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ON MAKING 1:1



Photo: 1st Maker Space

Making STEAM

A Maker Mindset for STEAM education

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Most post-millennial students lack important problem-solving skills. Learning a “maker mindset” through STEAM education can inspire and equip them as a new generation of thinker-makers.

Hands-On Thinking

As an artist and a designer, I love to bring ideas into reality. I do it for a living. I passionately believe in the power of our imagination, and the importance of creative thinking for all. Sometimes, I imagine a product so clearly I can almost touch it. It seems only a thin veil separates it from reality, but it might as well be a million miles away. The hard truth is that even our most impressive solutions are worthless until they are born into, and tested in the physical world.

I’m also an educator, teaching UK and US university art and design courses for over thirty years. I encourage students to think outside the box, explore, experiment, and to exercise their creativity bravely. One 3D Design project I run challenges students to design and build an armchair using glue and two 4’ x 8’ sheets of cardboard. Some are befuddled when chairs they imagine and draw, defy organization in three-dimensional space. They learn that physical reality is very different from imagined reality, and that even drawings can lie to us about three-dimensional space (think optical illusions). In order to successfully complete their chairs, these students must make a paradigm shift.

They have to start *thinking through their hands*. Students make dozens of small paper models and experiment with how cardboard wants to bend. They figure out how much weight the material can bear, and how it can best be joined; then they make scale models. There is much to be discovered. Testing and improving ideas through making is at the heart of this experience. Finally, when new understandings and concept come together, a good chair - sometimes a great chair is born.

My colleagues and I have been alarmed by a trend over the past ten or so years. The percentage of college-age students who can’t think well through their hands has greatly increased. Now, out of twenty students, I would expect fifteen of them to have little experience of hands-on learning. In the nineties, the reverse was true. These days, fewer students grow up play building, using hands and tools to make things, and a huge proportion of their time is engaged at school, (and at home) in screen-related activities. Add to this classroom instruction that emphasizes core learning through rigorous testing, and the results are understandable.

Educators are concerned we are producing a growing number of students who have a deficit in their problem-solving abilities, their experience of, and understanding of relationships between things, and of how things actually work in the world around them.

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“The whole purpose of education is to turn mirrors into windows.” -Sydney J. Harris, journalist and education advocate

Are students today being trained to pass tests, mirroring our expectations, or think for themselves, seeing their future into the world? If we are failing them, what can be done?

Making Magic

A “maker mindset” and STEAM teaching could provide teachers with some of the answers. “Making”, as it is commonly referred to, is a technology-based extension of DIY. This grass-roots movement promotes a hands-on approach to inventing, improving, and tinkering that utilizes technology, such as 3D printing, electronics, and robotics. Importantly, it also intentionally embraces traditional construction techniques such as woodworking, metalworking, and sewing.

To older generations, its philosophy may seem familiar. Many boomers grew up in family homes with a workshop and went to schools that taught carpentry and welding. Indeed, self-sufficiency and a make-and-mend attitude were a way of life all the way up to fifties. But as national prosperity led to more leisure time, crafts once essential to living, became hobbies or disappeared from everyday life. Furthermore, over the last two decades, schools have been dismantling classes like wood shop, and welding. Administrators cite budget cuts and an increased emphasis on core subjects of reading, writing, and mathematics. But not all students are suited for college. Now educators are urgently reconsidering the importance of manual and technical skills, not only to fill a looming gap in the workforce as boomers with carpentry, electrical or plumbing skills are retiring, but also to strengthen “soft” skills, such as leadership and entrepreneurial thinking. For some, makerspaces are the answer because they provide a broad range of high and low-tech equipment all in one space.

“We must try to bring this kind of magic into schools, hard as it may be. I have been focusing on the importance of creating a space where kids have the opportunity to make—a place where some tools, materials, and enough expertise can get them started. These places, called makerspaces, share some aspects of the shop class, home economics class, the art studio, and science labs. In effect, a makerspace is a physical mash-up of different places that allows makers and projects to integrate these different kinds of skills.” -Dale Dougherty, Founder of MAKE: Magazine and Maker Faires

Makerspaces encourage sharing and innovation. they provide fertile environments for developing 21st-century skills such as critical thinking, communication, collaboration, and creativity, and have provided skills useful to STEM education. They will be of even more value to STEAM education.

