Bots for Tots: Leveraging 'Ways of Knowing' to Increase Diversity in Makerspaces

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Abstract

Projects designed to give children experiences playing and building with high tech equipment such as 3D printers, laser cutters, and microcontrollers have gained momentum in recent years among researchers, educators, and parents. Despite an explicit commitment to epistemic diversity, *makerspaces* have struggled to serve a diverse population of creators and have become heavily dominated by men and the highly educated and wealthy (Moilanen, 2012). The Bots for Tots project is an effort to move beyond surface level participant characteristics (such as girls like fashion) and to instead explore the affordances of activity framings and structures that tap into alternate mental dispositions and ways of knowing to broaden participation and interest in maker activities.

The Bots for Tots project engages elementary children to design and build a "dream toy" for younger children in their community. Workshop sessions are designed to engage participants in interviewing stakeholders, brainstorming and critiquing, prototyping, and construction. In a pilot study involving 8 girls and 2 boys, dream toys were constructed using a variety of methods, such as sewing, laser cutting, and 3D printing as well as materials such as fabric, cloth, wood, acrylic, and extruded plastic. While data collection is ongoing, early findings suggest this activity framing may be fruitful as participants drawn to the project were overwhelmingly female, were highly interested in technology and making, and had some experience engaging in craft activities. Further analysis will evaluate the materials and techniques used by participants, how mixed and same gendered teams interacted, STEM content encountered by participants, and the degree to which framing the activity as being about making for others impacted day to day activities.

Figure 1. Dream toys were constructed using a variety of methods, such as sewing, lasercutting, and 3D printing as well as materials such as fabric, cloth, wood, acrylic, and extruded plastic.

Keywords

Construction; STEM; making; technology; craft; increasing diversity

Introduction

Projects designed to give children experiences playing and building with high tech equipment such as 3D printers, laser cutters, and microcontrollers have gained momentum in recent years among researchers, educators, and parents. Despite an explicit commitment to epistemic diversity, *makerspaces* have struggled to serve a diverse population of creators and have become heavily dominated by men and the highly educated and wealthy (Moilanen, 2012). Maker communities, companies, and flagship projects tend to revolve around typically male-centric projects such as cars, robots, and rockets and fabrication equipment development kits continues to require a prohibitive investment (Buechley, 2013). As the "maker movement" continues to expand and enter formal education settings this mainstream method of engaging kids with STEM ideas is in danger of marginalizing girls and underrepresented communities, leaving them out of this exciting opportunity.

In an attempt to counteract this imbalance and begin to explicitly target women and underrepresented communities some designers and scholars have explored the potential of adding technology and computation to existing craft cultures and communities such as sewing and woodworking (Buechley & Perner-Wilson, 2012). While the development of sewable microcontrollers and conductive threads has led to a burst of activity within existing craft communities, these tools and fashion-centric activities have also become the de facto method of engaging young girls (who may or may not have any experience sewing) in making (e.g. Kafai, Peppler, Burke, Moore, & Glosson, 2010). Though we are optimistic about these efforts, there is a danger that relying solely on interest and assumed gender and cultural "norms", such as "girls like fashion," may inadvertently perpetuate gender and cultural stereotypes and exacerbate existing community divides.

Drawing on literature from the feminist tradition (e.g. Belenky, 1986), research on service learning (e.g. Bielefeldt, Paterson, & Swan, 2009), and data indicating female makers are driven by a desire to help and give back to their communities (e.g. Intel Corporation, 2014), the Bots for Tots project is an effort to move beyond surface level participant characteristics and to instead explore the affordances of activity framings and structures that tap into alternate mental dispositions and ways of knowing to broaden participation and interest in maker activities. In this poster we offer a brief description of the project and describe some early findings from a pilot implementation.

Activity Design

The Bots for Tots project engages elementary children to design and build a "dream toy" for younger children in their community. Workshop sessions are designed to engage participants in interviewing stakeholders, brainstorming and critiquing, prototyping, and construction. In our first pilot of the Bots for Tots project, students in two forth grade class from an elementary school located in a highly urban Northeastern US city were invited to attend a free, five-day "making workshop" with the explicit goal of designing and building toys for their school's pre-kindergarten (preK) class. Participants were broken into five design teams consisting of two children each. Design teams interviewed 3-5 preK children asking them to describe a dream toy. Design teams were prompted to probe explicitly for information about what the dream toy might look like, what it would be made of, and what it could do.

In the following workshop session, design teams described the dream toys requested and began brainstorming, individually, as a team, and as a full group, ways to combine and construct these toys. Following this brainstorming session, design teams began prototyping possible designs with an eye towards exploring the mechanics and functionality of the toy. Prototype construction and iteration occurred over 2 workshop sessions before design teams began constructing dream toys. Throughout all prototyping and final construction sessions, participants frequently came together to discuss the design process and to offer suggestions and criticism. Dream toys were constructed using a variety of methods, such as sewing, lasercutting, and 3D printing as well as materials such as fabric, cloth, wood, acrylic, and extruded plastic.

All design sessions were video recorded. Participants were interviewed before the workshop began and after the final session to determine the extent to which their interest in making and craft changed or stayed the same and to determine which activities they found interesting, motivating, and challenging. A STEM and technology interest survey was also conducted during the first session (composed of selected items from the Young Children's Computer Inventory v5.27 (Miyashita & Knezek, 1992) and the STEM Semantics Survey (Tyler-Wood et al., 2010)).

Preliminary Findings

Data collection and analysis is ongoing, however, a few interesting observations suggest this activity framing may be fruitful. In our first pilot of the project, ten children, eight girls and two boys, ages 8-10 responded within 36 hours of receiving a flier describing the workshop. One of the boy participants even expressed dismay when arriving for the first workshop session stating, "I figured there would be more boys than girls here!' Three girls explicitly indicated an interest making toys for the school's preK children suggesting that the workshop goals may have been motivating for some of the girls.

During pre-workshop interviews, all participants expressed enthusiasm for technology and making and these findings were verified by the interest survey. Participants also claimed to frequently use craft materials during their free time. For two participants, crafting and construction seemed to be particularly central to their interests as they described discovering on their own that they could mix flour and water to create play objects such as cups and bowls for use with dolls and other toys. Further analysis will evaluate the materials and techniques used by participants, how mixed and same gendered teams interacted, STEM content encountered by participants, and the degree to which framing the activity as being about making for others impacted day to day activities.

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