

# Makerspaces

## Time-to-Adoption Horizon: One Year or Less

**T**he turn of the 21st century has signaled a shift in the types of skillsets that have real, applicable value in a rapidly advancing world. In this landscape, creativity, design, and engineering are making their way to the forefront of educational considerations, as tools such as robotics, 3D printers, and web-based 3D modeling applications become accessible to more people. Makerspaces are increasingly being looked to as a method for engaging learners in creative, higher-order problem-solving through hands-on design, construction, and iteration.<sup>233</sup> The driving force behind makerspaces is rooted in the Maker movement, a following comprised of artists, tech enthusiasts, engineers, builders, tinkerers, and anyone else with a passion for making things.<sup>234</sup> The foundation of the Maker movement was built on the success of the Maker Faire, a gathering that launched in 2006 and has since propagated itself into numerous community-driven events all over the world.<sup>235</sup> School leaders are considering the addition of makerspaces into the formal learning environment to encourage students and teachers to act on their ideas and explore design thinking from start to finish.

### Overview

Makerspaces, also referred to as hackerspaces, hack labs, or fab labs, are community-oriented workshops where tech enthusiasts meet regularly to share and explore electronic hardware, manufacturing and mechanical tools, and programming techniques and tricks.<sup>236</sup> Much of the hype around this cultural trend burgeoned around the advent of MakerBot printers, a rapid-prototyping technology that requires a DIY mentality to assemble, operate, and replicate.<sup>237</sup> Tools that are commonly found in makerspaces include laser cutters, soldering irons, Arduinos and Raspberry Pi computers, saws and drills, and circuitry gadgets, as well as analog tools such as Legos and sewing devices. The value of these spaces is also in community members who provide a resource of expertise. Makerspaces are places where anyone, regardless of age or experience, can exercise their ingenuity to construct tangible products. For this reason, many schools are seeing their potential to engage learners in hands-on learning activities.

Widespread enthusiasm behind makerspaces has helped the concept gain global traction. The CEO of

Maker Media and creator of Maker Faire is a major advocate of installing makerspaces into learning environments, and has helped make it a part of national discussions about innovative approaches to education. Recently, the White House hosted its first ever Maker Faire, leading President Obama to publicly highlight the power of DIY to revolutionize American manufacturing and stoke innovation and job growth.<sup>238</sup> Makerspaces are also catching on in other parts of the world; in China, an increasing number of community makerspaces, called Chaihuo, are populating major cities and mass-production hubs such as Shanghai and Shenzhen. Industry experts believe these making centers will help China stay competitive by cultivating creativity and experimentation among Chinese entrepreneurs whose innovative products will give the country an edge in the global economy.<sup>239</sup>

While many makerspaces are founded to promote creative expression through design and construction, they also have the more pragmatic purpose of being start-up accelerators and tech incubators for local communities. Since its start in 2013, the Garagem, a Brazilian community fab lab in São Paulo, has evolved from a workshop equipped with an open source 3D printer to a platform that nurtures up-and-coming entrepreneurs by helping them find funding and gain visibility. The founder envisions that these successfully incubated companies will co-finance the space so that it can be free and open for everyone.<sup>240</sup> Business experts highlight the positive ripple effect of successful product-launch on the growth of local economies; new companies have a range of legal, marketing, and packaging needs, which can be fulfilled by regional providers.<sup>241</sup> Makerspace communities have also leveraged other avenues including Kickstarter and Etsy.

### Relevance for Teaching, Learning, or Creative Inquiry

Public and school libraries are spearheading the makerspace movement in K-12 education. In Fryslân, Netherlands, a mobile fab lab called Frysklab was started by the city's public library to bring maker curriculum and tools to young learners in rural areas. Targeted toward primary and secondary students, the Frysklab course focuses on using digital fabrication to solve local challenges including water technology, sustainable

energy, and new craftsmanship, among other 21st century themes. The Frysklab has been actively recruiting educational partners and schools for support, and is currently developing a program called Fab the Library!, which will guide libraries through the stages of incorporating a fab lab.<sup>242</sup> The library at the International School at Dundee in Greenwich, Connecticut has been transformed into a “learning commons,” which features a makerspace in addition to new classes that are co-taught by teachers and the library’s media specialists.<sup>243</sup>

