The Maker Movement

"Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other."

—Paulo Freire

To define a school makerspace by its purpose in the simplest of terms, it is a place where young people have an opportunity to explore their own interests; learn to use tools and materials, both physical and virtual; and develop creative projects. It should be envisaged and implemented as a concept that can adapt to a wide variety of uses, shaped not only by educational purposes defined by teachers or the school or the wider curriculum but also by students' own creative goals and interests. With a real potential to revolutionize education, we have begun to see makerspaces popping up all across the country.

The Chattanooga Public Library in Tennessee created a 14,000 sq. ft. space covering the whole of their 4th floor that is part-public-laboratory-part-edu-space. The Westport Library, in Westport, Connecticut, has a makerspace which serves very well as a model to be emulated and learned from in this new wave of library services. The space includes a 3-D printer and hosts presentations and participatory workshops on topics ranging from robotics to arts and crafts. At the Fayetteville Free Library in New York, they have not one but three makerspaces:

- Creation lab—focusing on digital creation
- Fab lab—focusing on the fabrication of tangible objects
- Little makers—offering a free play area that encourages children to create, imagine, and build.

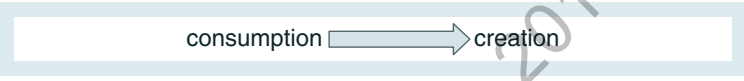
At the Allen County Public Library in Fort Wayne, Indiana, they set up a makerspace that they call a Tekventure Maker Station, which is actually in a trailer outside the library. It houses a number of hand, power, and electronic tools for school use but also for the use of the community beyond the school.

All of these fine examples of the Maker Movement, and there are countless others across the country that deserve a mention too, are rooted in the idea of a "Participatory Culture," a term coined by American media scholar Henry Jenkins (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006). Jenkins recognizes the key elements of a participatory culture to include low barriers to expression and engagement, strong support for creating and sharing one's creations with others, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices. That core idea of sharing one's creations is also reminiscent of something that Ivan Illich (1973) wrote in *Tools for Conviviality*:

> Tools are intrinsic to social relationships. An individual relates himself in action to his society through the use of tools that he actively masters or by which he is passively acted on. To the degree that he masters his tools, he can invest the world with his meaning. (p. 34)

Illich encouraged the use of what he termed "convivial tools," namely those that offer each of us opportunities to enrich our environment with the fruits of our own vision. Such tools are quite different from the passive tools that render us as "consumers" of their output, as recipients of meaning determined by others, and that deny us the power to use our own creativity to construct our own meaning in life.

Fundamentally, therefore, the Maker Movement is about moving from consumption to creation and turning knowledge into action. In pedagogical terms, it is firmly located within the broadly constructivist philosophies of education.



While the idea of making is certainly not new, today's makerspaces are rooted firmly in the 21st century in the here and now. They are of their time! They are a mash-up of differentiated learning experiences combining traditional elements supported by new technologies. The maker approach to learning is highly learner-driven and recognizes that while immediate and teacher-defined learning certainly does occur most of the time, it should not be the primary objective. One of the overriding themes in maker education is individuality. For the student to be given productive opportunities to shape his or her environment through making is a critical element in helping each of them to define his or her individuality within a social and sharing context. Their individuality within such an environment comes out of the solutions that students create and from the self-confidence and self-awareness that come from the process of designing, making, and sharing.

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In my opinion, maker education is an organic movement that has gained particular traction in the United States since the adoption

and implementation of the Common Core State Standards. It has been the great equalizer within, and in some ways against, our modern education system by allowing opportunities for informal learning to take place. Most learning in the makerspace happens casually, and even most intentional learning that happens there is not the result of programmed instruction (Illich, 1973). The effective use of educational makerspaces forms the basis for a paradigm shift in education that in many ways is a throwback to earlier educational systems that included programs like industrial arts and craftsmanship, but with a very modern twist, namely a renewed emphasis on informal learning. Our education system, I feel, has to recognize that informal learning should by no means be perceived any longer as irrelevant or in any way secondary to formal learning. As Frank Coffield (2000), professor of education at the Institute of Education in London, has written:

> Informal learning is not an inferior form of learning whose main purpose is to act as the precursor of the main business of formal learning. It is fundamental, necessary and valuable in its own right.

Quite elusive by nature and difficult to pin down, we should be nonetheless clear that informal learning opportunities for our students can inspire innovation and increase student performance in formal educational settings. As Eric Schmidt, the ex-CEO of Google, says, virtually everything new seems to come from the 20 percent of their time they give to their engineers to spend on side projects (The 70 Percent Solution, 2005).

