

Maker-centered Instruction 101 Q&A

STARTING

What processes should I follow to get started? What materials should be purchased? What about training?

[Autodesk has a GET STARTED guide](#) that has a ton of useful information and resources. It is a great place to begin.

One rule of thumb is to start small. Consider easing staff, faculty, and students into the process of making by starting with accessible crafting challenges. Cardboard is a good entry point. You might also consider [Instructables](#) as a place to start. This allows people to riff on an existing project rather than starting from scratch. The [silhouette cameo](#) is a great entry level tool. Very accessible and gets students feeling comfortable converting ideas into digital files.

In terms of training, you will want to work with your school or organization to find out the specific training that would be needed. I like the idea of starting with a group of interested teachers and training them on a few select pieces of equipment.

What curriculum resources are available? Where would I find guidance?

Depending on your grade level, there are a lot of great resources out there. Scratch, Instructables, Maker Ed, and The Tinkering Studio all have great project ideas. For secondary, check out the [UTeach Maker lesson bank](#). These are aligned to STEM standards but can be easily adapted for other content areas.

How do you get support from admin who do not have a background in or knowledge of making? How do you get schools to support maker education?

First of all, help make connections to paradigms that others already understand such as hands on, student-centered learning, PBL, or the 5E lesson cycle. Show how making can humanize the classroom by having students bring their own passions into projects, increasing exposure to innovative tools and materials, and promoting socio-emotional learning by helping students practice collaboration, communication, and resilience. There are also some great workforce stats in the [Autodesk starter guide](#) and this [report from pi-top](#) is also worth a look.

In addition, proof of concept is a great way to start. Low investment (see crafting a silhouette ideas above) technologies can let admin see great outcomes with minimal cost. Get them excited then go for the bigger asks in terms of dollars and support. Consider using one of the ideas from the Maker Educator Summit to host a mini PD for teachers and admin. And, strong alignment to standards is key for most administrators (see assessment section below).

Some articles that might help are:

Rodriguez, S., Harron, J., Fletcher, S., & Spock, H. (2018). [Elements of making: A framework to support making in the science classroom](#). *The Science Teacher*, 85(2), 24-30.

Rodriguez, S., Allen, K., Harron, J., & Qadri, A. (2019) [Making and the 5E Learning Cycle](#). *The Science Teacher*, 86(5), 48-55.

Lowery, K., Rodriguez, S., & Benfield P., (2019). [Making as a Performance Task](#). *Science Scope*, 42(7), 78-86.

How do I get teachers to commit to the time it takes for a project?

Making takes time, a very real constraint in the everyday school setting. We have found that using a maker project as the context for learning a unit of material to be a successful approach. This allows teachers to spend some time on making one class period or a week through the unit and gives students time to iterate on their creations. Maker projects also work well as performance assessments and creative content review. Here are some examples:

[Collaborative paper quilt](#) - test review

[Interactive Museum Exhibit](#) - performance assessment

[Multimodal books](#) and [Living Sculptures](#) - unit projects

How do you help students decide what to build and make? How do we help students connect in a personally meaningful way?

This takes a bit of a paradigm shift. It takes seeing the classroom as a place where students not only learn content but they also learn about themselves and others. Tools like inspiration journals that students engage with on a regular basis can help them tap into their own voice. Some useful prompts can be found [here](#). The element of making is often overlooked in favor of fabrication but it is key to helping students build confidence and believe that they have something worth saying.

Additionally, it is important to look for opportunities to help students connect maker project to themselves in a personal way. Having them consider a specific audience to make something for is helpful. But, take time to have them practice empathy before hopping into the project. How might the person in this situation feel? What do they need? How will this product help? How does their situation connect to something in your own life?

Where are good places to find funding?

Great question but don't let the funding stop you. Making is about much more than the tools and materials. Look for low cost options to get started (see above). Kickstarter and Gofundme have been used or consider asking a local business for sponsorship. The [Infy Maker awards](#) come around every year and offer grants of up to 10K for K-12 making. And don't feel like you have to build out an entire makerspace at once. Most experts agree that you should start with 1-2 pieces of equipment that make sense for your context (what do you know how to use? What has a low entry point?) and then build up over time based on the emerging interests of your community.

MANAGING

How long should I spend on safety (worried about kids getting hurt)? I always go over safety at the beginning of every maker session (eye protection, ear protection, protocol on how to use the tool, what to do if the tool stops working or does something erratic).

