

# Unconventional wisdom about the maker movement

It's not a fad, you don't need to break the bank and your teachers are really creative



By Gary Stager

Just as a chorus of politicians, policymakers and education leaders began to sing the virtues of creativity, STEM, entrepreneurship and computer science, an informal learning revolution outside of schools emerged to not only combine these aspirations, but to put wind in educators' sails.

The maker movement represents the marriage of new technology, timeless craft traditions, engineering, the basic human desire to create, rugged do-it-yourself determination and the internet's ability to share expertise.

If learning-by-doing is valuable, learning-by-making concretizes such learning experiences, while offering students an even higher level of accomplishment—making something work. When one invents, makes real things and engages in the process of solving personally meaningful problems, powerful knowledge construction is the result.

Making is a way of viewing the world with the confidence and competence required to solve any problem you encounter, even if only to discover that there is a lot more you need to learn.



*NOT JUST 3D PRINTERS—Making achieves its greatest potential when it is found everywhere in the school. A makerspace can be flexible to change with project goals.*

The following addresses some misconceptions about bringing making to your school or maximizing your return on investment in schools with a tradition of making.

## **Myth: Making is about the space**

The greatest threat to realizing the potential of the maker movement in the schools is the coupling of the words “maker” and “space.” It turns out that it is comparatively easier to hang a sign on a room full of stuff than it is to change classroom practice.

The makerspace threatens to repeat

the historical accident of the computer lab: The enthusiasm of an early adopter and presence of new technology created a specialized bunker that kids would visit each fortnight for the next two generations—like a field trip to colonial Williamsburg. We need to avoid any chance that making, like computer integration, will remain a novelty and be left to a “specialist” while other teachers remain disengaged.

While it is true that some of the new equipment may be dangerous, expensive or in need of ventilation, making should always be within reach of each learner. Making achieves its greatest educational potential when it is found in every corner of the school, all-day long. This is an invitation to bring centers back to the classroom and flexible spaces back to your school. Elevated levels of student agency result.

### **Myth: Making is about 3D printing**

In our book, *Invent To Learn: Making, Tinkering, and Engineering in the Classroom*, we identified three technology game-changers represented



*FIRING THE IMAGINATION—A makerspace doesn't always have to be built around high-tech equipment. Recycled materials such as cardboard boxes, fabrics, scrap wood and more can help young people bring their ideas to life.*

by the maker movement: personal fabrication, physical computing and computer programming.

The technology that has most captured the public's imagination has been the 3D printer. It has also contributed the least to educational practice while the technology improves and the industry developing it matures. The power of 3D printing isn't every seventh-grader making an identical Yoda keychain, but in the fact that for the first time in history kids have access to the Z-Axis—which makes thinking and designing in three dimensions possible. With a 3D printer, you can make the part



you need to solve your problem.

However, making also occurs with wood, cardboard, recycled materials, code and arts-and-craft supplies.

### **Myth: Making is just about STEM**

Although making is an obvious context for bringing STEM to life in schools (especially engineering, which typically is absent from K12 education), it has implications for every discipline.

Making is about developing expertise via authentic experiences. We want kids to be historians, mathematicians, authors, composers and scientists rather than being taught history, math, English,



music or science. A student who builds a telegraph system not only learns aspects of electronics, physics, history and design, but also gains an intimate understanding of the countless ways in which that invention transformed society.

### **Myth: Computer programming isn't a necessary skill**

Making does not require computer programming, but is supercharged by it. Learning to program gives students agency over an increasingly complex and technologically sophisticated world.

It is the new liberal art. It is how you express ideas and control your world. One may create artifacts out of code, but the skills involved are transferable to solve problems in other domains.

### **Myth: Making offers little for academically successful students**

While it is true that making provides an on-ramp to educational success for students who have been thought to

*MAKING SCIENCE  
"A-PEELING"—Some makerspace projects can demonstrate understanding of scientific principles such as electric current and conductivity, as in this exercise where student can make music with various fruits.*



be “good with their hands,” the future requires that schools value learning with one’s head, heart and hands equally.

When the same materials, processes and technologies are found in the art studio, physics lab and auto shop, we can finally stop sorting kids into winners and losers.

Students who have been traditionally successful in school are now at-risk if they graduate without the ability to make the things they need to solve their own problems. The best thing schools can do is prepare students to solve problems that their teachers never anticipated.

