

## **The role of community epistemologies in supporting expansive iterative design in youth's efforts to invent with and for community**

### **Objectives**

We examine the role that cultural epistemologies play in supporting youth in iteratively refining their STEM-rich inventions across settings and time. The idea that iteration is an important principle in design has been well established (Dym et al., 2005). However, in this area of research, iterations refer to opportunities to re-think or re-work designs based on technological and social dimensions, within the prototyping process (Cunningham & Kelly, 2017). Little attention has been paid to a) how the iterative process involves both pre- and post-design “lives” of inventions, and b) an intentional incorporation of cultural epistemologies towards advancing new forms of legitimate inventor knowledge and practice (Yosso, 2005).

Objectives include:

- To examine when/why youth iterate on their inventions meant to address community concerns, the role that technical and cultural dimensions play in facilitating/constraining the iterative process, and how it takes shape as youth move from idea conception through the afterlife of an invention project.
- To examine if/how the expanded iterative process disrupts normative power hierarchies as youth move/refine their inventions over time and across settings, as well as the emergent tensions in the process.

### **Theoretical Framing**

We draw from a critical justice view of equity and a social practice view of learning. Critical justice focuses attention on recognizing diversity and addressing structural inequalities perpetuated through systemic racism and classism. A central focus is in re-shifting relations of power and position within multiple scales of activity in education, and their intersections with historicized injustice that play out in classrooms. Juxtaposing social practice theory on critical justice, we make sense of how two forms of history – “history in person” and “history in institutionalized struggles” (Holland & Lave, 2009) – yield pivotal interactional practices, and how the micro-dynamics at play, create (and foreclose) opportunities for engaging in iterative design.

### **Methods**

Our study takes place in two makerspaces located in community centers in mid-sized cities. Both makerspaces have a community-engaged focus, and support youth in designing and inventing novel artifacts that address problems they and their communities care about. Both also serve a diverse youth population, with attention on youth of color and youth from low-income communities. In our overlapping researcher-educator roles, we have collaborated with both makerspaces to establish the programs within them, with the primary goals of supporting youth in sustained engagement in STEM, while also learning about making/inventing in culturally sustaining ways.

Our study was carried out as a longitudinal critical ethnography (Trueba, 1999) over a two-year period. Data were generated between 2016-2018 academic years, weekly community making

sessions with youth. Data include artifacts, youth conversation groups, and video analysis capturing youth interaction with STEM and community experts at various stages in their design process. Data analysis involved multiple stages and levels of coding based on procedures for open-coding and method of constant comparison.

## **Findings**

We ground our paper in four in-depth longitudinal cases of youth's iterative design work: Nila's light-up #stopracism sign; Su'zanne's massaging slipper for homeless people, Sharon's geodesic play dome, and Jazmyn's portable fan. Across cases, we illustrate three key findings. First, youth located broader injustices within their making/inventing discourses, suggesting that youth drew from multiple epistemologies, some grounded in community cultural wealth, others in making and STEM. For example, Su'Zanne drew from familial capital (brother's project), aspirational capital (serving the homeless in a practical way), social capital (help from allies like maker mentors) and resistance capital (recognizing injustices nested in the state of homelessness). The geodesic dome youth-makers also drew from aspirational and resistance capital in their desire to make a play structure for younger peers because of the unjust lack of play infrastructure at the community club. They too, drew on social capital in garnering support from maker mentors.

Second, iteratively engaging in design work in tandem with mining relevant community wealth afforded further design and making experiences to both the original designers and other youth-inventors. In both cases, ownership of inventions expanded to more members of the youth-making community. In Nila's case, the sign was turned on when youth felt that racism needed to be foregrounded in group discussions, and also served as reminder of how powerful electric art could be. Third, the afterlife of inventions are significant in impacting the emergent inventor-maker culture through influencing the iterative process.

## **Significance**

Iterations expand the ways in which cultural knowledge/practice became more legitimized in and hybridized as a part of STEM-rich making, re-shaping whose cultural knowledge had capital, suggesting that "expanding iterations" are critical to legitimizing knowledge and practices toward rightful presence.

## **References**

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The geodesic dome youth-makers drew from collective solidarity/resistance in their desire to make a play structure for younger peers due to unjust lack of play infrastructure at the club.