STEAM Succeeds

The recent nationally adopted educational effort known as STEM training integrates knowledge of engineering, math, and science and applies them to create technologies and solutions for real-world problems. But students engaged in STEM education are not performed as well as expected. Like a lot of good ideas, the first version seems to need tweaking. STEAM education combines aspects of arts thinking with science and math thinking. Researchers have found that by including, rather than excluding, this important way of working, students’ technology and engineering projects are greatly improved. Best of all, this approach, increases participation, solidifies learning, and deepens students’ understanding of the world, and how things in it work. As they brainstorm solutions for an engineering problem, employing their artistic right brain and hands-on learning, their creative and innovative thinking comes alive and the appearance, design, and usefulness of science and technology projects are improved. Performing arts, such as drama and speech help students communicate ideas, and creative writing improves their technical and persuasive descriptions. For more, see my previous article, “STEM vs. STEAM”.

Innovation On Hold

In the leading global innovation index, the US ranks 5th in the world. It has not improved that position for the last 3 years and scored lower in 2014 and 2015 than it did in 2013. Who leads the list? Switzerland by almost six points, followed by the UK, Sweden, and the Netherlands. Hot on the heels of the US, within a one-point spread, are Finland, Singapore, and Ireland.

If we want our 21st-century citizens to be innovators, we need to urgently address how we are asking them to think and be empowered to work, lead, and innovate. Teaching them the way we were taught is not working.

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“Our task is to provide an education for the kind of kids we have... Not the kind of kids we used to have... Or want to have... Or the kids that exist in our dreams” -Mary Kay Utecht, experienced educator, and advocate

Defining The Mindset

Jen Ryan, an education researcher at Harvard, has been studying the maker mindset and how educators, schools, and organizations are learning to cultivate maker empowered youth. She describes how making can empower students to deconstruct and construct their world. To look closely, and think critically about it, and to know what they use and why they use it. She believes if they understand how things work, they will understand why things are designed the way they are, and equipped with that, they will improve the world they live in, affecting positive change by design.

Makerspaces are hotbeds for helping students develop maker mindsets because they bringing together mind and body in fruitful problem solving. In a school setting, craft, invention, and innovation, will have significant roles to play in STEAM and the reformation of education. Here’s a short list of what most maker leaders proponents agree the mindset involves:

Play to learn – play is discovery

Develop skills – you can’t make good stuff without them

Reflect often – make it a habit

Be accountable – presentations, shows, sharing, feedback

Appreciate failure – you can’t learn without it

Look to role models – be inspired by others achievements

The Greatest Challenge

Adding makerspaces to schools is exciting and hopeful. However, as some are finding out, it’s not enough to equip teachers with tools and a space to use them; there’s yet one more essential ingredient. Changing the way students think requires teachers to change the way they teach. And here lies the greatest challenge.

“We can create a workshop or makerspace, and we can acquire tools and materials, but we will not have succeeded at creating innovative thinkers and doers unless we are able to foster a maker mindset.” -Dale Dougherty, Founder of MAKE: Magazine and Maker Faires

Making It Happen

It’s not that teachers don’t want to change. I’ve met plenty of teachers in public and charter schools who are willing to foster a maker mindset But it’s not going to be easy because they are required to continue standardized testing practices at the same time as incorporating these new teaching methods. To many, despite how much they want to help, this is a tall order. Without help from inside and outside school walls, teachers will be limited in what they can achieve. On the other hand, with the help and partnership of the broader community, especially businesses that these young adults may one day serve, anything is possible.

“We are approaching a new age of synthesis. Knowledge cannot be merely a degree or a skill... it demands a broader vision, capabilities in critical thinking and logical deduction without which we cannot have constructive progress.” -Li Ka Shing, Business magnate, and philanthropist

Makerspaces and the mindset they encourage, combined with STEAM educational initiatives can inspire and equip a new generation of thinker-makers. As they synthesize advances in digital technology, hands-on understanding, and the limitless ingenuity of the human mind, they will empower students to find new solutions to old problems, and to lead us into a world of possibilities we are yet to imagine.

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Jen Ryan

<http://tedxtalks.ted.com/video/The-Maker-Mind-Jen-Ryan-at-TEDx;search%3Ajenryan>

Global Innovation Index

<https://www.globalinnovationindex.org/analysis-indicator>

Directed vs. Self-Directed: Developing The Maker Mindset

<http://www.maggiehosmcgrane.com/2013/05/directed-v-self-directed-developing.html>

Dale Dougherty – The Maker Mindset

<https://llk.media.mit.edu/courses/readings/maker-mindset.pdf>