

Title: Makerspaces in the school library learning commons and the uTEC maker model

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Contents

1. [WHAT IS A MAKERSPACE?](#)
2. [WHAT IS A MAKER?](#)
3. [TRADITIONAL MAKING IN THE SCHOOL LIBRARY](#)
4. [THE UTEC MAKER MODEL](#)
5. [FORMAL AND INFORMAL EDUCATION](#)
6. [THE DEVELOPMENT OF MAKERSPACES IN THE SCHOOL LIBRARY LEARNING COMMONS](#)
7. [CHALLENGES AND OPPORTUNITIES](#)

WHAT WORKS

When news in 2012 of the major new space for teens at the Chicago Public Library caused a sensation, and the ALA webinar series on Makerspaces had a thousand attendees, we all knew that this was an exciting new frontier in librarianship, a new step in the evolution of libraries. Now, in 2013, the interest continues and is expanding to universities and school libraries. This article considers the foundational ideas of Makerspaces but, even more importantly, a model of the principles of what the development of a Maker looks and acts like that we call the uTEC (Using, Tinkering, Experimenting, and Creating) Maker Model.

[WHAT IS A MAKERSPACE?](#)

For a project we were doing as a trio of authors, representing various fields of librarianship (academic, public, and school), we developed the definition of a Makerspace as follows: A Makerspace is an evolutionary step in library facilities' design and programming. It is a destination for thinking, learning, doing, creating, producing, and sharing; a space that takes advantage of multiple learning styles. It is a place to reinvent old ideas with new conceptual frameworks, utilize advancements in thinking and doing, and investigate and construct a hybrid of fine arts, sciences, crafts, industrial technologies, foods, inventions, textiles, hobbies, service learning, digital media, upcycling, STEM/ STEAM, and DIY (do it yourself) and DIT (do it together) concepts. In this space, which can be physical and/or virtual, the intersection of formal and informal learning can include designing, playing, tinkering, collaborating, inquiring, mentoring, experimenting, problem solving, and inventing. Through actively engaging in the Makerspace, patrons take command of their own learning, with the potential for demonstrating entrepreneurial behavior. Through the development of a Makerspace, the library can expand and extend connections to community and learning organizations, businesses, families, and mentors throughout the world. These connections can provide teachers, partnerships, sponsors, donors, and volunteers. Every library Makerspace is unique and always in transition. A Makerspace has the potential to transform a patron from a consumer to a creator.

[WHAT IS A MAKER?](#)

Considering the idea of a Makerspace, the person who is creative and constructive either as an individual or as a group in- or outside of a Makerspace can be included in the definition of a

Maker. Consider young people whose passion for something leads them toward the invention or creation of something unique. They seem to be developing dispositions that prod their own efforts to think outside of the box and make or create. They can be old or young, rich or poor, or in any cultural environment. They are the common folk with an uncommon epiphany. They are the crazies, the idea folks--those who are unhappy with a current way of doing something and decide to invent their own approach to a problem. They take matters into their own hands. Their ideas may be considered radical, or they may be typed as dreamers and sometimes "problems" for not conforming. Perhaps you remember the early advertising slogan at Apple, their Think Different Campaign, as follows:

Here's to the crazy ones. The misfits. The rebels. The trouble makers. The round pegs in the square holes. The ones who see things differently. They're not fond of rules, and they have no respect for the status quo. You can quote them, disagree with them, glorify, or vilify them. But the only thing you can't do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think they can change the world are the ones who do.

TRADITIONAL MAKING IN THE SCHOOL LIBRARY

When encountering the idea of Makers and Makerspaces, it might be easy to assume that for some, the Making has been going on in school libraries ever since their creation. Perhaps your library exhibited the creations of children or teens; perhaps students created posters or models or dioramas of something they were studying. Perhaps they were creating video presentations or writing major research papers as products for assignments. Perhaps there was a community event to showcase student research projects. So Making has always been a part of any vibrant library program; it is just now blossoming into a major movement utilizing much more technology, tools, and advanced resources in a variety of ways unlike ever before. It is a more focused, dedicated, and intentional effort blending creativity, inquiry, and kinesthetics.

Sometimes Making happens in other parts of the school under other creative classroom teachers or departments. Perhaps it is being started at the public library, or maybe a project workroom in a local museum, or somewhere in a group workshop in the community, but it is there if you look for it and extend your recognition of who, what, why, and how it is happening. It is moving up Bloom's Taxonomy to the highest level. This has been our experience as we have discovered the rising interest and studied the movement. After attending a Maker Faire in New York City recently, we sat down and designed a model and a QuickMOOC that might help others interested in the Maker movement get started. Here is the result.

