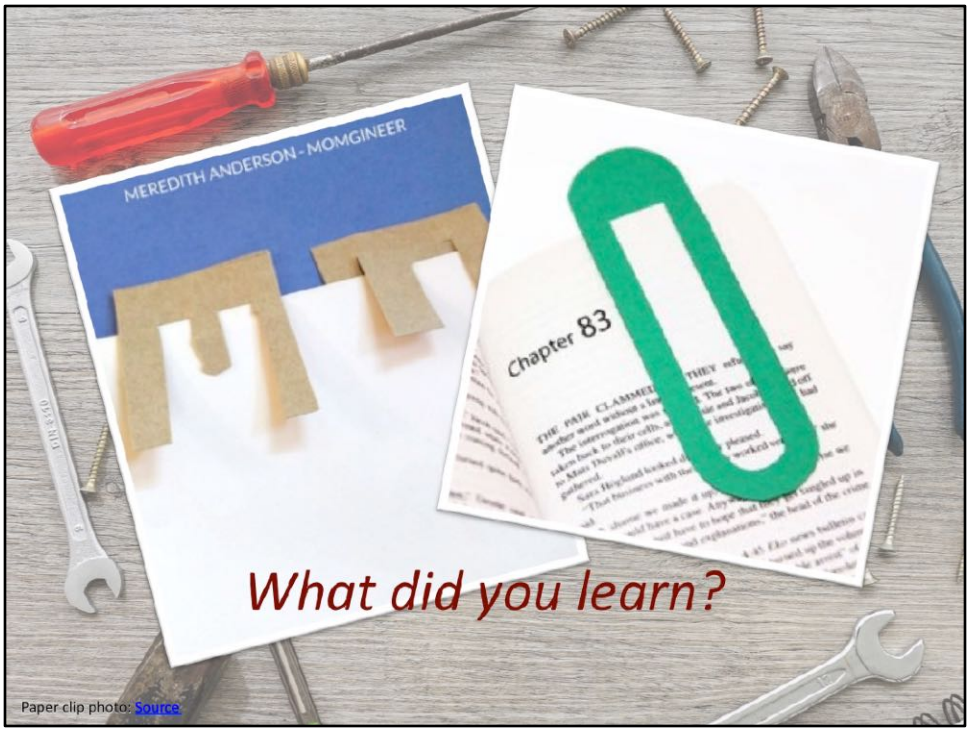
Hello everyone! Before we begin, I'd like you to take a piece of card and a pair of scissors from the table in front of you [these items will be placed on staff tables in advance]. I would like you to use these resources to design an eco-friendly paper clip. You have 1 minute to make your clip. Ready? Go!



So, what do your paperclips look like? What lessons have you learned from this exercise? Is your design strong? How many pieces of paper does your clip hold? Would you use different materials next time or different tools? Think of everything you learned in only one minute!

It's easy to conflate the term "technology" with the digital tools that are fully ingrained in our day-to-day lives, but the term is hardly a new one. The word itself has been around since the 17th century!

Technology is more than smart phones, self-driving cars and Internet hacking. It is "The application of scientific knowledge for practical purposes..." - https://en.oxforddictionaries.com/definition/technology

The innovations we take for granted today would not exist if humans hadn't built upon the knowledge gained by scientific experimentation, trial-and-error muddling, and good old-fashioned tinkering.

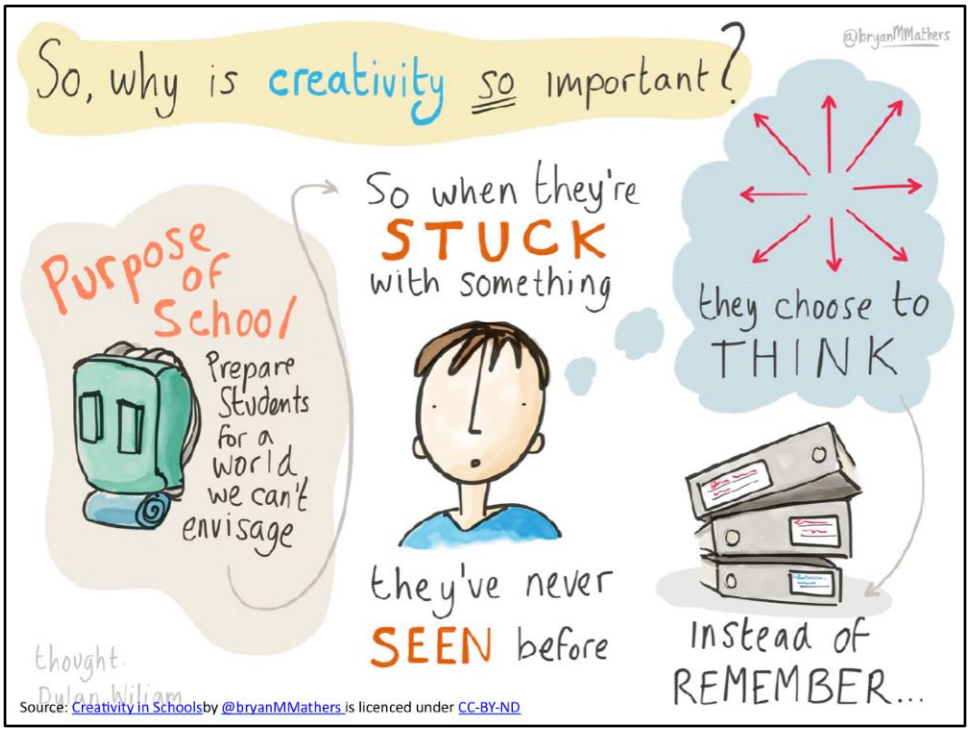
From First Nation and Indigenous peoples refining canoe designs,

to Leonardo Da Vinci fiddling in his workshop,

to that vinegar and baking soda volcano you made for your school's science fair, the urge to create and to innovate has always been with us.

Makerspaces are very much workshops. In essence, they are a place for the kind of experimentation – of tinkering – that leads to knowledge and hence to creativity and invention, whether that means 3D printing, or making a new kind of eco-friendly paper clip from a cereal box.

