Sitka Makerspace Project: A Preliminary Analysis of Phase One

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2016-17 School Year

Overview

During the spring of 2016, and the 2016-2017 school year, the Sitka School District inaugurated Phase One of a makerspace project. Phase One consisted of defining the approach to developing and using makerspaces; identifying and purchasing makerspace materials; and facilitating teachers who wanted to use "making" in their classrooms. Facilitation happened largely through the efforts of Sitka Winter Fellow Shoshi Bieler, who conducted many workshops that introduced teachers and students to the makerspace cart, materials, and methods.

During Phase One, a limited case study research methodology was used to document how teachers and students responded to engaging in makerspace activities. The primary research questions were simply: How was the makerspace received by teachers and students? What suggestions do they have for further development of makerspaces in the Sitka School District? Before presenting the major findings from that research, "makerspace" is defined in basic terms to provide context for the findings.

What is a Makerspace?

The Oxford Dictionary defines a makerspace in general terms in the following way:

> A place in which people with shared interests, especially in computing or technology, can gather to work on projects while sharing ideas, equipment, and knowledge.

Redina, from the Journal of the American Association of School Librarians, defines makerspaces from the perspective of using them in a school context in the following way:

> A makerspace is a place where students explore, create, tinker, play and imagine.

Spaces.makerspaces.com defines makerspaces from the perspective of community makerspaces (vs. school makerspaces) in the following way. I include this because it is important to note that makerspaces translate from school to community:

> … makerspaces are community centers with tools. Makerspaces combine manufacturing equipment, community, and education for the purposes of enabling community members to design, prototype and create manufactured works that wouldn't be possible to create with the resources available to individuals working alone.

To paint a composite picture of makerspaces as they appear in schools, imagine students abuzz with activity, using a number of materials – including everything from pipe cleaners and programming languages, to 3D printers and small robots – to invent anything from vehicles to electronic games. Imagine students working together, sharing ideas and materials, as they create original projects in an atmosphere of excitement, exploration and learning. That is what a makerspace looks like.

But to appreciate the truly evolutionary nature of makerspaces, one needs to look beyond just the activities and see makerspaces as a new way of thinking about learning. In maker activities, students are combining playing, inventing, engineering and artistry to create original projects that reflect personal and often evolving goals. The general development process they use is the two-step creative development process described by Sir Ken Robinson. In this process, students first enter the “flow of creativity” to produce an iteration of their projects. Then they back away from their projects to make objective judgments about their progress, before re-entering the creative flow to create the next iteration. This process continues until students feel they are done, or a limitation, like class time, ends the project. The two steps taken together are what this researcher calls “creatical thinking” or “creatical production.” This process is at the heart of the making process.

Major findings from Phase One

1. **Phase One was an exploratory year.** The first year of using makerspaces was purposely open. The focus was exploring the potential of "making," rather than on tying making to academic goals. The materials provided by the maker cart facilitated a wide range of activities and helped define making as arena of activities and perspectives that could be adapted to many curricular areas and kinds of projects, at many grade levels.
2. **The benefits of using a makerspace were positive, clear and compelling**. Questionnaire results and observations confirm that teachers were overwhelmingly positive about using making activities in their classrooms, noting that students were highly engaged as they used creative problem solving and critical thinking to invent original projects. Students were observed to be highly engaged in a creative process of trial and error in pursuit of goals they had largely defined. Making enables students to define and own their learning in very real, engaging ways.
3. **Makerspaces provide effective environments for STEAM training.** The academic movement known as STEAM (Science-Technology-Engineering-Art-Math) is clearly evident in the makerspace movement, and in the activities of those involved in the Sitka Makerspace project. In Phase One, STEAM was approached in an informal way. It subsequent phases there is the potential to approach STEAM more formally through curriculum integration.
4. **"Making" is highly regarded, yet its benefits are difficult to measure, which could limit its adoption.** Using makerspaces has emerged as an important component of K-12 education. However, even though the value of "making" is highly regarded as facilitating a kind of learning that students need in a world driven by creativity, innovation and invention, that

value is hard to measure using traditional methods of learning evaluation. This may impede the adoption of using makerspaces in education.