THE UTEC MAKER MODEL

The uTEC Maker Model visualizes the developmental stages of creativity from individuals and groups as they develop from passively using a system or process to the ultimate phase of creativity and invention. As illustrated in the model below, there are four levels of expertise. (You can see an enlarged original at <http://tinyurl.com/mf8w3lv>.)

A Makerspace participant begins at the Using level. A User enjoys engaging in an activity to sample something new. Here individuals or groups use a tool, device, or program in the way--and for the purpose--the inventor intended. The User follows through an experience, re-creating something others have already created. Examples include learning how to, then playing the computer game, playing the musical score, or using a software program pretty much

the way it was designed to be used. It is following the step-by-step instructions already developed by another to create a foodcraft, DIY, fine art, or fashion. We recognize high levels of skill and perhaps even addictive behaviors on the part of these consumers, but they are still just at the consuming level. Teens might be completely absorbed and totally obsessed for endless hours by the levels of play in World of Warcraft. A pianist may practice hundreds of hours trying to master a Liszt concerto. A student knows every trick in the manual for producing an acceptable term paper using Microsoft Word. In each of these cases, the User makes little attempt to alter the game, the score, or the software but may become very skilled and adept with a particular or variety of tools and resources.

At the Tinkering level, the user begins to fiddle with or retry things that the original creator did not intend or build into the invention or instructional pattern. The Tinkerer is at the formative stages of questioning the how and why and has gained enough confidence through his Using-level experiences to begin making personal changes to others' creations. The gamer learns to trick the game into performing different results. This might require altering some code just to see what happens. The decorator might modify the decorations intended on the cupcakes. Often, the User is bored with the usual procedures or results and so fiddles around to produce a different result. Our musician plays with the composer's original score, making his own changes to the arrangement. And our report writer tricks Word into doing something unusual.

At the Experimenting level, the individual or group begins to seriously abandon what has been created by others, working beyond curiosity and fiddling to a purposeful design of something new. The Experimenter begins to contribute to a topic's knowledge base. We recognize that a passion for a goal is beginning to emerge, and as the ideas begin to flow, trial and error are enacted as hour after hour slips by unnoticed. Hard work and dedication to a project take over—it is the transition stage to the next level. The Experimenter learns from failures as well as successes. He modifies to test pre-existing theories, sometimes repurposing what is known about the world into new understandings. Our gamer, convinced that a new and better game can replace past experiences, starts to learn the skills necessary to program a new experience. He envisions an app that plays as a better game than World of Warcraft. Our musician, tired of performing the works of others, takes the knowledge of musical theory and begins serious work on composition: I like this idea; not that. Does this work? What if ...? No, not right yet. Tired of Word, our person decides that there has to be a better experience of document creation: What if? Suppose that ... Can we design this? Here we find experimenters keeping notebooks and Google Docs of newly forming ideas blended with what has been tried already, by themselves and others. It all becomes not only a passion but also an organized process of experiences and experimentation.

At the top, or Creating level, success, independent thinking, and action occur. There is a result. It is unique, perhaps innovative. There is a novel product or design, something to share, perhaps publish or market. The Creator makes a difference in the world with his inventive actions. We begin to think about impact, benefit, entrepreneurial possibilities, and, in the world of perpetual beta: Can I create an even better version? As Einstein said, this is the level where "imagination is more important than knowledge." Our gamer is now beyond the prototype and into production; our musician is publishing a new work and encouraging others to perform it.

And, with this new style, he is off to his composition career. For our software developer, what avenues will he choose for dissemination? Open source? Commercial sales? And will he do versions or constant improvements as other commercial companies do?

Those watching this entire process happen begin to recognize that a series of dispositions is developing. We have, in the model, recognized many under the topics of roles, actions, and strategies. But it is important to recognize that the growth of creative thinking and independence is difficult to thoroughly define in a manner that fits all because we are unique, our learning paths distinct, and success for the individual varies greatly. We realize that our lists are not exhaustive, and so we encourage users of the model to create other dispositions worthy of attention.

Readers of Malcolm Gladwell's book *David and Goliath* will track through those stories of people who rise above great challenges and find success. Perhaps we can staircase all the dispositions into three levels that seem to be exhibited in the current networked and flat world.

