

## **Principles and Practices of Making Inside and Outside Schools**

**Provocation:** How does a make/maker framework support learning?

**Discussant:** Deborah Fields

## **Connected Youth-Adult Partnerships in Informal Environments**

Ericka Brunson, Kitsap Regional Library

Megan Burton, Kitsap Regional Library

With our Make Do Share project, Kitsap Regional Library has created a framework for public libraries to engage with their communities in order to facilitate informal STEM learning. Integral to this framework is Practice, an intensive internship in which youth leverage personal interests in order to co-design a project which supports library and community needs. Through this process, staff intentionally coach youth through the 21st century skills which they are developing/demonstrating and how those skills might transfer to college and career goals. By taking the time to develop individual youth - staff partnerships, we have been able to achieve deep impact with participants as well as richer and more authentic youth programs.

Project staff will highlight individual case studies, as well as share program components applicable to youth workers in other informal learning environments.

## **Implementing Culturally-Centered Robotics Programs Through Library Partnerships**

Jiéyì Ludden, Seattle Public Library

Libraries have traditionally practiced within an equality rather than equity model, mostly centered on reading literacy. At the Seattle Public Library (SPL), we are looking for novel ways of practicing library instruction by being more culturally responsive in the way we serve communities and support digital literacy access. As part of a multi-pronged research and education collaboration, The University of Washington (UW), SPL, a science center, and a Native American cultural center partnered on a 3-year NSF grant teaching robotics to families across Seattle through multi-part workshops. In this talk, I will focus on SPL's role in the Robotics Backpack project and observations around cultural equity in digital media programs from an informal learning practitioner's perspective.

Over the past few years, SPL has been engaged in a community listening process with researchers, educators, community leaders, and the general public about the role SPL has in the community and the kinds of changes that our communities would like to see. Some of these changes include emphasizing equity; utilizing community partnerships; and supporting multiple kinds of literacies, including digital literacy. SPL has expanded the way that we serve our community by bringing books and mobile hot spots to homeless encampments, coordinating summer learning programs, and hosting mobile makerspaces.

With the Robotics Backpack project, SPL partnered with a low-income housing organization to offer culturally-centered and intergenerational robotics workshops at the housing site and will be hosting more workshops at other locations across the city. Our hope is that by going to where people are, and providing critical services such as providing meals, translators, and hiring

on-site childcare, we can reach families who may see coming to the library as a barrier to access. And, by grounding workshops in narratives around individual, family, community, and cultural identity through visual storytelling we can introduce robotics as another tool for expressive meaning-making.

Amy Twito, Seattle Public Library  
Rekha Kuver, Seattle Public Library

### **Designs for Digital Making: How Programmatic Forms Impact Constructionist Learning**

Emily Schindler, University of Wisconsin-Madison

This presentation explores maker program variation across one public library system seeking to brand 'making' as a core service of their libraries. To engage learners in constructionist practices without forgoing ideals of equity, access, and diversity, public libraries have stepped in as learning environments that offer maker programs from a democratizing perspective. This presentation will characterize the maker programs available across nine libraries and examine how programmatic design impacts constructionist learning. Using frameworks for classifying programs developed by the Children's Museum of Pittsburgh, we find that programs tend to be single session, occurring in modifiable spaces, and geared towards amateur makers. Most interestingly, we find that digital technology-focused maker programs deviate the trends offering more robust opportunities for constructionist learning. First, many of the digital technology programs took place in a dedicated space –the "Media Lab" at the city's largest library. The space provided a physical sense of "being there" over time; the space, tools, materials, and people are always there. Further, the special requirements of digital making seem to encourage a permanence that invited return visitors and more extended learning trajectories, providing an anchor to participants for place and identity.

In efforts to broaden access, many programs focus on breadth rather than depth; yet, constructionist learning requires open-ended time. While access to new things fits well with enabling the widest swath of people to have exposure to the widest range of experiences, it may undermine structures to support dispositional and extended learning, and opportunities for learner agency. The democratizing promise of the Maker Movement cannot rely solely on increasing access to such brief encounters. For people to truly express themselves, a process whereby learners can invest is vital. Indeed, learning via digital tools demands opportunities to construct meaningful relationships with materials, tools, community, and place. Making, when part of this constructionist ideal, comes from the privilege of resources: access to tools, materials, guidance, community, sense of place, purpose, and time. This is no easy task; thus, we offer up these programmatic features, affordances and constraints, to better address the need to democratize making and expand these privileges.