Recommendations for Phase Two

5. This recommendation concerns the curricular integration of making and is in two parts:

a. One way to further develop the use of makerspaces is to tie maker activities to traditional curriculum. Using makerspaces in a goal-oriented academic environment in which students deliberately apply math, science and principles of narrative to what they build, will bring makerspaces into the K-12 mainstream. This would allow educators to use making to demonstrate learning, and to evaluate that learning using current assessment tools. In addition, teachers can base maker activities upon existing standards drawn from a number of content areas, as well as professional groups, such as the International Society for Technology in Education (ISTE). It already appears that teachers are trying to incorporate making into their classroom activities, as suggested by the following questionnaire responses:

- (Students used) Ozobots (small robots) to practice finding the slopes of different lines.
- The Ozobots added an element to

our unit on Wants and Needs in a Community that I was not expecting.

b. **However, approaching the use of makerspaces solely by requiring it to fit current curricular goals could eliminate or at least dilute what it has to offer modern education. Therefore, the curriculum will also need to change and expand in order to reflect the benefits that making offers.** Making has the potential to redefine some aspects of education in important ways. This can only happen if we change some of the assumptions about what is important in the education of our children, and the skills associated with success. Placing more value on innovation and creativity would create a natural context for makerspaces. Elevating the importance of STEAM would do the same. Expanding the curriculum in ways that facilitate what making has to offer may also require the development of new standards and methods of evaluation.

7. **There is clear demand for more access to makerspace materials.** The Sitka School District wisely started small by investing in just one makerspace cart in order to test interest. According to an educational technology survey administered this year, teachers expressed great interest in using makerspaces and requested more access to makerspace materials. This will be achieved during Phase Two by purchasing a smaller cart for each school.

8. **Phase Two should continue to pioneer new ways to use makerspaces**. While the focus of Phase Two should be the issue of integrating makerspaces into the curriclum, Phase Two should always reserve some of its resources to explore new makerspace territory. A makerspace by definition is a place – as well as a way of thinking – that facilitates the invention of new perspectives and products. Sitka can keep this alive by looking for ways to continue to expand the boundaries of what makerspaces can do as well as the needs that it can meet.

Implementation Notes

Given the flexible nature of "making," the space itself can take many forms, including a separate space within a school; makeshift areas within classrooms; and a mobile approach- a makerspace on wheels. In addition, making can be approached in a number of ways, including integrating it into classrooms; pursuing it as an afterschool activity; and integrating it into community makerspace activities. The Sitka Makerspace team decided early on that it wanted a makerspace that was mobile – that is, easily transportable - so that it could be shared throughout the district relatively easily. In addition, the team wanted to integrate making into classroom activities to ensure the widest penetration into school culture. Therefore, Phase One focused on finding the right mobile cart to facilitate this. The mobile cart pictured here was selected because it offered a good combination of design, durability, and mobility, and was relatively inexpensive.

A makerspace also needs the raw materials of "making." The goal in selecting materials was to serve a number of different content areas at a number of grade levels. Research about other makerspaces helped determine the makerspace materials list that can be found in Appendix II.

Research Methodology

In this first phase of integrating making into the Sitka school culture, research was conducted in accordance with limited resources. The research goal was to provide a sense of the attitude towards making by those involved in using makerspaces in order to chart a course for the further development of using makerspaces in Phase Two. The makerspace team opted for a case study approach, combining the following kinds of data:

1. Questionnaire data – One questionnaire was specifically about using the makerspace cart and materials and sought input from teachers who used these resources about their experiences. Another source of questionnaire input was the technology survey, which was administered to all teachers. Most responses in both questionnaires were very positive about using makerspaces, noting student engagement, creativity and experimenting with problem solving strategies.
2. Direct observations and participant observation – These were conducted by myself and Ms. Bieler of teachers and students using the maker cart and making materials. I conducted four observations during the 2016-2017 school year, for a total of 8-10 hours of observations. Ms. Bieler worked with students and teachers throughout the year. See Appendix I for a list of hours logged by teachers using the makerspace cart and materials. Observations support the

questionnaire results: Students were observed to be positively engaged as they took charge of their own learning to pursue the development of unique art and engineering projects.

3. Artifacts – These consist of lesson plans, meeting notes, the IRB application, and other artifacts. IRB application was made through Fielding University, where I work.

Concluding remarks

Phase One was a successful exploratory year. It established a base line of makerspace activity and generated a good deal of interest among teachers and students. Phase Two holds great promise. The purchase of smaller makerspace carts for each school, and the goals of both facilitating the integration of making in curricular areas as well as exploring new areas of makerspace activities, should provide breadth and depth to the makerspace culture in the Sitka School District.

References

Redina, D. 3/21/16. *How We Define Makerspaces.* http://knowledgequest.aasl.org/how-we-define-makerspaces/

Oxford Dictionary. (n.d.) Definition of Makerspace. https://en.oxforddictionaries.com/definition/makerspace. Retrieved 5/13/2017.