Personal Expertise. At each level of the model, individuals are developing skills and dispositions that contribute to success. It is a never-ending development of what they know, can do, and can contribute.

Cooperative Group Work: When working together on a project or task, individual contributions have to be significant and actually aid the success of the whole. Each person's thoughts, opinions, and findings are valued by the group. Each individual provides a noteworthy addition to the outcome.

Collaborative Intelligence. Often a specific goal is general in nature and develops as a group tackles an idea. The invention of a new tablet or iPad is a series of ideas, testing, and collaborative work, and what emerges is greater than the sum of the minds that created it.

In all this, there is one cautionary idea, and that is the assumption that age has something to do with the various levels of the model. One merely has to attend a large Maker Faire to understand that children, teens, college students, graduate students, true entrepreneurs, corporations, and everyday individuals of all ages can and are Makers. A few examples might illustrate our point:

"If Students Designed Their Own Schools," Youtube (<http://tinyurl.com/c5389ke>). Here teens actually create their own curriculum and learn various skills as they solve their unique essential questions.

"My Invention That Made Peace with the Lions," TED talk by Richard Turer (<http://tinyurl.com/mqvhvmf>). Turer is a thirteen-year-old Maasai boy who developed an invention to help his family and others deal with the threat of lions, and he speaks here at a TED conference. Inspiring!

"Sugata Mitra Builds a School in the Cloud," TED Talk (<http://tinyurl.com/cl7wvd7>). Mitra begins by discussing the current school system and how it is not really preparing kids for their future anymore. What will their future look like? He shows how giving students time and a compelling question can engage them enough to learn on their own. His environment online sounds a bit like the virtual learning commons and knowledge building center in its collaboration component; he also talks about something like a personal learning environment, but he calls it SOLE (Self Organized Learning Environments).

Association of Science, Technology & Innovation (<http://tinyurl.com/m7brzlg>). Consider the phenomenal entries they received for their Young Inventors Challenge. The 2013 theme was "Green Inventions: Ideas on Sustainability". Their YouTube channel showcases young minds accepting the challenge to develop a "new composition, device, or process." Their solutions range from an automated waste sorter, portable air filter, smart pillow, and many more fascinating innovations.

FORMAL AND INFORMAL EDUCATION

As teachers and teacher librarians, if we use the uTEC Maker Model as a framework for thinking and internalize the various levels, we will start recognizing it as we work with children and teens. Recognition is the first element. We recall the story of a colleague whose first-grade child had created an elaborate community on Minecraft for his class project. When he showed it to his teacher, she immediately told him that it would not count since "we don't do computer games" in our class. This was a child well into the Tinkering Level, but the teacher did not recognize the amount of time, creativity, skill, and play that had gone into that project. Whether we understand the technology or fear it, whether we know anything about the content of a passion-driven idea a young person is working on, we all need to investigate the idea a bit before automatically condemning it as a nonstarter. It has been said that children come to school with the excitement of creativity built in, but it tends to get squashed the longer they remain in K-12 education. For adults, the question immediately becomes, "How do I encourage and support creativity in a standards-driven testing environment that does not reward creativity?" If we use rubrics to judge the progress of a learner, and that rubric does not allow for creativity, originality, or even total innovation, am I treating one child differently than another? The product or behavior might well not meet that original rubric. We suggest that an alternative route of recognition always be built into assignments, projects, or inquiry. Consider the effects of the 80/20 rule of Google as it could be applied to schooling. It is reported that Google requires every employee to spend 80 percent of their work hours doing their job on whatever task they have been assigned. But 20 percent of the workweek should be devoted to doing, creating, thinking, making, learning, or hatching new ideas that might be of value in the overall mission of the company. Perhaps this is the central reason to have a Makerspace in the library learning commons: it is the place where young people can excel at being independent, learning autonomously, and doing unofficial and unassigned learning.

The logical next step is to ask how being a Maker, a creator, a builder, an inventor, or a dreamer can be the foundational element of education. Certainly in the last few years we have seen the rise of a movement against the current top-down, test-driven educational model, and whether the move toward Common Core standards alters that idea will depend on its implementation in a particular school. But whether creativity is being encouraged formally or not, the library learning commons can be a place where the crazy ideas are not only developed and created but also rewarded and recognized. This can be done not only in physical space via exhibits and displays but also in the virtual learning commons, where both individual creativity and Making can be developed, shared, and rewarded. Teacher librarians can support and challenge individuals and groups to participate in national and international contests and challenges; they can hold contests to build Minecraft structures and reward creativity in digital storytelling; robots can be displayed and demonstrated; unique art can be exhibited. It is not just the star basketball

player who gets recognition-it is the sophomore who creates a \$1,500 centrifuge that does as well as a \$15,000 model. It is recognizing the team who invents a new system for controlling bullying in the school.

