**Suggested Use**

This document links Maker activites to school settings and introduces the use of a design challenge.

**Creating a Design Challenge or Problem Sketch**

Whether you invite students into a maker project through (1) an inquiry question, or (2) position it as problem to be solved, or (3) cast it within a scenario, what aligns it to the Maker Movement is the intentional use of design thinking and the hands-on construction of a solution, using real tools and materials. A design challenge or problem sketch creates a narrative from which participants can use design thinking to find creative solutions to problems through empathy and research.

**In a School Setting**

When we bring the Maker approach into a school, we may want to guide the students using an ***inquiry orientation***. Wiggins and McTighe (2006) offer guidance in approach in their book, *Understanding by Design*. Central to their approach is the suggestion of thinking with the end in mind. This has lead to their work being called ***backward design*** as it considers the learning objectives, an approach, the use of materials and resources, and still allows the students to have an active role in determining individual aspects of the project and the ways in which it might be completed. The teacher has an active role in shaping the inquiry with the students and guides the students to use the available materials and resources within the specific context of the learning environment and curriculum under study.

***Three Approaches to Forming a Design Challenge***

***1. Inquiry*** (Alberta Learning, 2004) allows curriculum to be explored through authentic experiences – a key contribution of MAKING to teaching and learning activities. ***Authentic learning*** encourages students to inquire into things that are real and of interest to them. It positions the learning activities as problems to be solved. Edutopia has a site sharing tools, tips and ideas about ***problem-based learning*** (PBL) (<http://links.edutopia.mkt5094.com/ctt?kn=17&ms=NzE3NDM0OAS2&r=MjcyODg5NjI0MjMS1&b=0&j=OTMyNDg3NjYS1&mt=1&rt=0>).

2. According to Mayer and Wittrock (2006), ***problem solving*** is “cognitive processing directed at achieving a goal when no solution method is obvious to the problem solver” (p. 287). They explain students need five kinds of knowledge to be successful problem solvers:

* facts: knowledge about characteristics of elements or events, such as “there are 100 cents in a dollar”;
* concepts: knowledge of a categories, principles, or models, such as knowing what place value means in arithmetic or how hot air rises in science;
* strategies: knowledge of general methods, such as how to break a problem into parts or how to find a related problem;
* procedures: knowledge of specific procedures, such as how to carry out long division or how to change words from singular to plural form; and
* beliefs: cognitions about one's problem-solving competence (such as “I am not good in math”) or about the nature of problem solving (e.g., “If someone can't solve a problem right away, the person never will be able to solve it”) (Mayer & Wittrock, 2009).

***3. Scenarios*** are a form of story or narrative. They can be used to introduce students into a project. The purpose of a scenario is set a scene for a project and to create a common starting point. A scenario can also get the parameters for the project, outlining any limiting factor, special conditions and time / context constraints. Scenarios are creative ways of imagining a “different future” or an alternative way of doing something. They help the students visualize the context for the task as they usually cover environmental, social, technical, political and economic concerns.

The sample task (Appendix 1) uses a ***problem sketch approach***. The component of the problem sketch help frame a task within the following:

* background (Overview)
* context (Design Rationale),
* scenario (Problem Scenario),
* character for assessment / evaluation (Success Determinants), and
* rules / limitations (Parameters)

Martinez and Stager (2013) suggest there are eight elements of a good project. The following list is modified from their book and Gary Stager’s web resource.

1. Purpose and Relevance

Is the project personally meaningful? Does the project prompt intrigue in the learner enough to have him or her invest time, effort, and creativity in the development of the project?

1. Time

Sufficient time must be provided for learners to think about, plan, execute, debug, change course, expand, and edit their projects. Class time affords students equal access to expertise and materials; projects may also need sufficient out-of-school time.

1. Complexity

The best projects combine multiple subject areas and call upon the prior knowledge and expertise of each student. Best of all, serendipitous insights and connections to big ideas lead to the greatest payoff for learners.

1. Intensity

Children have a remarkable capacity for intensity that is rarely tapped by the sliced-and-diced curriculum. Projects provide an outlet for the exercise of that intensity. Think about how long kids can spend mastering a video game, reading a favorite book series, memorizing the attributes of Pokemon, or building a tree house, and you have a good template for successful project-based learning.

1. Connected

During great projects students are connected to each other, experts, multiple subject areas, powerful ideas, and the world via the Web. The lessons learned during interpersonal connections that are required by collaborative projects last a lifetime.

1. Access

Students need access to a wide variety of concrete and digital materials anytime, anyplace. Personal student laptops make this possible, but we also need adequate access to craft materials, books, tools, hardware, software, and Internet access that allow learners to follow paths we may never have anticipated.

1. Shareable

This is the big idea of project-based learning! Students need to make something that is shareable with others. This provides a great deal of motivation, relevance, perspective making, reciprocal learning, and an authentic audience for the project.

1. Novelty

Few project ideas are so profound that every child needs to engage in its development in every class, or year after year. Yes, that means that it may be time to rethink the annual marshmallow adobe project. If one student makes a fantastic discovery during a project, others can learn from it without slavishly repeating the steps of the pioneering student. In a healthy community of practice, learning continues and knowledge is shared naturally without coerced repetition (<http://stager.org/articles/What%20Makes%20a%20Good%20Project.pdf>)

**In a Maker Space**

Not all Maker activities start with a problem sketch or a challenge. Typically at non-profit or commercial Maker Spaces, individuals come to a site like the TechShop in Menlo Park, CA (one of the first and started in 2006) with a project they would like to work on or a tool they would like to learn.

For example, the Maker Space in the Chelsey Market in New York City (<http://makezine.com/2013/09/14/summer-of-making-in-nyc/>) posts projects that people can do, lists the price for the activity, and has people sign up to work in a facilitated group. The price includes expert help, all materials, and a set time for project completion.

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**Appendix 1 - Design Challenge: Our Aging Society**

**Overview**

In 2011, Human Resources and Skills Development Canada reported that 15.3% of British Columbia’s population was classified as aged (age 65 and over). It also predicted that this population would increase to 23.8% by 2036. As a result, there is a real concern about providing support structures for these citizens.

**Design Rationale**

The population of BC prides itself on being mobile, whether it is by driving, riding public transportation, biking or walking. Mobility is important for many reasons, including shopping, accessing health care, and participating in social gatherings – just to name a few. Research suggests aging in place is beneficial on many levels, but experience tells us that as people age it becomes increasingly difficult to satisfy their need to enjoy the activities that make life rewarding as well as participate in everyday tasks.

**Problem Scenario**

Your team has been selected to develop the prototype of a tool that will help this identified population with their need to get out of their homes and participate in public outings.

This tool must be hand-held and be able to satisfy one of the following identified concerns:

* Getting dressed
* Transportation / travel
* Personal Security
* Carrying purchases
* Paying for purchases
* Shopping for food, clothing, other personal items
* Maintaining their homes – basic repairs, gardening, etc.

**Success will be determined by**

* Uniqueness and usability of the tool
* Alignment of the prototype with the design
* Ability of your tool to help the elderly get out and about
* Alignment to engineering design motto: **“Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener”**

**Parameters**

* You must use each of the items in tool kit in some way
* You may make a pitch to use the materials found in the Pantry.
* You should use the tools located in the Shared Tool Area

**References**

Alberta Learning. (2004). Focus on inquiry: a teacher’s guide to implementing inquiry-based learning. Edmonton, AB: Learning Resource Centre. Retrieved from <http://education.alberta.ca/media/313361/focusoninquiry.pdf>

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