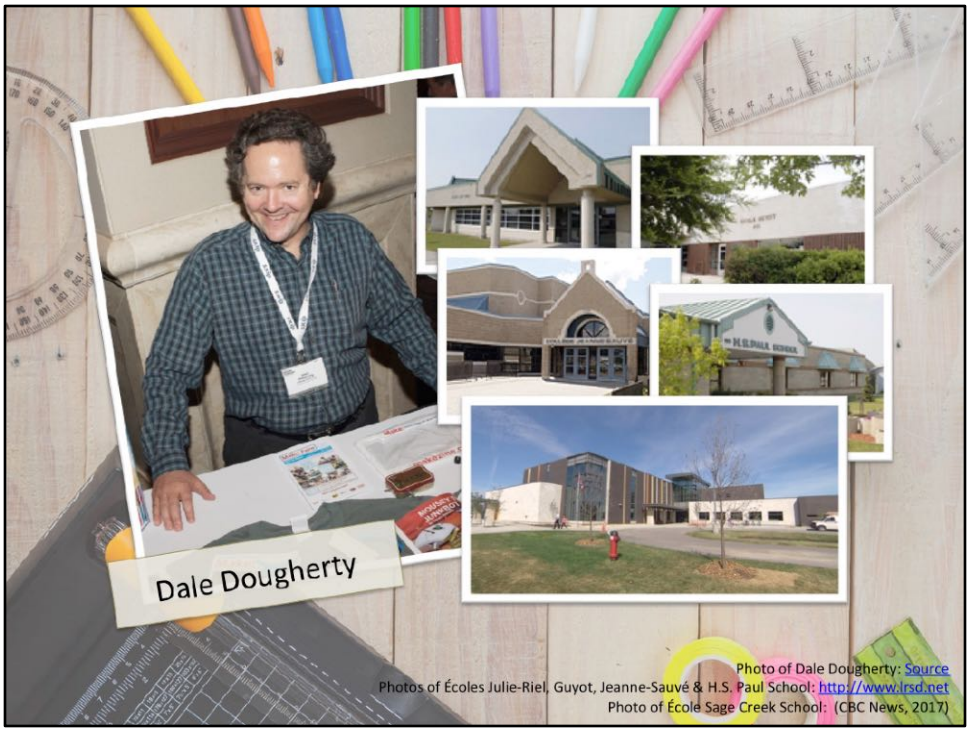
Makerspaces are about providing tools and materials to encourage a maker mind-set focused on creativity. (Graves et al., 2017)



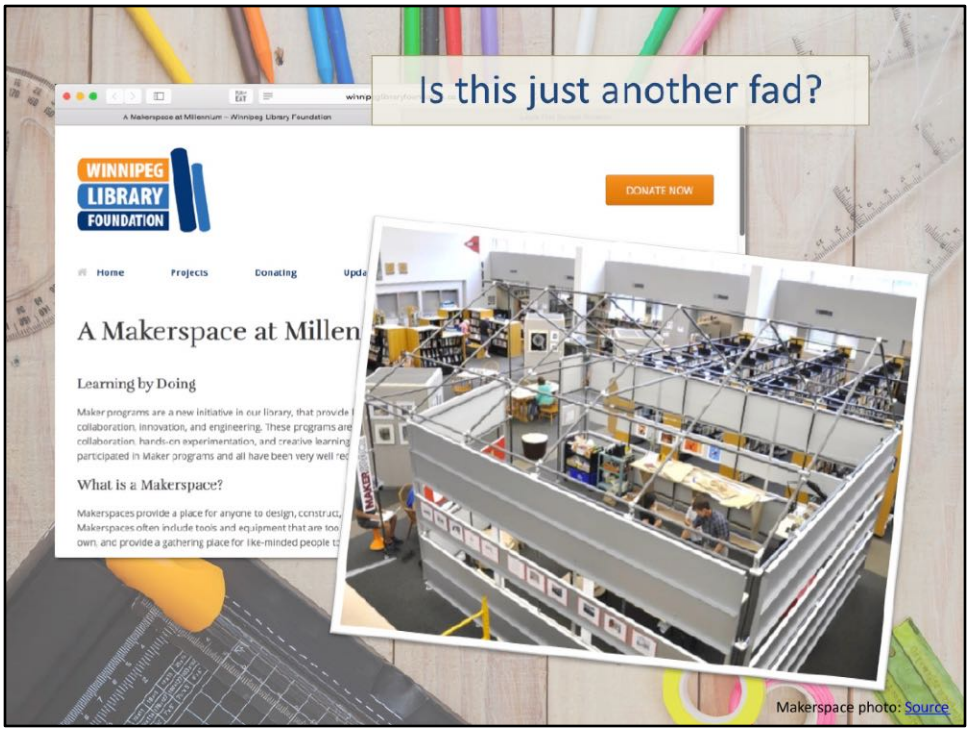
"These spaces encourage students to develop a growth mindset through hands-on project-based learning." (Hsu, 2) The Makerspace is as much about the process as it is about the outcome.

The modern Maker movement dates from the launch of Make Magazine in 2005 by Dale Dougherty, co-founder of O'Reilly Media. One year later, he held the first Maker Faire in San Mateo, California. Since then, the movement has quickly spread worldwide to include fabrication laboratories (or "Fab Labs"), mobile Makerspaces, and an increasing number of initiatives to bring Makerspaces to schools.

Schools in the Louis-Riel School Division that have already implemented Makerspaces include École Julie-Riel, École Guyot, Collège Jeanne-Sauvé and H.S. Paul School.



École Sage Creek School was even designed and built to include a dedicated Makerspace area. (CBC News, 2017) The Maker movement is here and it is growing!



The term may be new, but the principles behind the Maker movement have been with us for some time. Those of us who are of a certain age remember rockets and silk-screening tee-shirts in “shop” classes. We spent our evenings preparing cardboard presentation boards for science fairs. We took apart motors in our spare time or altered clothing to make it more fashionable. Humans have always designed, innovated and created. Makerspaces honour these traditions while integrating 21st century technology. “Making” is just a new term for a timeless concept.

Makerspaces are 1) Student-centred and directed; 2) Playful areas where failure is always an option – a welcome one at that; 3) All about collaborating and sharing knowledge and skills; 4) Physically-sited and as accessible as possible, and; 5) Well-stocked with interesting materials, tools and components
(adapted from Oliver[1], 2016, 161)

A Makerspace is not necessarily gadget or tool driven. 3D printers, lathes and robotics are nice, but hardly essential to a successful Makerspace. Students may create with wire, glue and wood, or with words, fabric, and paint. At the same time, students don't need to build physical assets, either. Computer or tablet-based applications also present avenues for creativity and problem-solving. Students could build a game in Scratch, of code their own web page with HTML, for example.

What could our Makerspace look like? It will look however we – meaning students and educators – decide it should look!

It could be in a dedicated space or room: (It's a section of the library in this example)

Or it could be in a corner of your classroom: (Remember: our division's Surplus Furniture department is your friend!)

Or it could even be housed in a mobile cart: (Did anyone else notice the sewing machines?)

Aside from the 3D printer, there's nothing very exotic in this list that isn't already in our school's inventory. Also remember that a Makerspace can include computers, but it doesn't have to. The goal of a Makerspace is to get students creating, designing, refining and learning with the tools and the resources they have at hand.

