



# Beyond Rubrics

While there are many benefits of making and makerspaces, one of the greatest challenges of implementing making in K-12 schools is the question of how to assess collaborative, cross-disciplinary, and iterative making practices and outcomes. We believe that it is crucial for educators to design and implement making activities with assessment in mind, to be able to understand what students learn, provide meaningful support for individual students, and connect making activities with learning in other disciplines. Since making requires constant interaction between learner and teacher, the teacher's ability to assess and facilitate student learning in the process, without being overly prescriptive, is critical.

*Beyond Rubrics: Embedded Assessment in Maker-Centered Classrooms* aims to address the lack of assessment strategies in making contexts. We use an embedded assessment approach in which teachers and students collect rigorous forms of evidence of student learning, without constraining or interrupting complex and iterative making processes. To do this, we have codeveloped a series of Maker Elements, our assessment constructs, and assessment tools with educators from Albermarle County School District, Portola Valley School District, and the San Mateo County office of Education.

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# Maker Elements Overview

Embedded assessment can measure not just knowledge and skills, but also attitudes, beliefs, interests, and practices, instances often referred to as constructs. While this is a principle for any good assessment, this principle is particularly relevant for maker environments where each student's learning process can take various forms and trajectories, and where anticipated learning outcomes tend to be ambiguous. Therefore, embedded assessment in making should include a clear understanding of a possible outcome space and how specific actions within the learning environment could be connected to these constructs.

We designed our assessment tools targeting seven constructs that we call Maker Elements. We first studied the Learning Dimensions from Tinkering Studio (Gutwill, Hido, & Sindorf, 2015; Tinkering Studio, 2017), a list of learning identified through a video analysis of museum visitors engaged in making activities, and MAKESHOP Learning Practices from the Children's Museum of Pittsburgh (Wardrip & Brahm, 2015), list created out of content analysis of MAKE MAGAZINE and collaborative examination of children's engagement at MAKESHOP. These seven constructs are selected based on literature and feedback from teachers we collaborated, and are not meant to be a comprehensive list of constructs potentially learned in maker activities. Rather, these are a list of skills and dispositions that maker educators wish to further foster during maker activities, designed to help teachers adapt the assessment tools in the needs and contexts of their classrooms.

## Agency



The capacity to make intentional choices and to understand that you have such a capacity. With agency, you see yourself as a contributor and an agent of change in the world surrounding you.

## Troubleshooting



A capacity to persist and to find solutions. If a project is not progressing as expected, you can use different strategies to diagnose and fix the problem. Not giving up requires patience, resilience, and resourcefulness.

## Design Process



A way to approach challenges by brainstorming, prototyping, testing, and iterating. Designers are aware of the many steps to reach a solution and deliberately work on each step to improve a design.

## Bridging Knowledge



Using knowledge from your lived experiences at home, community, and culture as well as from OST experiences and other subject areas to benefit the project you are working on.

## Social Scaffolding



The capacity to make intentional choices and to understand that you have such a capacity. With agency, you see yourself as a contributor and an agent of change in the world surrounding you.

## Content Knowledge



You may develop stronger conceptual understanding, be able to accurately understand why this do or do not work, or be able to use materials in safe and effective ways.

## Productive Risk-taking



To try an idea or a solution beyond your comfort zone. Even when an action ends in an unexpected way, you can identify lessons learned and connect it to the next iteration or future projects.

# Tool Overview

Our tools fall into three categories, which we intend to be a progression within the classroom which includes setting context with both students and teachers, collecting evidence (including reflecting on that evidence to inform formative feedback), and finally an ongoing process of longterm meaning making.

The individual evidence collection tools are designed so that teachers may pick, choose, and adapt evidence collection tools that will work best with the classroom culture, maker project, and learning goals.