In most people's minds, the Maker Movement in education is associated most often with STEM-related concepts and technology-based activities. There is good reason for that. However, my entry point into the makerspace movement came from a different route altogether, and it is important to recognize that there are many equally valid routes into the movement. I came to it primarily through the unusual route of literacy.

For years, in my library, I had often allowed opportunities for my students to play and tinker with their reading and writing.

A favorite of mine that I have used in this way is the digital story *Inanimate Alice*, written by Kate Pullinger and produced by Ian Harper (2005). This "born-digital" story has an "open text" construction and deliberately allows opportunities for student co-creation. My students enjoyed creating their own next episodes in the series by crafting their own narratives, using various tools and resources, both print and digital, or even remixing the *Inanimate Alice* assets to tell an original story. Another story I used to move my students through the continuum of creating, but with literacy as the inspiration, was *Skeleton Creek,* written by Patrick Carman (2009). This hybrid text is told half in print and half in video. Similar to *Inanimate Alice*, at the heart it tells stories across multiple media platforms. This transmedia story helped to move my students from consumption to creation and sparked a mash-up of differentiated learning experiences. Students designed multimedia reading experiences that fused story with video, games, and puzzles. Those early experiences were my first attempts at "making" in my library even though they were seemingly far removed from the usual conception of making with tools in the physical realm.

After years of experiences in playing with story in informal ways, I decided to take all these concepts and formalize them into a makerspace learning experience at a Mozilla Maker Party—one of hundreds of events around the world where people become active makers of the world around them. At the event, kids had the opportunity to create online comics, design video games, make stop-motion animation, and many other activities designed to unlock their creative potential. It was after this event that I decided to designate an area in my library as my makerspace. A string of highly imaginative literary experiences had led up to this and had therefore set the stage for creativity and making.

The Maker Movement encourages a growth mindset, which tolerates risk and failure and maybe even encourages it. It is a truism that is nonetheless rarely acknowledged in formal education that failure is a necessary step on the road to success and innovation. In the words of developmental psychologist and philosopher Jean Piaget, "When you teach a child something you take away forever

his chance of discovering it for himself." Learning through mistakes is very much encouraged. This seemingly novel but in fact long-cherished approach to solving problems encourages our learners to try things they are interested in or to develop unknown capabilities. Steve Jobs taught us all that making mistakes and even failing can sometimes end up being the best things that ever happen to you.

The Maker Movement embraces the power of collaboration. The collaborative environment of a makerspace allows an individual to embrace and even seek out challenges beyond his or her comfort zone. Together, students can collectively engage in shared learning experiences. Students today are already aware that learning extends beyond the four walls of a school and they are part of a global educational community. This knowledge feeds directly into the networked learning that the Maker Movement allows for. Proponents argue that the networked aspect is a key distinction between this and earlier construction-centered affinity groups, such as a local woodwork or sewing club. Today's equivalent, the makerspace, offers far wider spheres of communication and enables a critical mass of learning to be achieved globally rather than necessarily locally (Sharples et al., 2013). Again, this speaks to and in creating a participatory culture where members feel some degree of social connection with one another (Jenkins et al., 2006).

This new and exciting Maker Movement is one that all educators need to embrace. In a recent piece written by Sylvia Libow Martinez and Gary Stager (2013), they pointed out what lessons educators need to embrace in light of this movement. They include the following:

- "Doing" is what matters
- Openness
- Give it a go
- Iterative design
- Aesthetics matter
- Mentoring defies ageism

- Learning is intensely personal
- It IS about the technology
- Ownership

By nature, the idea of making is playful. Tinkering is a uniquely human activity, combining social and creative forces that encompass play and learning (Kolk, 2011). At the high school level in particular, we tend to lose that playful spirit that we all know so well gets kids so engaged in whatever they are doing. I have seen firsthand in my library how receptive students are to having time for play as a part of their school day. If play is what you do outside school, then that is where the real learning will take place and that's where innovation and creativity will be found (Hlubinka et al., 2013). Dr. Stuart Brown has called this "neoteny," defined as the retention of immature juvenile qualities into adulthood and most assuredly an orientation that is a critical component of innovative thinking and real creativity in young people and adults. We need to find ways to bring that same spirit into school and to keep it there. The makerspace can help in that objective.

Research shows that play builds social-emotional competence in many domains: language skills, social skills, empathy, imagination, self-control, persistence, and higher-order thinking. Many argue that our focus on academic achievement has been at the expense of valuable play-based programs. The Maker Movement may be a way of bringing play back into the picture (Jackson, 2014).