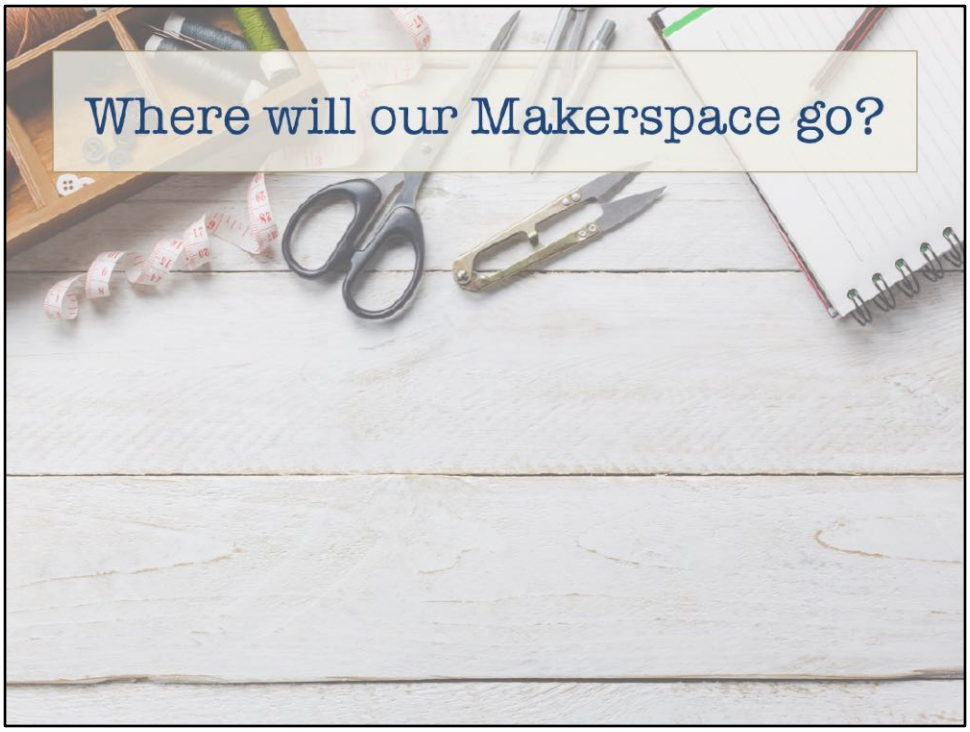
First, we need to go hunting through our classroom cupboards and closets. After that, students' and staff members' families are a great source of materials. Some family members may work in industries that produce waste products (such as cardboard, packaging, wire, etc.) that could be integrated in the Makerspace. Donation drives could be held a couple of times a year (September and January).

Neighbouring businesses could also be an excellent asset, as we could take packaging waste off their hands or even broken or defective stock to disassemble. Consumables such as cardboard are particularly popular in Makerspaces, so having a variety of sources will be necessary to keeping the space stocked.

Disassembling already broken toys and gadgets is a great way of introducing the otherwise hidden aspects of engineering to students.

An emphasis on recycling pieces we don’t need will be essential. In fact, disassembling so that materials can be properly recycled would be the rule!

Items with moving parts, lights and switches are best. Some devices cannot be accepted due to safety concerns and we would communicate this to our donors.



As mentioned previously, we have a number of options:

We could have a permanent Makerspace cabinet in the library.

Maybe we could have one or more Makerspace carts spread throughout the school.

Or perhaps we could create Makerspace areas in as many classrooms as possible, based on demand from teachers and students. Large resources (cardboard sheets), special or valuable parts, and stocks of consumables would be kept in our art closet.

Our Makerspace should feature the following hand tools and supplies. As you can see, it's possible to buy new tools, if necessary, for a reasonable price. Other items we could consider adding if a need were identified would include drills, saws, and sewing machines.

We'll also need furniture to house the resources and tools for our Makerspace. The first step will be to check the school for unused furniture. The next step will be to check our divisional "surplus furniture" website. The site often features unused desks, filing cabinets and even the occasional bookcase.

If we can't get used furniture, we may have to purchase or build carts. Educational supply carts are crazy-expensive and not an option in our case. IKEA stocks cabinets and carts that meet divisional fire codes and that could be easily hacked to suit our needs.

While some items can be purchased in bulk and at a discount through the school's procurement system, the money needs to come from somewhere.

The parent committee used to offer $100 to every teacher for school supplies. The fund still exists and is applied at the discretion of the parent committee. These funds would add up to approximately $2500 per year. Even half that amount would go a long way toward covering ongoing costs associated with the Makerspace.

I am in contact with the division regarding the possibility of procuring a startup grant for our Makerspace.

Fundraising directly from our student families would be an option of last resort. We risk competing with our Parent Committee for the same funds. There's also the danger of alienating our parents with too many requests. Donating materials is already a lot to ask.

ÉFM (Éducatrices et éducateurs francophones du Manitoba) offers up to $500 per year to schools willing to advertise the ÉFM's support, providing another avenue of funding.

While we want the very best tools for our students, it is important to remember that innovation is at the heart of a Makerspace. Constraints, whether they be in the form of intellectual challenges or in the form of limited resources, can foster innovation and creativity. Just look at the toys children in Malawi create with scrap materials such elastic bands, wire and cardboard.

And who can forget Caine Monroy, the little boy who made a fully-functioning arcade out of scrap cardboard and tape?

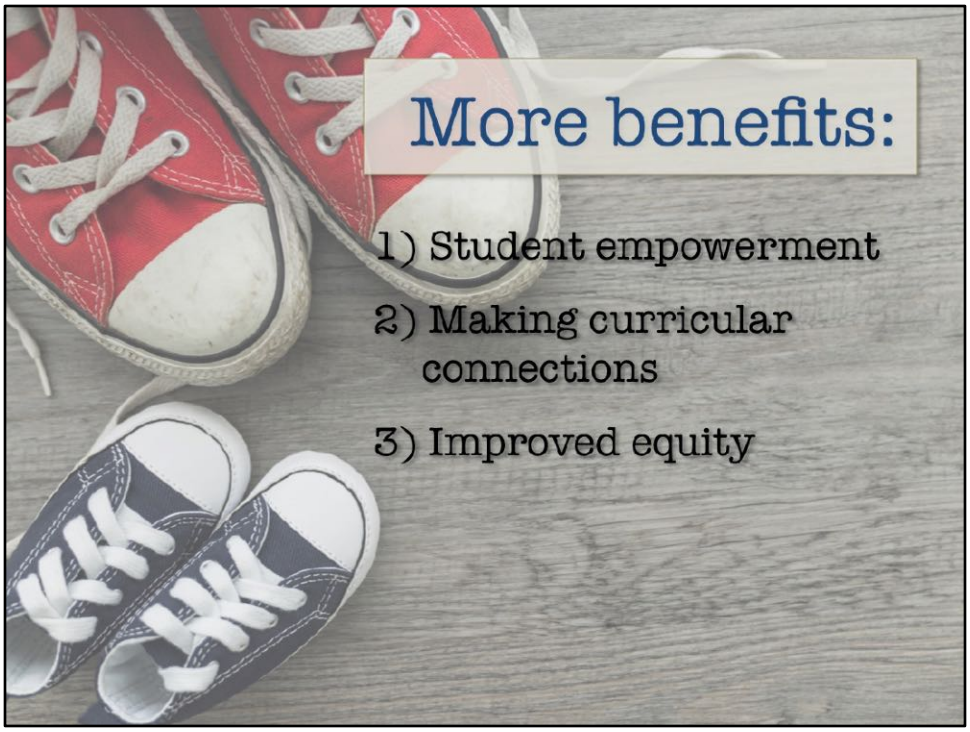
If we choose to incorporate Makerspaces into our classrooms, accessibility won't be an issue. If we go with a permanent Makerspace in the library or a series of mobile carts, we will simply need to book them through our existing laptop reservation system.