## Setting Context

*Collecting rich data about making process requires both students and teachers to be active participants in the assessment process. Context setting tools and activities give opportunities for students and teachers to learn what each of the Maker Elements are and see them in action.*

- **Superpower Hour**
- **Maker Elements Posters\***

*\*A series of printable resources with graphics, "I" statements, and descriptions of each Element.*

## Evidence Collection

*A series of tools to collect meaningful evidence of the making process. Tools provide a range of opportunities for both teachers and students to act as data collectors, to collect both qualitative and quantitative data, and to use once or over the course of a project.*

- **Sparkle Sleuth**
- **StereoCraft**
- **Maker Moments**
- **Stuck Station**

## Meaning Making

*After evidence is collected, teachers and students must interpret the information to inform feedback in the classroom, summative assessments, and communication with other stakeholders. While each individual evidence collection tool can be used as a reflection tool throughout a project, this tool currently looks at making meaning from evidence collected over time (a project, course, or year).*

- **Field Guide**



## Superpower Hour

*Introduce the idea of maker elements as superpowers*

To prepare for reflecting on and measuring Maker Elements, our collection of constructs, students and teachers need a solid understanding of what each looks like in action. This activity helps set that context and prepares for using the rest of the toolset.

In this activity, small groups of students are given a true story of an inventor, engineer, or scientist that describes their path to a discovery or contribution. Groups work through the story together identifying where they see their person using different Maker Elements. In the process they will build their own understanding of what that skill looks like in practice. The students then collaborate to create a cape the individual would wear as a superhero, that represents all of the Maker Elements the inventor used.

### Well suited contexts

- *Early in a class or project, to introduce the Maker Elements that will be documented.*
- *Classes that can devote at least 1 hour or class period to prepare for hands on making.*



# Sparkle Sleuth

Watch for small actions that add up to the Maker Elements.

Sleuthing for sparkles is really just a strategy of careful observing and documenting. During project time, teachers watch for instances of particular maker elements and take quick notes about them. The immediately give the slips to the student. In time, as students build their skills recognizing the constructs, they can act as observers of their peers.

The “sparkle slips” provide immediate but unobtrusive feedback to the students or groups. By collecting the slips and saving them over time, teachers can put together a picture of how students’ skills have changed and grown, and how the skills are being applied on an individual level and a class level.



**Well suited contexts**

- Students working individually or in groups.
- Teacher able to circulate, giving feedback and making observations.
- Less prescriptive, students demonstrating skills in many different ways.
- While supporting students in recognizing Maker Elements in action.

**Evidence Collection**



# Stuck Station

Transform your frustration to inspiration.

Stuck Station provides an opportunity for students to step away from their projects and groups when they are frustrated, stumped, or stuck with a technical problem or collaboration problem. Students are given an opportunity to explore strategies to get unstuck and talk through the problem they are having on video. This encourages (and builds students capacity) to troubleshoot, take risks/tinker, or work through struggles with peers.

At the end of the class session, students revisit their “stuck” moment, and write down how they worked through the issue, if their attempts were successful, and what they will do next on a Stuck Slip (exit ticket). These slips (as well as the recorded video) become evidence to be added to a portfolio or Field Guide.

**Evidence Collection**

**Well suited contexts**

- Classes focused on productive risk-taking, troubleshooting, and iteration.
- Open ended projects in which students will likely get “stuck.”
- Classrooms with access to a device (tablet, laptop, or chromebook) that can record and play back short video clips.

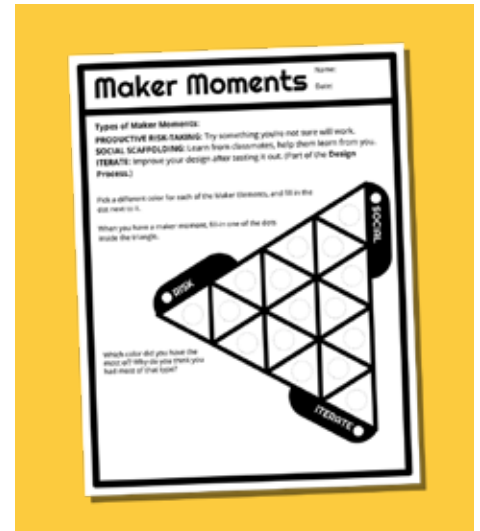


# Maker Moments

Quantify your meaningful maker moments.