Erica Halverson, University of Wisconsin-Madison  
Alexandra Lakind, University of Wisconsin-Madison

### **Making with Biology: How to Grow Socially Responsive and Creative Designs with bioMAKERlab**

Debora Lui, University of Pennsylvania

Traditional media learning has considered printed text, animated videos and even electronic textiles for communicating messages and making expressive designs. Few have considered living organisms as tools for making and designing. In synthetic biology, participants make their own DNA, gene by gene, and then grow their designs into real applications by inserting them into microorganisms to develop different traits and characteristics provided by the genes. These biological products can be used for real-world applications ranging from living sculptures and paintings, to DIY air or soil quality detectors. Here, we report on three biological making (biomaking) workshops for high school students that we developed with our interdisciplinary team of designers, biologists and educators, which utilize our bioMAKERlab fabrication machine: a tool that allows for growing and monitoring synthetic biology products. Focusing on real-world contexts for biomaking from sustainable manufacturing to public health, we implemented these activities in two high school STEM classrooms. Students in each workshop used our bioMAKERlab fabrication machine to make different synthetic biological designs such as 1) bioLOGO, a logo design using bacteria-created pigments for a student-proposed sustainable company; 2) bioSENSOR, a biologically derived environmental sensor that takes on a fluorescent glow in polluted water samples; and 3) bioCAKE, a vitamin-enriched designer cake made from genetically modified yeast. We will share examples of students' approaches to making with biology along with their final designs, looking particularly at how students integrated design thinking and creative making with biology content. We will discuss how these biological 'wet' making activities compare with traditional technology or media-based activities as forums for creative design and personal expression within K-12 educational settings, thus extending what people traditionally think of making and creative design into the future.

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### **If These Walls Could Breathe: The Literacies of Making a “Living Wall” in High School**

Molly Buckley-Marudas, Cleveland State University

With digital technologies and tools more accessible and the “do-it-yourself” ethos prevailing among youth, we have seen increasing interest in bringing the maker movement into schools (Pepper, Halverson, & Kafai, 2016). As “making” moves into schools, there is a need to deepen our understandings of the literacies that are tied to and emerge from this kind of intellectual work and hands-on making. Although there is a tendency to think about “making” in the context of STEM, there is much to learn about literacy practices connected to this work in school.

This presentation will share what happened when 12th graders were offered an invitation to build “living walls” in school. Although we have seen a rise in living walls in business settings (e.g., Goodyear), they are built by professionals. In this account, students in a public, urban, school were the creators. Instead of sitting at their desks and studying scientific systems in textbooks or imagining the impact of a living wall on a school environment, this digitally-mediated project put youth in charge of conceptualizing, designing, and creating their own living walls. As part of an interdisciplinary, 10-week unit, students worked in teams to build

their walls. All walls were 3 feet x 7 feet, but had different variables added in the growing process. The unit's essential question was: How does changing an aspect of a system impact the efficiency or result of the system? The project connected to many areas of the curriculum, from thinking about water purification to nitrogen cycles and sustainability to aesthetics.

This presentation will share results from a qualitative study that addressed the following questions related to the living wall project: What does it mean for teachers and youth when making is integrated into core curricula? What different literacies (e.g., disciplinary, digital, arts) are required to navigate the construction of a living wall? What literacies are developed in and through this learning opportunity? This account offers insights on the potential of making to expand adolescents' literacies. Practitioners and researchers could use this knowledge to design more progressive, more meaningful opportunities for all students in our schools.

### **Humanities Fabrication: The Wisconsin History Maker Kit**

Mitchell Ogden, University of Wisconsin - Stout

Inspired by the Kits for Culture from the Jentery Sayers' Maker Lab at the University of Victoria, the History Maker Kit (HMK) project is a manifestation of humanities fabrication that aims to engage historical and cultural content in a hands-on way. The first HMK project is the Spaghetti Spinner, the absurd invention of a Russell Oakes, a Wisconsin tinkering adman who, in the spirit of contemporaries Rube Goldberg and William Heath Robinson, offered a playful critique of the mechanical excesses of the mid-twentieth century. Unlike Goldberg and Robinson, who only illustrated their absurd machines in their satirical comics, Oakes created working prototypes, ranging from a Catsup Getter-Outer to a Donut Dunker, and toured with his menagerie of contraptions in an entertaining show around the Great Lakes region.

The driving goal of the HMK project is to present Wisconsin history to school-aged students through their hands. The vision of FabLabs and maker spaces, as promoted by Neil Gershenfeld and others, has caught fire in the education sector, and K–12 schools are ordering desktop fabrication equipment, especially 3D printers, before they know what they will do with them. It is an exciting, if chaotic, time as desktop fabrication capabilities rapidly expand across public school systems. Recognizing that many of the applications for maker spaces default towards science, engineering, and entrepreneurship, we want to assert productive and engaging uses of desktop fabrication for humanities-based learning, including haptic explorations of historical and cultural topics.

Each assembled History Maker Kit includes all of the digital files, laser engraved components, and hardware required to recreate Oakes' Spaghetti Spinner. The kits also include copies of primary documents, biographical and historical information, assembly instructions, and pedagogical documentation. Working in collaboration with the Waukesha County Museum, the University of Wisconsin–Stout will distribute physical kits to classrooms (from grade 4 through 8) across the state for testing during the 2017–2018 school year. The entire contents of the kit are open-sourced and will be made freely available to schools to create their own kits.