

Makerspaces:

Providing Pennsylvania Practical Prefiguration

By Sarah D'Urzo, John Foster, Anna Keune, Kylie Pepler and Andrew Stutzman

After reading the title you may think that Pennsylvanians, or at least the writers of this article, have a fixation on alliteration!

Prefiguration translates to a future imagined by a group, and the authors think that makerspaces can play a part in that future. The reality is that we believe there is a lot career and technical education (CTE) can learn from the Maker Movement, and that there is equally as much the Maker Movement can learn from CTE.

This article starts at the 10,000-foot level and descends to the ground level with two examples that bookend the state of Pennsylvania. Though each bookend focuses on a different part of the state, both work with secondary students, are scalable and have the potential to provide benefits to everyone involved!

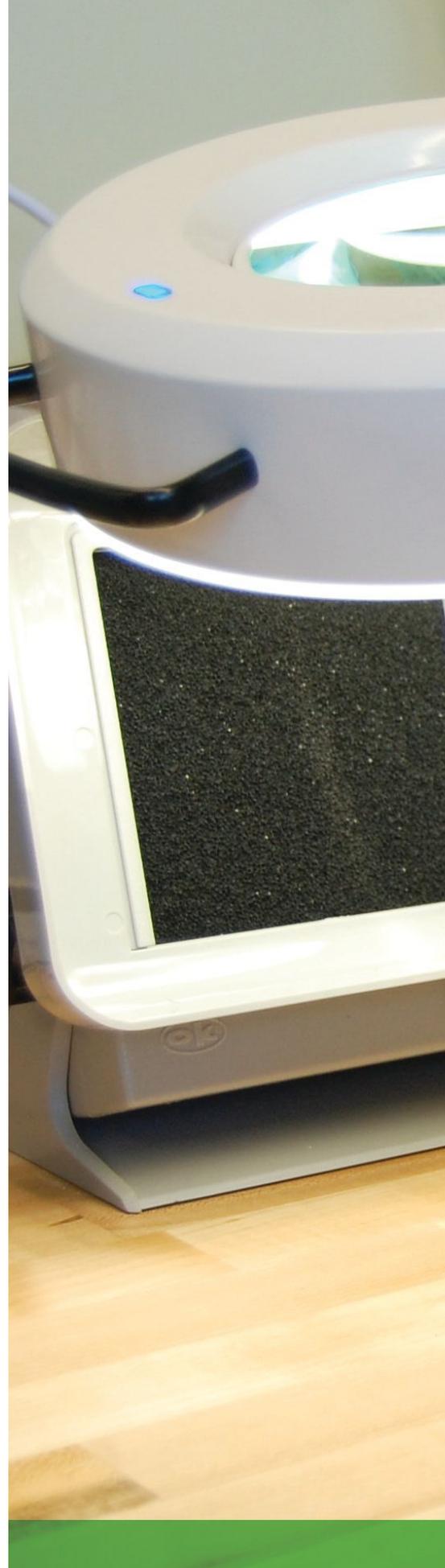
Let's start by taking a look at some conceptual underpinnings of makerspaces and how they work with these two populations.

Arboriculture, avionics, finance management, graphic design, mechatronics, radiology and wind turbine technology are all familiar pathways that are accessible through CTE, but what else do these pathways have in common? As those of us who work in this community know, CTE as an education methodology is a way to combine theoretical knowledge, applied practical skills and a desire to be one's best. That combination results in individuals who are

technically competent and confident, and who contribute to maintaining our standard of living.

But how do these individuals develop an interest in these pathways? Did they become interested because of a family member? Was it a friend, a counselor or an encouraging teacher who opened their eyes to these pathways? Of course, the answer will vary by individual. Many of today's discussions in educational circles focus on providing options for *all* students to learn a variety of pathways, with the goal of individuals having the opportunity to find their own passion.

Passion and interest-driven learning through production-centered projects are hallmarks of the types of work that can happen in makerspaces. Youth-serving makerspaces are physical settings located in different educational spaces, such as after-school centers, schools, libraries and museums that offer hands-on digital and tangible activities and programs for youth. The equipment of makerspaces ranges from sewing machines for designing items of clothing and circuitry toolkits for making interactive prototypes, to 3D printers and laser cutters for creating small models and larger projects. Youth-serving makerspaces in the United States offer an equally diverse array of activities, including the design and construction of full-sized dog houses that youth hope to sell, or the creation of a collaborative project





▲ An Intermediate Unit 1 Colonial student practices soldering in the stationary Fab Lab in Coal Center, Pennsylvania.



▲ IU 1 Fab Lab manager Brandon Prentice works with students using a laser cutter and engraver in the stationary Fab Lab.

that bridges digital media practices and hands-on tinkering with physical materials (Peppler, 2014).

With access to a range of high-tech and low-tech tools and activities that provide learning experiences relevant to technical fields, makerspaces promise to present contexts for gaining relevant hands-on experiences that could lead directly to careers. In makerspaces, youth can “try out” technical career practices and begin to develop the underlying skills and knowledge of specific CTE fields, while engaging both their minds and their hands. These hands-on experiences may present a foundation for youth to make more informed decisions about their interests or a particular career.

Despite the outstanding opportunities for makerspaces to prepare youth to make more informed decisions about CTE pathways, it is unclear what specific practices and what kinds of activities might better foster informed decision making later on. Equally important is determining how the experiences garnered in makerspaces can become more meaningful for youth beyond the spaces themselves.