How can safety be addressed in a positive way? Not just saying, “no” or “please don’t do that” and emphasizing difference between risk vs. danger? As a member of the classroom and maker community, we always look out for one another to stay safe. This looks like: not interrupting or talking to someone is using a power tool, getting their attention if something is wrong, getting help from the teacher if something breaks.

How to address the issue of single (individual) vs. group projects? It will depend on the project's physical size, budget, types of material, number of tools you have, and a balance of student voice and choice.

What about large class sizes and limited maker materials? You can have students do projects in small groups or choose different maker materials based on interest. Gathering tools and materials from the community is another way to get materials.

How do teachers manage all the materials one needs in a makerspace? I store my materials in labeled clear containers. When I need more of something, I request it from the community. When I have too much of something, I come up with projects that use up that material.

How to design a project to maximize student engagement? Finding a way to connect with the students and giving them a voice is very empowering. Tools that are low entry with high ceilings tend to reach most students such as cardboard construction, Makey Makey with Scratch coding, etc.

What are some of your strategies for project pacing? I use backward design for project pacing. I look at my learning goal and work backwards to build a timeline and rubric.

Where does the line end when play becomes just “messing around?” Students definitely need time to explore and tinker with material. I believe documenting the process of during play and then setting learning objectives/challenges/goals is a good way to transition from play to purposeful making.

Are parents supportive? Do you use volunteers? Parents are supportive when they see the excitement in their child’s faces or hear stories from the school day about making. It can be helpful to invite them in to Make with their child (maker night or maker faire). I personally don’t use volunteers in my makerspace but I do use volunteers at our maker faire.

ASSESSING

How to you measure student progress on a project? How can you formatively assess in a non-invasive way?

Documenting Milestones

Consider having students capture milestones of their work (pics in progress) to document the evolution of their designs. The pics can be added to a google slide presentation for each group and caption can be added. You will need to give reminders about this throughout the project. Pause the class every so often and have every group take a milestone pic to upload.

You can give specific prompts for the slide post depending on your purpose (ex. Content - describe the ways that what you have so far represents X and what it is missing. Maker Mindset - Describe one challenge you have encountered thus far and what steps you have taken to meet this challenge. Collaboration - How does this picture represent the collaboration in your group? What elements did each person contribute?)

You can also use the google slides they create as a summative assessment at the end by having students go in and label or additional captions or summaries using the lesson objectives.

Formative Assessment Checklist - have a checklist of objectives that you carry with you as you support groups in their work. Use your conversations with them as well as observations to complete it. As with the milestones, this can be tailored to meet your need. [See an example HERE.](#)

How can you assess mind set, collaboration, empathy etc? What if you don’t believe that you need grades in a makerspace but K-12 demand that a grade be given?

As mentioned above, you can tailor your assessment tools to capture whatever features you see fit. The key is to define what you are after and perhaps find a framework. This [2015 article by Lee Martin](#) provides identifies four elements of the maker mindset that can be useful. [The learning dimensions framework](#) from The Tinkering Studio is another great resource.

How can this type of assessment be weighted in a grading system? What % of assessment if paperwork, documentation, product, growth?

Maker lessons have a lot in common with other forms of inquiry learning like project-based learning. You might consider a large project grade but also include smaller grades along the way for reflections, content specific assessments, milestone posts etc. Because of this overlap, the [PBLworks](#) site, offers many nice tools that can be adapted for the maker context.

How can strong assessment help you convince admin, parents, and teachers of the value of a project?

A performance task is one that asks students to do or create something that shows evidence of what they have learned. This type of assessment gives students the opportunity to display their understanding outside of the traditional multiple choice test or essay. Rigorous performance tasks can are those that call for the application of knowledge and skills, are open-ended, provide authentic contexts, and show evidence of understanding (McTighe, J., 2015). Both of performance tasks and making rest on the notion of students doing and creating as a way to learn, apply, and demonstrate knowledge.

Describing your maker project as a performance task and having strong assessment plan can help reduce the fears that administrators, parents, and other teachers can feel when encountering maker-centered learning for the first time. The thoughtful use of rubrics and formative assessments aligned with standards is key to helping making gain acceptance as an instructional approach. Find an example of what this might look like in:

Lowery, K., Rodriguez, S., & Benfield P., (2019). Making as a Performance Task. Science Scope, 42(7), 78-86