THE DEVELOPMENT OF MAKERSPACES IN THE SCHOOL LIBRARY LEARNING COMMONS

In an attempt to promote the idea of Makers and creativity in the library learning commons, we have created a couple of resources that might expand on the idea and provide assistance in getting started.

The first is a new book, *School Library Makerspaces* (Libraries Unlimited, 2013) by school librarian and former Indiana teacher of the year finalist Leslie Preddy. This book provides a foundational understanding and overview of the school library Makerspace. It describes what it is, how to get one started, and programming ideas. Included is a framework for developing a Makerspace customized to the school library's community and patron interests and needs. The librarian Makerspace coordinator learns about facility, finances, connecting to learning standards, safety, mentors, communication, guiding instruction, programming, equipment, supplies, digital badges, and safety. Also included are robust lists of supporting resources: books, magazines, blogs, websites, and videos. Projects focus on the community, DIY and DIT movement, foodcrafting, fashion and e-textiles fine arts, hobbies and crafts modernized, STEM, teamwork, repurposing books and periodicals, and upcycling. Invaluable annotated lists of Maker communities, resources, local events, contests, activity ideas, and inspiration resources are included.

The second is an online professional development experience you can take either as an individual or with a group. It is available in a participatory format, a QuickMOOC titled "Makerspaces in Schools and Libraries: An Introduction," collaboratively developed by Bill Derry, David V. Loertscher, and Leslie Preddy. This and other QuickMOOCs cost a whopping \$10 and are communities where learners design their own pathway and stay as long as they want to participate and contribute. You can purchase your entrance at <http://lmcsources.com>. More information about other QuickMOOCs can be found at <http://quickmooc.com>.

CHALLENGES AND OPPORTUNITIES

Much progress has been made over the years through creativity and innovation in the United States and other nations. We are the developers of Facebook, iPhones, iPads, airliners, medical treatments, Twitter, and other amazing technologies that deal with huge problems and make life more pleasant and productive. Now that the world is flattening, a new race is on to remain in the forefront of invention, innovation, and problem solving. Makerspaces seem to be popular because they bring out the best in all of us-evidence that we can all contribute. We can contribute to a better world and grow through the creative genius associated with problem solving.

Teacher librarians are claiming a role in this effort, as are public libraries and other community organizations. It could be a fad, but it is unlikely to fade when so many find such exhilaration in the act of thinking, making, creating, and building. At the present time, teacher librarians can embrace the opportunities provided in this informal learning environment by creating space and tools for it and encouraging this idea, whether it is embedded in the curriculum or intellectual enrichment.

When parent night comes around, when Maker Faires happen, when challenges to education continue to emerge, we urge teacher librarians everywhere to add this dimension to their library learning commons design. We think the result will give a major boost to the best of teaching and learning happening in the school. It need not cost a great deal of money, but it can, depending on the vision of the library Makerspace. It may be difficult at first, but you will find Makers-hobbyists, craftsmen, artists, and inventors-everywhere who will help. Let the results and the enthusiasm and the recognition of what Makers do and produce guide you as you recognize and reward the various levels of the uTEC model in your school.

uTEC Maker Model

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Bill Derry is the Assistant Director for Innovation and User Experience at the Wesport (CT) Public Library. He and his library have become leaders in the Makerspace movement in libraries.

A Makerspace is an evolutionary step in library facilities' design and programming. It is a destination for thinking, learning, doing, creating, producing, and sharing; a space that takes advantage of multiple learning styles. It is a place to reinvent old ideas with new conceptual frameworks, utilize advancements in thinking and doing, and investigate and construct a hybrid of fine arts, sciences, crafts, industrial technologies, foods, inventions, textiles, hobbies, service learning, digital media, upcycling, STEM/ STEAM, and DIY (do it yourself) and DIT (do it together) concepts. In this space, which can be physical and/or virtual, the intersection of formal and informal learning can include designing, playing, tinkering, collaborating, inquiring, mentoring, experimenting, problem solving, and inventing.