Schools are turning to makerspaces to facilitate activities that inspire confidence in young learners, and help them acquire entrepreneurial skills that are immediately applicable in the real world. Eighth-grade students at Garden Street Academy in Santa Barbara, California organized a holiday boutique where they sold products they created in their makerspace, as part of their entrepreneur unit in language arts. The students donated the money they collectively earned to area nonprofits.<sup>244</sup> The Possible Project (TPP) in Massachusetts is one of the latest ventures that combines business education and making for students.<sup>245</sup> The nonprofit provides a three-year afterschool program that teaches high school students from low-income neighborhoods how to create and run a business. Housed in an 1,800 square-foot workshop, TPP has collaborated with the Cambridge Housing Authority and Biogen Idec Foundation to increase access to a specialized type of education that will help disadvantaged youth become business leaders.<sup>246</sup>

Makerspace education also has the potential to empower young people to become agents of change in their communities. The International Development Innovation Network, from MIT’s D-School, recently awarded five grants to makerspace projects around the world, including an all-girls high school in Sierra Leone that intends to create opportunities for young women to gain familiarity with the design thinking process.<sup>247</sup> A 2014 FabLearn Fellow from Stanford University has created the Happy Feet project to set up mobile centers that will teach poor communities how to design and make their own 3D printed shoes to protect themselves from fleas, a struggle that has led approximately 50,000 students to drop out of Nairobi schools due to infections.<sup>248</sup> The Happy Feet project leader posits that access to maker education and tools will help alleviate the greater issue at hand, like poverty, by enabling youth to learn skills that can be applied to solving local problems.<sup>249</sup>

## Makerspaces in Practice

The following links provide examples of makerspaces in use that have direct implications for K-12 education settings:

### Maker Ed

[go.nmc.org/maked](http://go.nmc.org/maked)

Maker Ed is a nonprofit organization that focuses on both online and in-person professional development, network, community, and capacity building, as well as resource and model sharing to allow educators to integrate making into their current settings and prepare them to train others. > [Leadership](#)

### Sierra Vista Students Create in MakerSpace Lab

[go.nmc.org/sierr](http://go.nmc.org/sierr)

Sierra Vista has seen significant increases in attendance, math scores, and rising interest in science and engineering careers since the addition of their makerspace. > [Leadership](#)

### Transforming Monticello High’s Library Into the Creative Hub of the School

[go.nmc.org/monti](http://go.nmc.org/monti)

Monticello High School gradually transformed their library into a more flexible learning environment that encompasses a technology exploration space, a music creation lab, and smaller collaborative learning areas with a variety of tools for educators and students to create the objects they envision. > [Leadership](#)

## For Further Reading

The following articles and resources are recommended for those who wish to learn more about makerspaces:

### Facebook Pitches in on ‘Makerspaces,’ Giving Disadvantaged Students Chances to Tinker

[go.nmc.org/pitc](http://go.nmc.org/pitc)

(Angela Swartz, *Silicon Valley Business Journal*, 19 May 2015.) Ravenswood Makerspace Collaborative is being supported by nearby businesses, organizations, and universities, including Facebook, the Ravenswood Education Foundation, and Stanford’s Transformative Technologies Lab. > [Leadership](#)

### Making Matters! How the Maker Movement Is Transforming Education

[go.nmc.org/matters](http://go.nmc.org/matters)

(Sylvia Libow Martinez and Gary S. Stager, *We Are Teachers*, 3 April 2015.) This article underscores that making is about understanding the world, not about the physical tools in the lab. > [Leadership](#)

### Inquiry-Based Arts and Engineering Space Enriches Student Learning

[go.nmc.org/enriches](http://go.nmc.org/enriches)

(Peter Balonon-Rosen, *Learning Lab*, 11 March 2015.) Malden High School has transformed a near-abandoned woodworking shop into a hub for inquiry-based arts and engineering projects at the high school that appeals to not just engineering students, but anyone who wants to create. > [Practice](#)