Makerspace.com. Definition of Makerspace. (n.d.)http://spaces.makerspace.com/. Retrieved 5/13/2017.

Ohler, J. (2010). The Uncommon Core. *Ed Leadership*. 70(5).

Robinson, K. (20110. Out of our minds: Learning to be creative. Oxford, UK: Capstone Publishing.

Appendix I - Makerspace Usage

Sitka Makerspace Project		
Phase One Use		
2016-17 School Year		
	Classrooms	**Other**
Kindergarten	3	
1st grade	2	
2nd grade	2	MakerFaire
3rd grade	2	MakerFaire
4th grade	2	MakerFaire
5th grade	2	
8th grade	4	
Blatchley		DYP, Gifted
PHS		J session
REACH		Specials
Students Impacted		**357**
		+MakerFaires

WHAT IS THE MOBILE MAKER CART?

The Mobile Maker Cart is a portable station for making, tinkering, and creating.

The cart contains many resources, which are discussed in more detail in the following pages. Each section also includes some sample projects, though there are infinitely more! Most of the resources on the cart emphasize the use of familiar and unfamiliar materials. For example, through Squishy Circuits, students learn about circuits by using play-dough (a familiar material) and electrical compononets such as LEDs, wires, motors, and battery packs (potentially unfamiliar materials).

Cart resources

Below is a list of the cart's staple resources, though we are always adding new fun things to it:

1. MaKey MaKeys (classroom set)
2. Ozobots (classroom set)
3. Squishy Circuits (classroom set)
4. Paper and Fabric Circuit materials
5. Raspberry Pi computers (x6) + accessory kits
6. 3D Printer
7. Breadboards
8. LEDs
9. Drawdio (x1)
10. Various craft/building items (balloons, pipe cleaners, popsicle sticks, etc)
11. Soldering Iron + accessories
12. iPad Minis (x6)

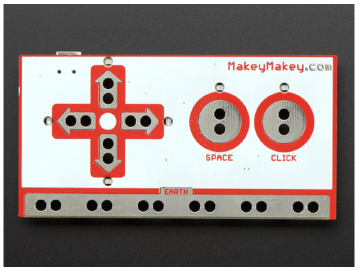
Why making, tinkering, and creating?

Ultimately, the resources on the Cart are all about creativity, imagination, and learning. The Cart provides students with a chance to creatively and imaginitively explore. There is no "one way" to use any of these materials. Because of this, students and teachers are encouraged to tinker, have fun, and see what they discover!

Making mistakes and learning from them is also a huge part of tinkering and the discovery process of making. Often, these materials will not work as expected right away, requiring students to try out numerous approaches and see what works.