If enough teachers sign up to supervise, we could also offer "free-range" makerspace sessions during the lunch hour. Students participating in these sessions are issued challenges or they are allowed to simply tinker aimlessly. Before and after school sessions aren't possible due to the daycare, but our students are keenly interested in lunch hour clubs – particularly during our cold winters!

Students develop the following fundamental skills through Makerspaces. These are all extremely valuable skills, not just in the marketplace, but for life in general. But Makerspaces promise even more for our students.

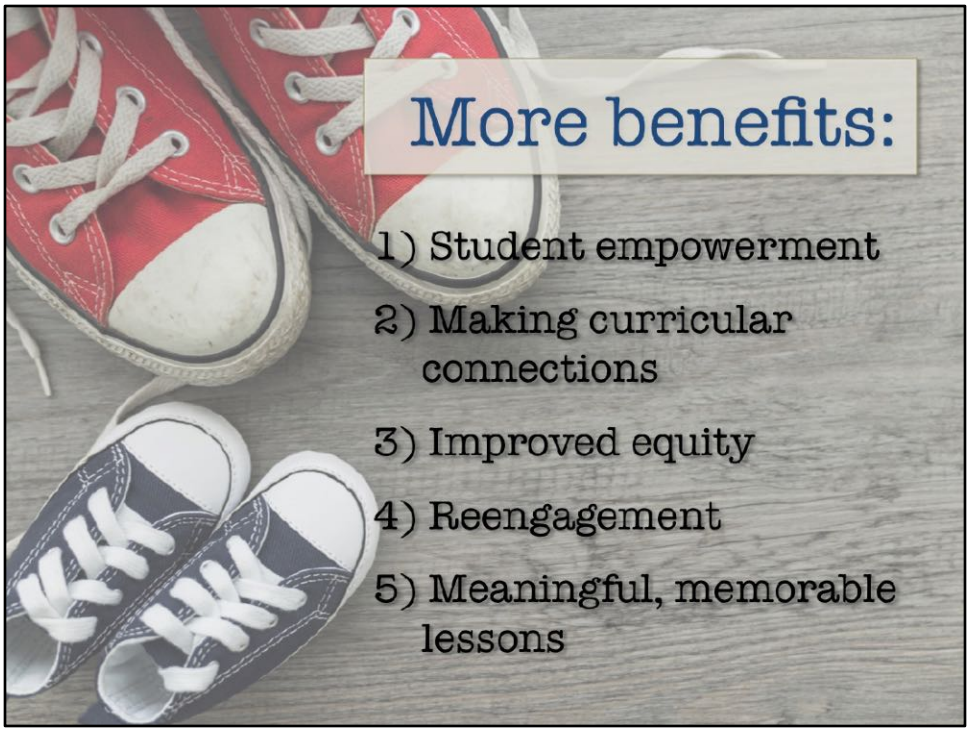
Student empowerment: Makerspaces are student-led and student-centred learning spaces. Teachers may issue challenges, or tell students what outcomes they would like to see, but it's up to students to decide how they meet those challenges and with whose help. This situation is very empowering for students. (Robinson, p. 36)

Making curricular connections: The student who has built spaghetti towers in a Makerspace has learned through trial and error which configurations are more stable than others. They can draw on that skill set in later lessons and make links with curricular material in the classroom. (Oliver [1], 2016, 160)



Improved equity: Not all of our students have the opportunity to explore, to craft and to tinker at home. Makerspaces have a broad appeal that reaches across ages, skill levels, cultural backgrounds, and gender to help level the playing field within a diverse student population such as ours. Makerspaces allow students who may not have otherwise considered applying themselves in science, technology, engineering, arts or mathematics (STEAM) to realize their potential in these domains.

Reengagement: How many of our students struggle in science or in math because they're not so good at reading texts, or writing assignments, or even just sitting through lessons? A Makerspace, used correctly, can reengage those students with the lessons and give them a sense of accomplishment that may otherwise elude them in a more traditional classroom. (Hlubinka et al., p. 4)



Meaningful, memorable lessons: Makerspaces are the ultimate application of constructivist learning principles. Are you more likely to remember that which you've read, or that which you've lived? Piaget, Vygotsky and Dewey would almost certainly approve of the Maker movement.

Less preparation – more collaboration: One obvious benefit of a Makerspace is having access to a wider range of tools and materials than an individual teacher might be able to acquire on their own. Having a ready-made cart also results in less prep work when planning a class project and more time to interact and collaborate with students.

Meet curricular objectives: Every science module requires students to design, prototype, refine and finalize a product. Our Makerspace will make it easy for students to explore the materials and develop their designs. Experimenting in the Makerspace beforehand also gives students a leg up as they are already familiar with the possibilities and the limitations of the available resources.

Student-led learning: You may even want to BEGIN a unit by using our Makerspace. Give your students a general direction (let's explore sound), let them tinker, and THEN connect the vocabulary to the lessons they've learned through hands-on exploration. Ask them what they learned in their last Makerspace session. Have the students teach YOU!

Take the next few minutes to mark down at least one theme you could explore in a Makerspace and the materials you would need to build those projects. Remember: They don't have to be science themes. Imagine a cardboard Greek temple in Grade 3. Or how about exploring fractions using Legos? Let's brainstorm some ideas together!

The same way you would any project! The Makerspace method allows for more options than a typical study-and-drill approach would.