The Western Example

In conjunction with the White House Maker Faire of 2014, Chevron made a \$10 million commitment to the Fab Foundation. The foundation’s goal was

to establish state-of-the-art design and fabrication equipment labs (i.e., Fab Labs) in geographic areas where Chevron conducted business. One of those areas was the southwestern corner of Pennsylvania. The Intermediate Unit (IU) 1 Fab Lab, a stationary lab in Coal Center in Washington County, serves 25 school districts in Fayette, Greene and Washington Counties.

The Fab Lab provides a platform for STEM education, workforce development and business idea prototyping. Through authentic and real-world contexts, students have access to the tools that enable them to progress through the concept, design, modeling, prototyping, redesign and final product stages of the engineering design process. Furthermore, these tools help students develop practical and critical thinking skills—for the present and the future. Thanks to Chevron, IU 1 Fab Lab will promote innovation and design in the community and will be instrumental in building the local workforce.

In addition to the stationary Fab Lab at Coal Center, a mobile Fab Lab was also made available to serve communities in rural areas of Fayette, Greene and Washington Counties. This mobile unit gives students access to high-tech equipment and provides teachers with resources that are not often available in parts of these counties. The mobile Fab Lab helps bring tools into the community

so that students can build interest and skills needed for jobs in STEM and technical fields.

During the 2015–2016 school year, the mobile Fab Lab was able to visit school districts throughout Greene County to connect their work to the work being done at the regional CTE centers. Both the mobile and stationary Fab Labs conducted week-long sessions throughout the school year, exposing middle school students to new technologies such as laser and vinyl cutters, 3D printers and milling machines.

At the end of each week, local CTE school representatives were available to show the students how their interest in design, machines and/or tools could develop into a more formalized career pathway. In addition to providing an exciting, supportive and motivational environment for students to engage with new technologies and pursue personal interests, Fab Labs were also used to supplement initiatives like project-based learning.

Ultimately, one of the goals of the project in the western part of the state is to serve as an introduction to CTE pathways, and to give students the opportunity to discover how CTE can lead to a successful future. In the coming school year, the IU hopes to scale the model into other counties (besides Washington, Greene and Fayette Counties) and continue to work with the corresponding CTE centers to introduce students to the technical concepts and available fields.

In Pittsburgh, the Maker Movement is thriving with the Carnegie Library of Pittsburgh’s (CLP) program called The Labs @ CLP. The Labs started in 2012 to support the technology interests of youth from grades six through 12. Supplying access to and programming training on digital media equipment (video cameras, microphones, etc.) and software have given youth a safe place to learn and play based on their various interests. Over the last several years, The Labs has increased permanent programming to include five library branches, with programming also rotating across 13 other branches. Although not directly connected to CTE, The Labs’ connection with the Sprout Fund’s Re-

make Learning Network offers youth opportunities directly related to core 21st-century competencies.

The Labs has recently received a small mini-grant from the Sprout Fund to support the creation of digital badges via the LRNG platform. The digital badge initiative includes areas such as design, photography, inventing and sewing. NOCTI (mandatory for Pennsylvania CTE students) maintains a SkillBadge Locker that houses student end-of-program competencies. Both programs are designed on open-source platforms and are capable of importing and exporting. As students progress on their pathway, these badges could potentially be displayed on both sites, thus showing a student's growth in knowledge and skills over time.

The Eastern Example

Philadelphia has a diverse Maker arena that is continuing to grow. Local organizations such as NextFab, Public Workshop, The Hacktory and Maker Jawm are all vibrant programs where students—both young and old—can learn skills such as fabrication, design concepts, electronics, art, carpentry and technology. Over the past several years, funding from the Knight Foundation, the Barra Foundation and others has supported the growth and success of the Maker Movement in Philadelphia.

These public-facing Maker groups have expanded and collaborated over the past few years. In 2013, NextFab, Public Workshop and The Hacktory created common space in West Philadelphia known as The Department of Making + Doing. The Maker Jawm program grew out of the Free Library of Philadelphia's central branch in 2011, and it now offers programming at five branches across the city. The opportunities for youth to create and develop interests via the Maker Movement in Philadelphia are wide open. Programs like Public Workshop and its spin-off, Tiny WPA, have had particular success in working directly with schools and connecting with students based on both their interests and needs.

Although students in Maker programs are directly learning many of the

technical, project management and collaboration skills involved with CTE programs, a direct connection to the school district of Philadelphia's successful CTE programming appears to be missing. Philadelphia boasts a graduation rate of more than 90 percent from its CTE programs, compared to the 70 percent overall graduation rate. Connecting the learning from Maker programs with career-oriented CTE programming could help drive more students toward their career interests and postsecondary opportunities.

Conclusion

Both ends of the state of Pennsylvania are reflective of the potential and relative "newness" of the Maker Movement. The authors believe that connecting maker-spaces to CTE programming could yield compelling results through the sharing of facilities, the creation of engaging experiences for youth and the multitude of opportunities for students to pursue their passions. We also believe that by engaging community resources and concepts like mobile labs, programs have increased opportunities to scale effectively.

We hope this article piques your interest and that it offers a springboard to begin dialogue in your state or region, putting you on the path to prefiguration! **Tech**

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