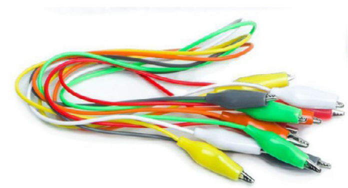
CART INVENTORY

MaKey MaKeys



6 MaKey MaKeys

6 USB Cords



Assorted Alligator Clips

Ozobots

24 Ozobot Bits

3 Charging Ports

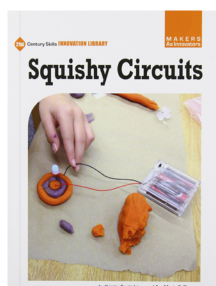
Markers

Code Sheets

Squishy Circuits

6 Battery Packs

6 Motors



Guide Book

Paper and Fabric Circuits

Copper Tape

Conductive Thread + Sewing Needles

3V Coin Cell Battery

CART INVENTORY continued

Raspberry Pi

6 Raspberry Pi Computers

6 Monitors w/ Speakers

6 Wifi Dongles

6 Pi Power Cables

6 Monitor Power Cables

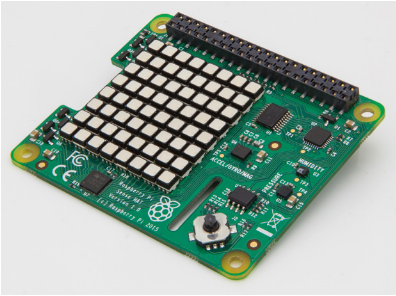
6 HDMI Cables

6 Computer Mice

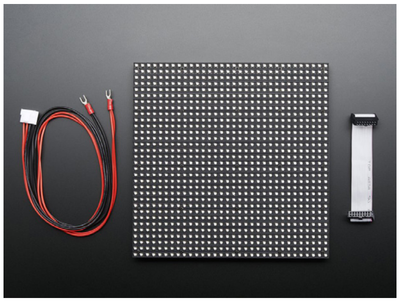
6 Keyboards

CART INVENTORY continued

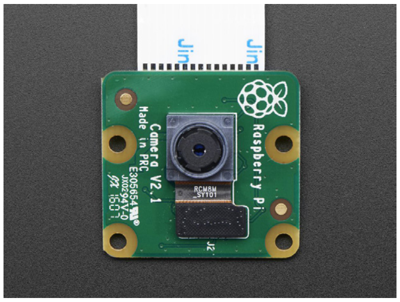
Raspberry Pi continuted



1 Sense Hat



1 LED Matrix

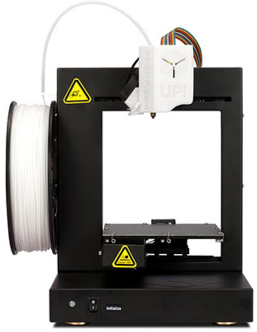


1 Camera

1 Spy Camera

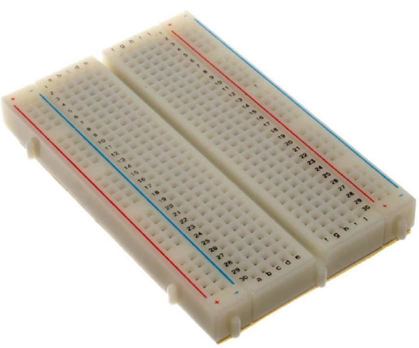
CART INVENTORY continued

3D Printer



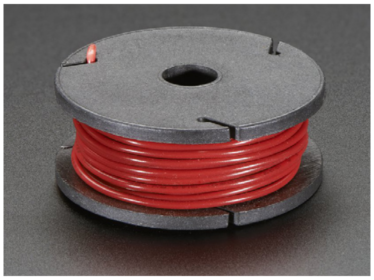
UP! Plus 2 3D Printer

Breadboards + Accessories



Breadboards

Jumper Wires



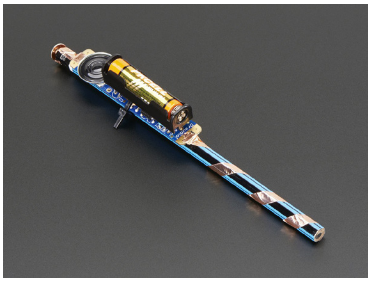
Insulated Wire

Assorted LED lights

Assorted Resistors

Push Buttons

Drawdio



1 Drawdio Kit

CART INVENTORY continued

Soldering Iron

Soldering Iron

Soldering Wire

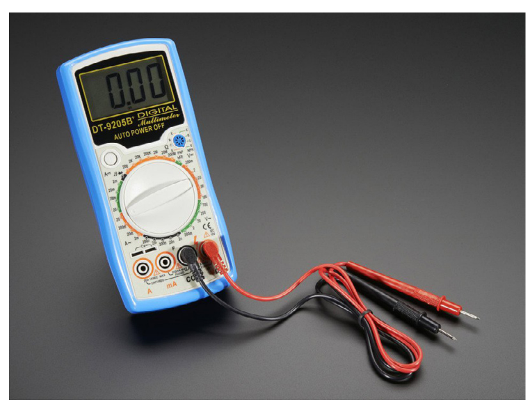
Solder Wick

Solder Sucker

Vise

Solder Tip Cleaner

Soldering Stand



Digital Multimeter

CART INVENTORY continued

Assorted Tools

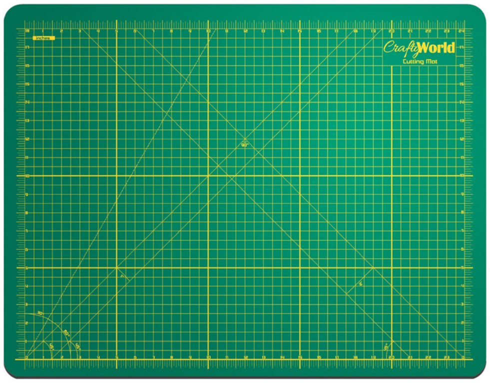
Flush Diagonal Cutters

Pliers

Hot Glue Gun

Wire Cutters/Strippers

Power Strips



Self-Healing Cutting Mat

CART INVENTORY continued

Assorted Tools Continued

Tweezers

Super Scissors

65-Piece Ratchet Screwdriver and Tool Bit Set

Rotary Cutter

CART INVENTORY continued

iPads

6 iPad Minis