### **Myth: Projects should be ‘fridge ready’**

Quality work takes time. Schools need to create more flexibility and time for students to choose projects, change their mind, pursue new paths of inquiry, invent original things and share their accomplishments. This is impossible in one 43-minute period and we should not expect or celebrate the perfect result at the expense of respecting the process.

### **Myth: We know how to assess making**

A colleague from a leading tech company who’s supportive of the maker movement recently told me, “The first thing we need to do is help teachers

learn to assess these new projects.” I entirely disagree.

If I walk into any school and ask a random fourth-grade teacher to show me writing samples indicative of below, on and above grade levels, they can do so with great alacrity. That is because they have read thousands of pieces of student writing and there is a long tradition of doing so.

We have no idea whatsoever what kids can do with Arduino, drones, Scratch programming or Hummingbird robotics kits. The best thing we can do

today is to begin collecting examples of student projects made with these new “maker” materials. It is impossible to create benchmarks without such knowledge and experience. That could result only in sloppy laundry lists of nonsensical standards created by bureaucratic committees.

To the extent that you are absolutely compelled to assess making, measure the skills advocated by the Next Generation Science Standards or those found in your existing curriculum.

### **Myth: You need to rob a bank**

Most of the materials I use with teachers and kids cost less than \$150. An ethos of the maker movement is recycle, repurpose and remix. There is a strong ecological component to making that supports the engineering concepts of affordability and constraint. Most of the robotics, computer science, microcontroller engineering and fabrication projects I recommend will run on a 10-year-old PC. Rather than toss all of those old monitors, keyboards and mice, let kids connect them to a \$5 Raspberry Pi Zero or quad core \$35 Raspberry Pi 3 so they build their own computers for use at home or school.

### **More tablets and Chromebooks will help**

Tablets and Chromebooks are intended for passive consumption and notetaking. Making is about active learning.

The lack of USB ports on many tablets makes controlling the world outside the computer unnecessarily difficult or impossible. This may

*LEARNING TOGETHER—  
Makerspace leaders don't  
have to be experts on a  
subject. In fact, they can  
often be more effective as  
collaborators, learning along  
with students.*



change, but for now, buy (or recycle) conventional computers.

### **Myth: This is a fad**

If this is a fad, then the future viability of schooling is in doubt. We have never had more of the pieces in place to make education reformer John Dewey's ideas of hands-on learning a reality. Some 150,000 people attended the Bay Area Maker Faire; 120,000 typically attend the events in New York, London and Rome. There are hundreds of Mini Maker Faires each year around the world. Millions of people are excited about making.

Schools have an obligation to provide equitable access to these rich experiences.

### **Myth: Teachers are the bottleneck**

Many of the most impressive makers had poor school experiences, and the startup culture know-it-alls behind some of the new technology hold educators in low regard. I often hear that teachers are the creative bottleneck, but find that assertion to be as insulting as it is

untrue. Teachers in our workshops are desperate to have the tools and freedom with which to create and innovate.

"We want kids to be historians, mathematicians, authors, composers and scientists rather than being taught history, math, English, music or science."

One team of educators in our Constructing Modern Knowledge summer institute programmed their own local version of Pokémon Go five days after the actual product was launched. Some create projects of great utility, others of great beauty. Many projects combine style and substance. We cannot believe that children are competent if we behave as if their teachers are incompetent.

Educators must experience what it is like to learn with the new materials available to them and their students.

### **Myth: This is a new phenomenon**

In *Invent to Learn* we take great pains to situate making in a theoretical and historical context to help educators understand that while the materials may have changed, we stand on the shoulders of giants who have taught us how to create productive contexts for learning for centuries.

The maker movement brings us as close to realizing the vision of progressive educators like Dewey, Papert, Malaguzzi, Holt, Kohl and Meier than perhaps even they ever imagined. Getting the most out of making in your schools requires a commitment to those child-centered progressive traditions and a willingness to change everything. **DA**

---

*Veteran teacher educator Gary Stager, Ph.D. is the coauthor of Invent To Learn: Making, Tinkering, and Engineering in the Classroom, CEO of Constructing Modern Knowledge, and a former senior editor of DA. He may be reached at [stager.org](mailto:stager.org) or [constructingmodernknowledge.com](http://constructingmodernknowledge.com)*