Maker Moments is a chance students to capture quantitative data about moments when they are exhibiting evidence of different elements. The tool can be used by individual or groups of students, and can capture data for up to three different elements. It works best with indicators that are easily observable and quantified (Design Process: We improved our design based on testing one. Productive Risk-taking: We tried something without knowing what would happen.)

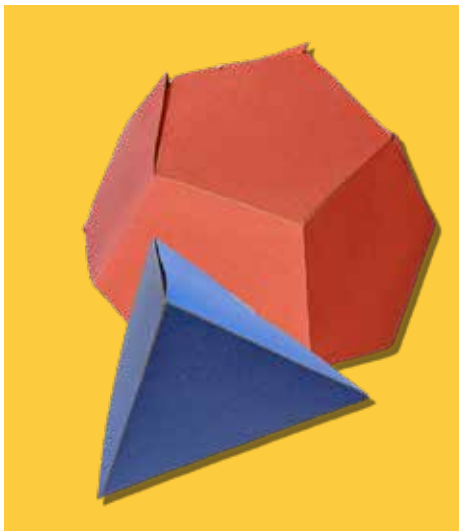
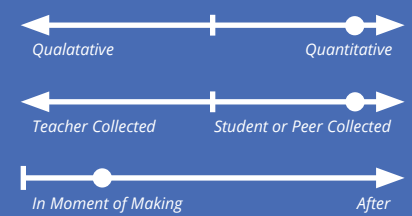
The tool builds students' ability to recognize behaviors associated with the Maker Elements and gives a snapshot of the behaviors from each day. At a glance, students can see what they did that day. Over a time, the data from multiple cards can be graphed to see change over time.



## Well suited contexts

- Groups working together on a project, who can share a Maker Moment sheet.
- Projects with opportunities for students to make design decisions, not entirely prescribed by teacher.
- When documenting easily observable and can be Maker Elements such as Social Scaffolding or Productive Risk Taking

## Evidence Collection



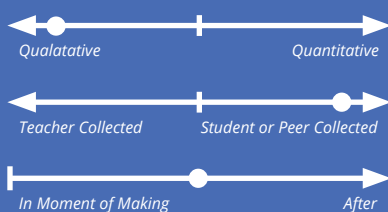
# StereoCraft

Make 3D shapes to share evidence and tell your process story.

Students transform a flat piece of paper into a 3D shape that shows evidence of the Maker Elements students demonstrate. At the start of a class period, the flat shape may prompt students to set goals and/or show evidence for a particular Element. Then, as students carry out an assigned activity, they use the flat shape to record evidence of demonstrating the Element(s): recorded as writing, images, sculpture, etc. Once every face of the shape is filled with evidence, it can be assembled into a three-dimensional shape and shared.

Teachers, students, and other stakeholders can start seeing the many ways that Maker Elements can manifest in student work, develop a better understanding of each Element, and reflect on the progress students make through repeated (and remixed) use of this tool.

## Evidence Collection



## Well suited contexts

- A larger, ongoing project that students may capture data over time.
- Projects with natural opportunities to pause (e.g. without washing hands or while waiting for equipment to be available).
- Projects where student decisions may be less visible to teacher or peers (e.g. Scratch or stop motion on a computer).



# Field Guide

*Curate the evidence to show your achievements & progress.*

With Field Guide, students store all the evidence that's collected using other tools and are guided to identify pieces of evidence that are exemplars of their enacting each Maker Element. Students revisit evidence that was collected over multiple class periods, and find exemplars where they were *hatching*, *emerging*, and *soaring* for each element. They can classify the evidence into levels based on their solo reflections, group conversations, or one-on-one meetings with a peer or teacher.

As the term progresses and new Maker Elements are introduced, teachers and students gain a better understanding of the Elements and see the concrete ways the Elements are visible in student work.



## Well suited contexts

- *Classrooms with evidence collected using multiple tools over the course of one or more projects.*
- *Classes interested in a participatory summative assessment process.*