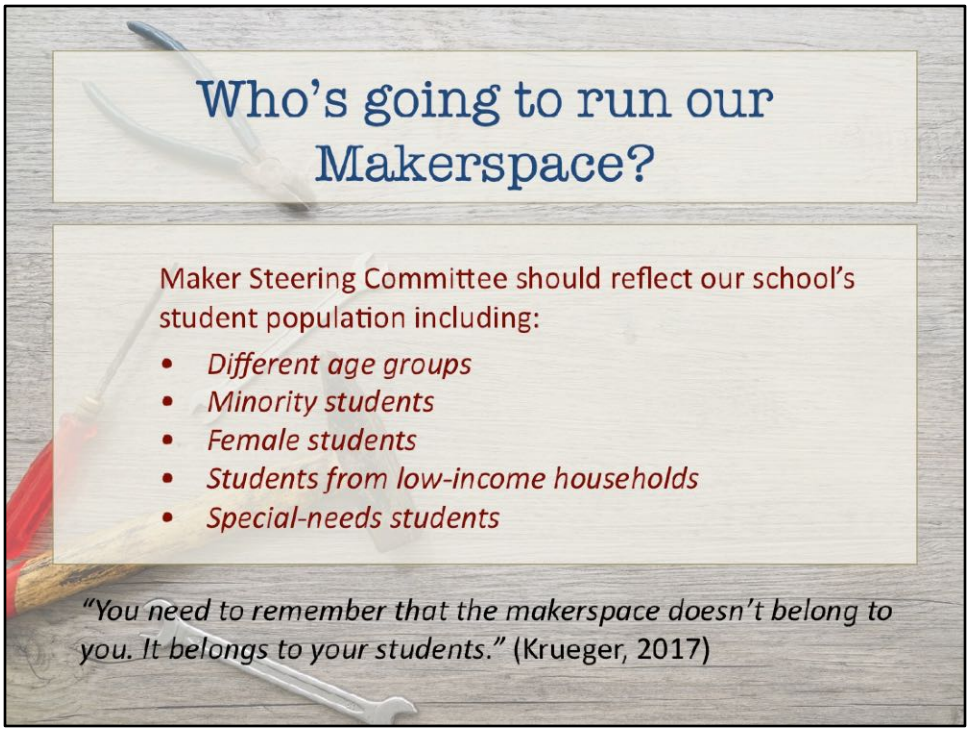
Hold a Maker Faire – Unlike science fairs, they are about sharing creations without any competitive aspects. Participants offer and elicit “useful feedback on what they are working on, and that the feedback is offered in a spirit of generosity and received with similar openness and magnanimity.” (Hlubinka et al., p. 2)

École Varennes could hold a Maker Faire to coincide with parent-teacher conferences so that students can show off their work to a wider, and very appreciative audience.

Steve Weeler calls experiential learning “a more balanced approach to education where teacher, students and content [are] given equal importance in the learning equation” (Wheeler, 2014).

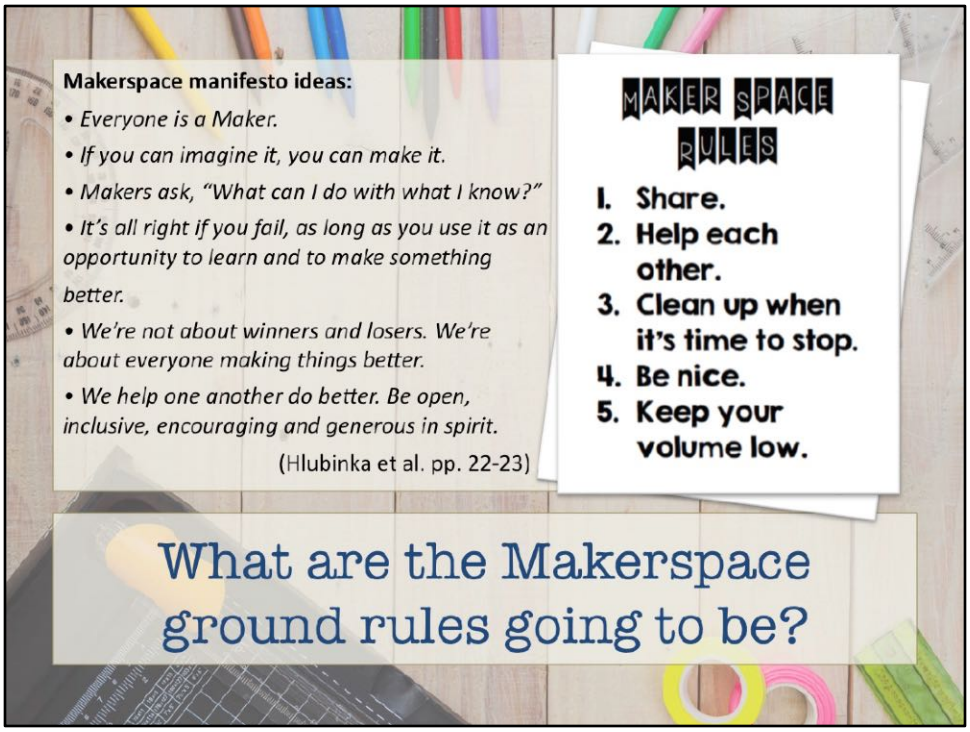
Collaboration and mentoring are a big part of the Maker movement. Students have been observed collaborating, creating tutorials and being recognized as experts in certain domains by their peers. (Cross, p. 85) This is an incredibly validating experience for students.

Teachers are encouraged to interact with students, offering assistance when asked to do so and interfering only when safety is at stake. Otherwise, teachers act as collaborators and mentors in the Makerspace creative process.



