

# Furthering Inclusivity in Making: A Framework for Accessible Design of Makerspaces for Learners with Disabilities

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## Abstract

✓ Recent discourse on inclusive and equitable design in makerspaces primarily focuses on gender equity (e.g., Buchholz, et al, 2014; Buechley, et al, 2008) and cultural diversity (e.g., Scott, Sheridan & Clark, 2015) with little scholarly attention devoted to the accessibility for learners with disabilities (e.g., Brady, et al, 2014). Given that the design of tools and environments have an influence on how learners position themselves in a community of practice, the inaccessibility of makerspaces and activities can lead to the exclusion of individuals with different sensory, physical, and cognitive abilities. Subscribing to Universal Design philosophies (Steinfeld & Maisel, 2012) and socio-cultural perspectives (John-Steiner & Mahn, 1996; Scott, Sheridan & Clark, 2015), we contend that inviting learners with disabilities as design partners not only serves to increase their personal accessibility but also serves to enhance inclusivity across the spectrum of ability, gender and culture.

## Research Aims

- ✓ To understand the current discourse around **equity** and **inclusivity** of making in the Learning Sciences.
- ✓ To shed light on the silent attention to the **accessibility** aspect of making for learners with **disabilities**.
- ✓ To propose a holistic framework for **equitable**, **inclusive**, and **accessible** design of makerspaces for **all diverse abilities**.

## Related Work

- ✓ Making and Constructionist Learning
  - Papert (1980) "objects to think with"
  - Scratch and robotics toolkits (e.g., McNerney, 2004; Resnick, et. al, 2009; Kazakoff, Sullivan & Bers, 2013)
  - Computational literacy and "computational thinking" (Wing, 2006)
  - The Maker Movement in informal and formal education (e.g., Blikstein, 2013; Halverson & Sheridan, 2014; Martin, 2015)
- ✓ Inclusive and Equitable Learning Through Making
  - The relationships between maker toolkits and gendered participation (Buechley, Eisenberg, Catchen, & Crockett, 2008; Kafai, Lee, Searle, Fields, Kaplan & Lui, 2014): e-textiles (e.g., the Lilypad Arduino) had a positive effect on girls' willingness to engage in computing and making.
  - Bridging cultural practices with computational skills (Kafai, Searle, Martinez & Brayboy, 2014; Buchholz et al. 2014; Richard & Kafai, 2015; Richard & Giri, 2017; Richard, Kafai, Adleberg & Telhan, 2015):
  - The complexity involved in learning through cultural practice and the importance of using cultural diversity as an educational and research design asset (Nasir, et al., 2014).
  - Culturally-relevant approaches within the environment when teaching computing and making (Scott, Sheridan & Clark, 2015).
  - **Accessibility** for learners with a wide range of dis/abilities lacks scholarly and practical attention in making (Brady et al.).

## Methods

- ✓ A survey of the literature and data derived from a current project on makerspaces.
- ✓ An exploratory study with blind/low-vision high school and adult learners (with 5 participants, aged 15-19) using Kibo, a programmable tangible wooden-block robotics (Seo & Richard, 2018).

## Results

- ✓ An accessible making design framework consisting of two overarching components: (1) opportunities for accessible and equitable collaborative learning; and (2) the utilization of materials with multiple modalities:

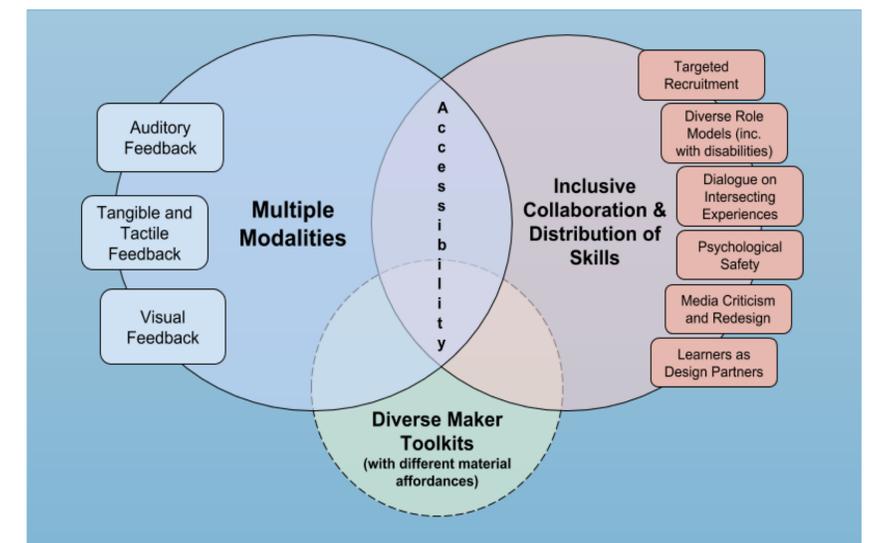


Figure 1. Framework for Accessible Makerspaces.

## Conclusions

- ✓ This framework will contribute to current maker discourse around the democratization of making by illuminating underrepresented facets, and providing practical guidelines that can enhance accessibility for all. Thus, we are not creating a space where non-disabled learners are designing for learners with disabilities, but we reshape the design stance so that learners with diverse abilities are partners in their practice.