconsin and the country on what can be done when business, industry, and local communities work together to help young people. Our commitment," said Meyer, "is to pay it forward."

Meyer said Brillion kindergartners have demonstrated, at five years old, that it's not too early to start solving problems with digital technology. "This is the perfect time," he notes. "Young people come into school and they're extremely creative. Their world is centered around 'play' and they haven't been told 'no' before. When solving problems, they come up with ideas that you never knew. It's our role as teachers to promote this creativity, innovation, and passion for learning."



Stoughton High School hosted its first "Girls Make Electric Guitars" workshop in August 2016. Kat Smith is one of five girls who applied fab lab digital technology to build five guitars in five days.

TECHNOLOGY TRACTION

Opened in 2013, Stoughton High School Fab Lab has been broadly integrated into high school curriculums and enjoys a very high rate of "return customers." Most students who've enrolled in the program have come back to take another class, and the district will welcome middle school students to the fab lab in January 2017. Weekend and evening adult/child workshops are free and very popular with the entire community.

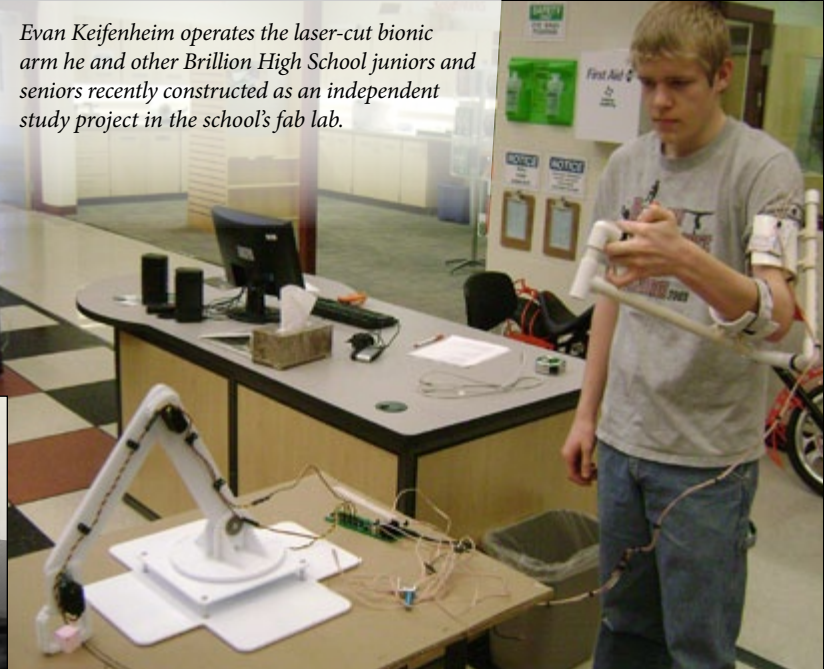
"Stoughton has embraced a very different model that's connected with students and teachers," said Renee Surdick, EdD, assessment co-lead and program director at UW-Stout. During her assessment visit to Stoughton's fab lab, Surdick was impressed by the excitement and interaction of students she observed. "They talked and laughed while they worked in teams that were engaged and self-motivated," Surdick recalled. "They have a comfort with technology that you just don't see very often."

BUILT ON PARTNERSHIP

Equally remarkable is the broad base of community support for Stoughton's fab lab, evidenced by mutually beneficial partnerships that ignited the project and enhance it today. "Education is a regional resource; that's how we need to look at it," said Tim Onsager, Stoughton School District Administrator who was instrumental in the district's acceptance of a proposal from Cummins, Inc.

Cummins, a global manufacturer of diesel and natural gas engines, approached the district in 2011 with a partnership offer to donate half the seed money. Regional business, industry, and community matched

Evan Keifenheim operates the laser-cut bionic arm he and other Brillion High School juniors and seniors recently constructed as an independent study project in the school's fab lab.



that amount to get the Stoughton High School Fab Lab up and running. "The partnerships aren't just financial," Onsager added. "We value the volunteers who come into our lab. Our students are working and talking with people in the industry and learning from each other. We're working together to prepare our kids for the future, to better our community."

SHARING WHAT WORKS

To inspire that success in other Wisconsin communities, UW-Stout recently invited Onsager and retired Cummins engineer Mike Connor to share their experience bringing industry and education together to build an extraordinary fab lab program.

The two presented information and fielded questions from regional business and industry leaders at the July 2016 CEO Peer Council, hosted by UW-Stout's Manufacturing Outreach Center.

As Connor spoke, his enthusiasm for the project, partnership, and students was clear. "It's exciting to see this generation. They're great kids! They're smart and they grew up with this thing in their hands," Connor said, referring to digital devices that are now commonplace. "Manufacturing loves our students because they're working at break-neck speed. They already know this new technology; they embrace it and can spread it throughout the organization."

Surdick sees tremendous potential in both Stoughton and Brillion models as they may apply to communities across the state and beyond. "It's the depth of commitment, willingness to grow, and receptiveness to change the way we educate students," she concludes. "It's important to remember that every community has these opportunities to advance and grow." ■

- Get more information on R3 Innovative Digital Technologies Retreat at www.uwstout.edu/profed/R3-Innovative-Digital-Technologies-Retreat.cfm.
- Learn about the Brillion Elementary School STEM initiative at www.brillionstem.com.
- Get involved at Stoughton High School Fab Lab. Visit <https://sites.google.com/a/stoughton.k12.wi.us/fablab-stoughton>.