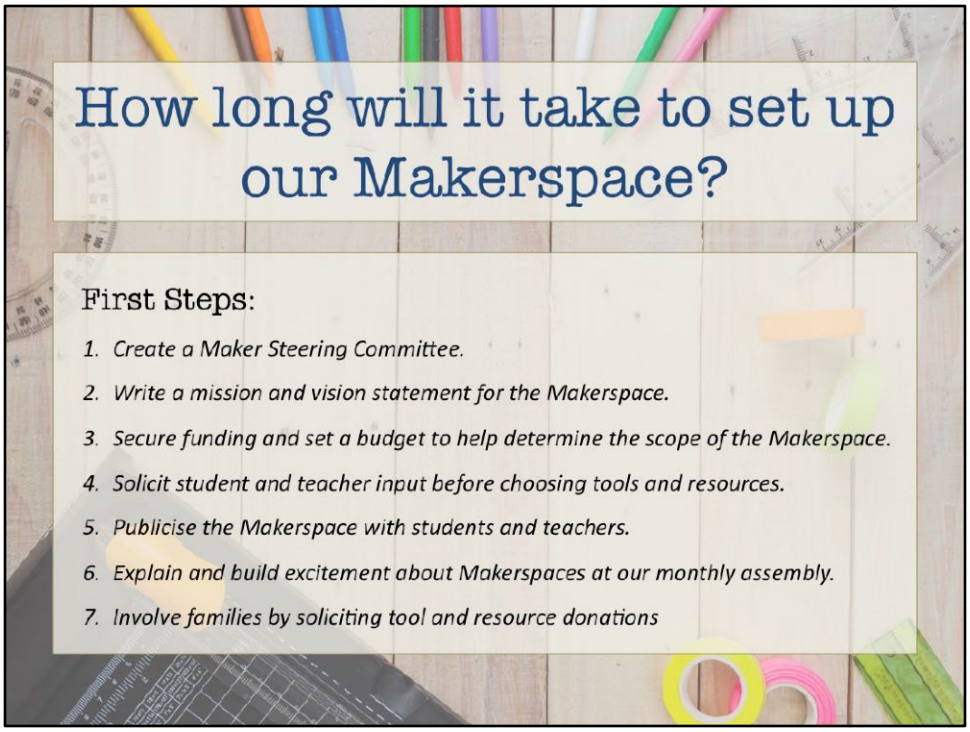
It's neither fair nor advisable to have only one person in charge of the Makerspace. First, we must gather interested students and teachers to form a Maker Steering Committee. The Committee should be representative of the groups that make up our student population.

A consultation process is essential to the success of a Makerspace. "It might be a really great space, but if it's not what the kids need and want, then it's just not going to work as well," says Diana Rendina. (2015) The Maker Handbook includes ready-made surveys to ease this process. (Hlubinka et al., pp. 64-65) The Steering Committee is also responsible for writing a Makerspace manifesto or vision statement.

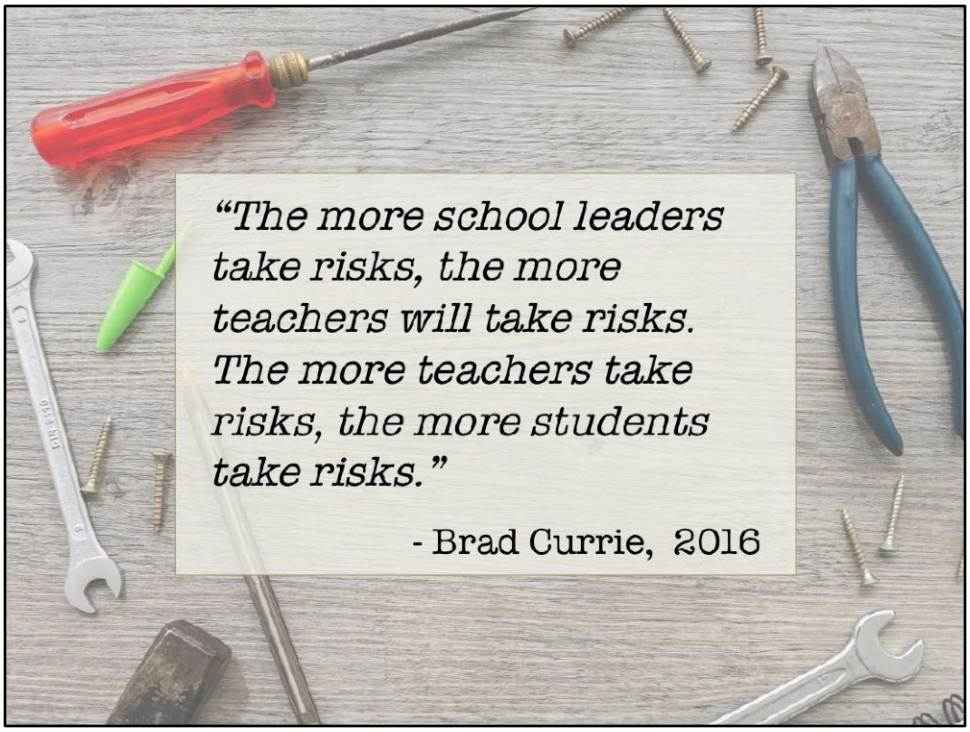


That's up to us – students and teachers! The Steering Committee will need to create a Maker Manifesto for display at the Makerspace. Here are some common elements from other manifestos. Students and teachers should also collaborate on establishing some Makerspace ground rules. These may be a part of the manifesto – or not.

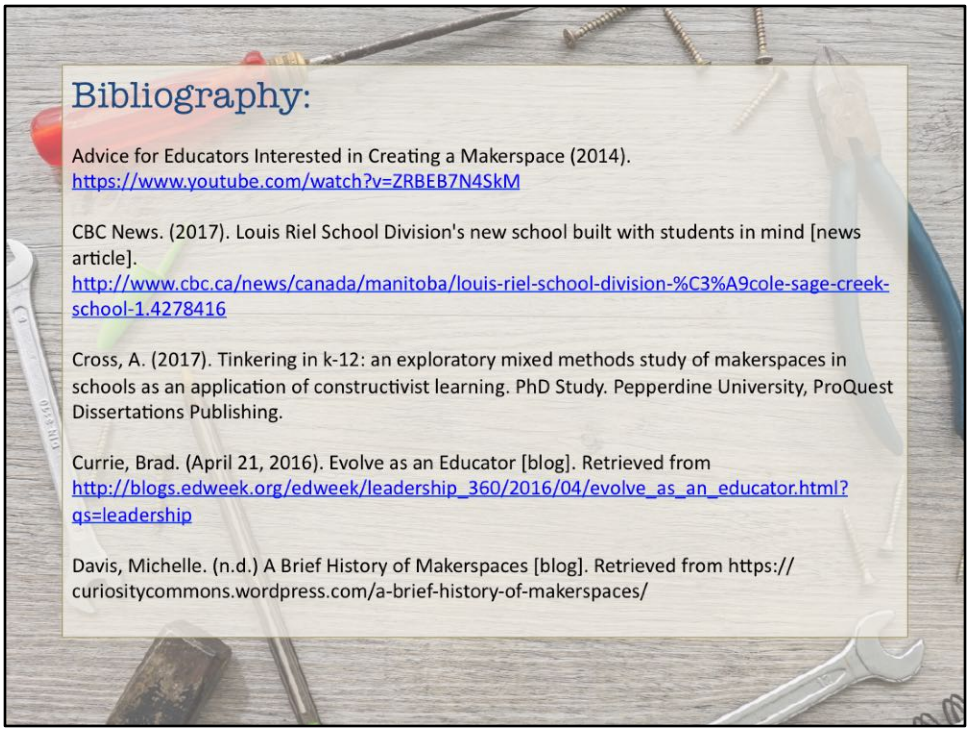
Another important task for the Steering Committee is identifying expertise within the school. Who can sew? Who understands circuits? Who likes woodworking? Who knows how to code? Teachers with particular expertise can offer their services either for training students, or for sharing their knowledge with their colleagues. I invite you to consider what knowledge you could bring to our Makerspace.



I've already mentioned the Maker Steering Committee and their responsibilities. I've also discussed funding our project. Another important element will be publicising our Makerspace and drumming up enthusiasm and support for the project within the École Varennes community. If we get all our ducks in a row, I can envision us implementing our first Makerspace in less than two months, but I'll need your help to do it.



A Makerspace aligns with teaching best practices, it benefits our students and it even makes our jobs easier. What's more, the Makerspace movement continues an ages-old tradition of design and innovation in schools. By encouraging exploration and by stimulating creativity, we are continuing that tradition even as we prepare our students for the modern world. It's a risk worth taking, don't you think? [Solicit questions]



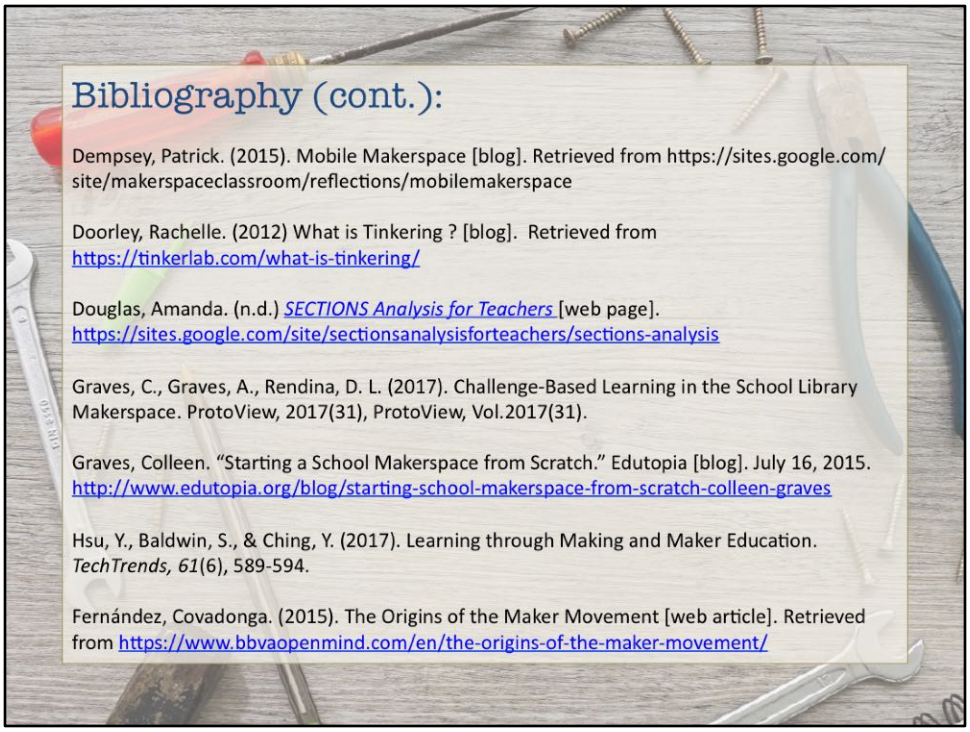
Advice for Educators Interested in Creating a Makerspace (2014). https://www.youtube.com/watch?v=ZRBEB7N4SkM

CBC News. (2017). Louis Riel School Division's new school built with students in mind [news article]. http://www.cbc.ca/news/canada/manitoba/louis-riel-school-division-%C3%A9cole-sage-creek-school-1.4278416

Cross, A. (2017). Tinkering in k-12: an exploratory mixed methods study of makerspaces in schools as an application of constructivist learning. PhD Study. Pepperdine University, ProQuest Dissertations Publishing.

Currie, Brad. (April 21, 2016). Evolve as an Educator [blog]. Retrieved from http://blogs.edweek.org/edweek/leadership_360/2016/04/evolve_as_an_educator.html?qs=leadership

Davis, Michelle. (n.d.) A Brief History of Makerspaces [blog]. Retrieved from https://curiositycommons.wordpress.com/a-brief-history-of-makerspaces/



Dempsey, Patrick. (2015). Mobile Makerspace [blog]. Retrieved from https://sites.google.com/site/makerspaceclassroom/reflections/mobilemakerspace

Doorley, Rachelle. (2012) What is Tinkering ? [blog]. Retrieved from https://tinkerlab.com/what-is-tinkering/

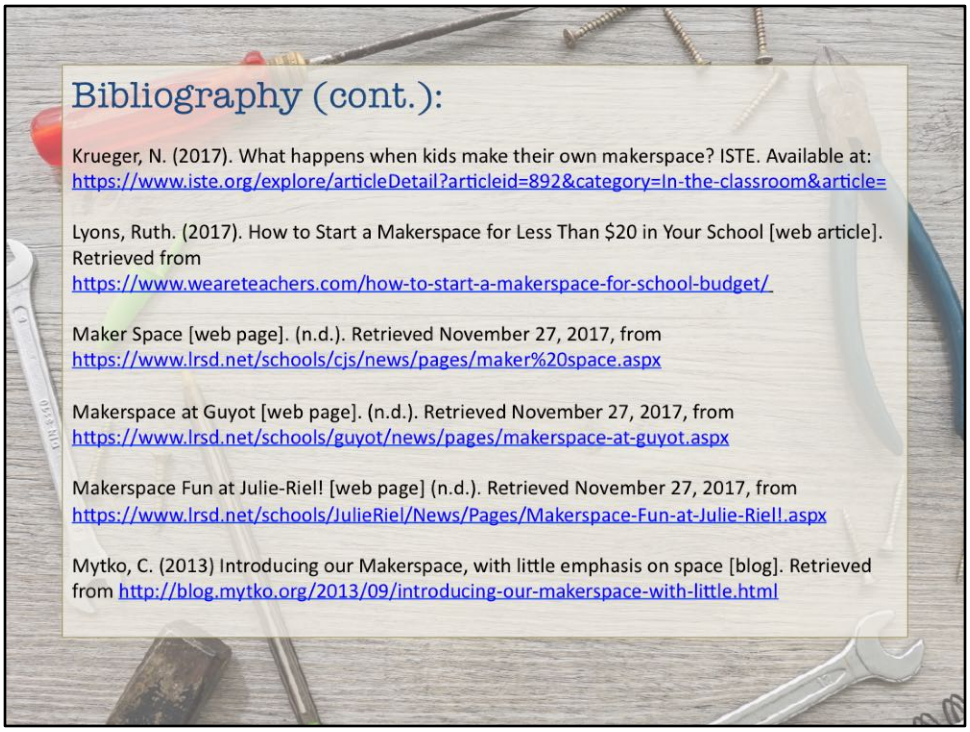
Douglas, Amanda. (n.d.) *SECTIONS Analysis for Teachers* [web page]. https://sites.google.com/site/sectionsanalysisforteachers/sections-analysis

Graves, C., Graves, A., Rendina, D. L. (2017). Challenge-Based Learning in the School Library Makerspace. ProtoView, 2017(31), ProtoView, Vol.2017(31).

Graves, Colleen. "Starting a School Makerspace from Scratch." Edutopia [blog]. July 16, 2015. http://www.edutopia.org/blog/starting-school-makerspace-from-scratch-colleen-graves

Hsu, Y., Baldwin, S., & Ching, Y. (2017). Learning through Making and Maker Education. *TechTrends, 61*(6), 589-594.

Fernández, Covadonga. (2015). The Origins of the Maker Movement [web article]. Retrieved from https://www.bbvaopenmind.com/en/the-origins-of-the-maker-movement/



https://www.iste.org/explore/articleDetail?articleid=892&category=In-the-classroom&article=

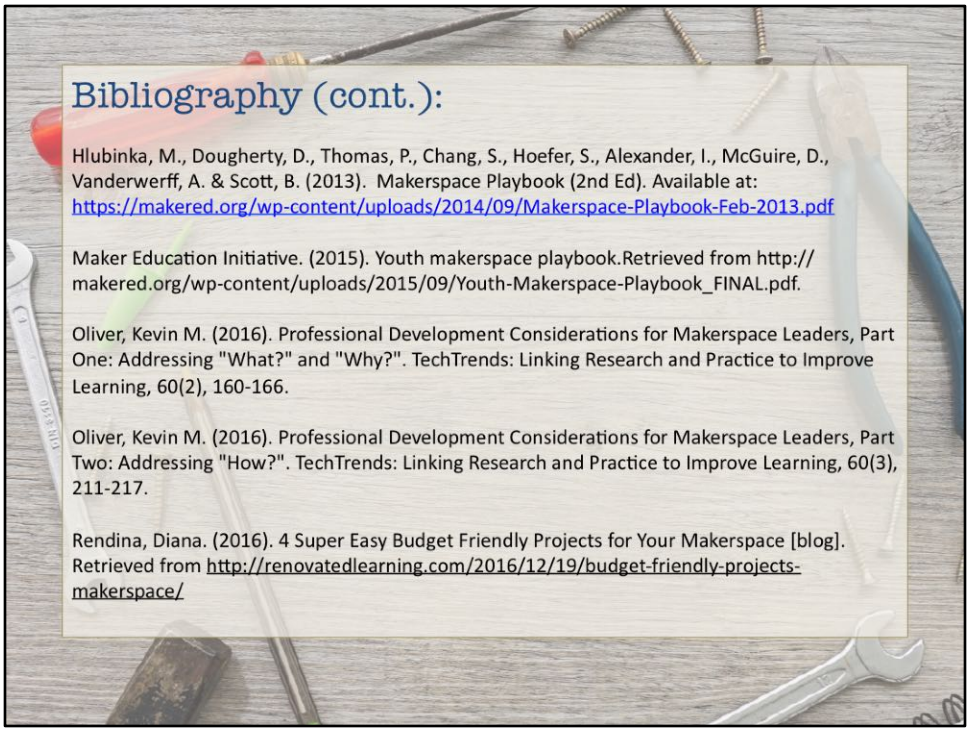
https://www.weareteachers.com/how-to-start-a-makerspace-for-school-budget/

https://www.lrsd.net/schools/cjs/news/pages/maker%20space.aspx

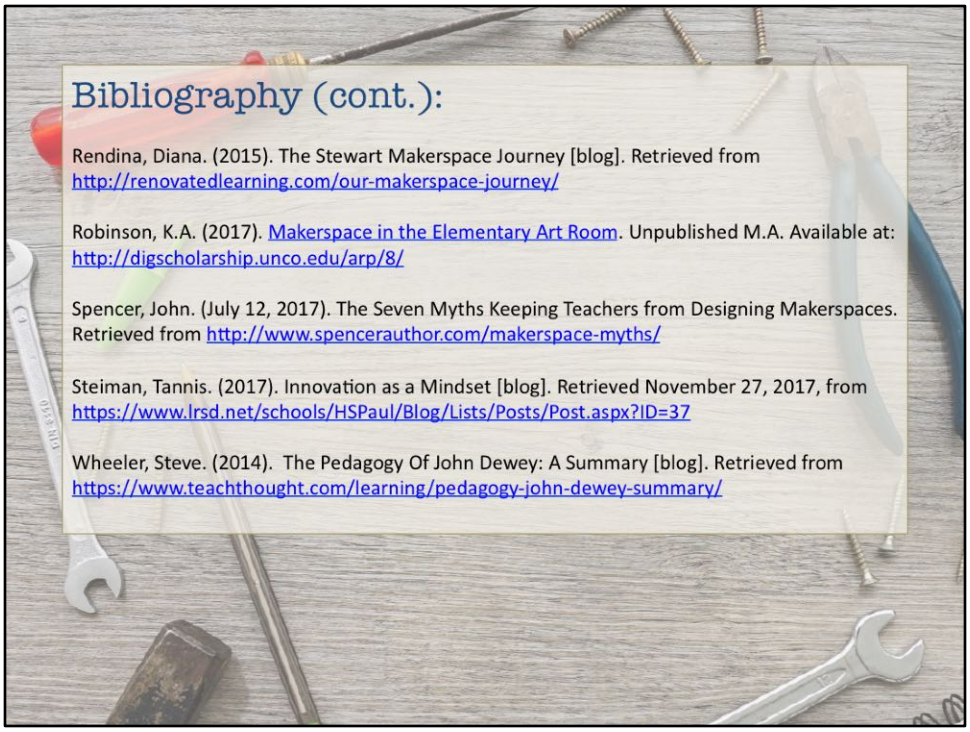
https://www.lrsd.net/schools/guyot/news/pages/makerspace-at-guyot.aspx

https://www.lrsd.net/schools/JulieRiel/News/Pages/Makerspace-Fun-at-Julie-Riel!.aspx

http://blog.mytko.org/2013/09/introducing-our-makerspace-with-little.html



https://makered.org/wp-content/uploads/2014/09/Makerspace-Playbook-Feb-2013.pdf



http://renovatedlearning.com/our-makerspace-journey/

Makerspace in the Elementary Art Room
http://digscholarship.unco.edu/arp/8/

http://www.spencerauthor.com/makerspace-myths/

https://www.lrsd.net/schools/HSPaul/Blog/Lists/Posts/Post.aspx?ID=37

https://www.teachthought.com/learning/pedagogy-john-dewey-summary/