Making 4 Change:
Becoming Community Engineering Experts through Makerspaces & Youth Ethnography

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Overview & Objectives

Making 4 Change supports youth in developing productive identities in engineering, while engaging in making. Our model involves youth iteratively and generatively engaging in ***makerspaces*** and ***community ethnography*** to make sense of local problems and design solutions, while connecting into a broader social network of experts. We hypothesize this approach supports youth in metacognitively reflecting upon

- what they know and need to know to define problems and design solutions,
- their developing engineering identities, and
- the potential agency they have to make change in their community

Project objectives

1. To use design-based research to develop and refine an informal STEM learning program, *M4C*, focused on engineering for sustainable communities.
2. To develop and refine associated instructional tools and research instruments for supporting and understanding "productive identity work in engineering" to scaffold work in both makerspaces and community ethnography.
3. To study the impact of *M4C* on identity work and engagement in engineering among participating youth from underrepresented backgrounds in Lansing, MI and Greensboro, NC.

Research Questions

1. What making practices do underserved youth, ages 11-14, take up in community-based makerspaces?
2. What forms of engagement matter, for whom and why? How do these forms of engagement respond to the ways in which youth frame problems worth solving in makerspaces?
3. In what ways do youths' making practices inscribe their spaces of making with possibilities for doing/becoming in STEM?
4. What are the equity-oriented and consequential implications that relate to designing makerspaces for youth from underserved communities?

Conceptual Framework

Mobilities of Learning (Calabrese Barton, Tan, & Greenberg, 2016)

- Learning involves both **vertical** and **horizontal** movement (Engeström & Sannino, 2010)
- Ideas, practices and tools are re-purposed and re-mixed towards new meanings and new possibilities for becoming (Gutiérrez, 2012)
- Learning always takes place somewhere, both in "relation to history (time) and context (place/space) (Bright et al., 2013)
- It challenges normative views of what it means to participate in practice within community by making visible the boundaries of formal/informal, novice/expert, and past/present/future, and how these boundaries change over time and across space (Rahm, 2014)
- Learning is situated within local practice (Holland & Lave, 2009)

Research Design

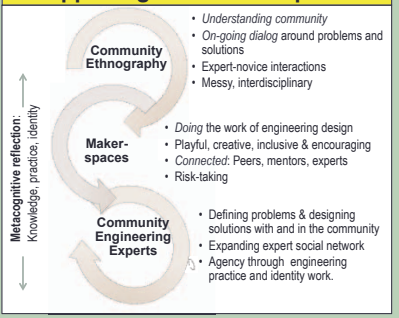
Contexts:

- United States, Lansing, MI & Greensboro, NC
- Partnership with Boys and Girls Clubs
- M4C : Afterschool Integrated STEM makerspace program
- Themes for 2014-2016: Engineering Design Challenge

Portable energy systems & safety for sustainable communities!

Data Form	Specific Data Generation Strategy
Participant Observation	• Afterschool STEM program (GET City): Video recordings & field notes of twice weekly sessions (2/wk, 30 wks) • Community Events (Feedback Cycle, Presentations at Art Museum, Field trip to college campus, etc.): Video recordings of events and field notes
Conversation Group	•Debriefing what was happening in the club as well as to plan for future activities (18 weeks, 36 hours) • 6-week segment of the conversation group focused on how/why youth shifted designs, what funds of knowledge & STEM knowledge youths drew upon for their design, and how youth positioned themselves in engaging in engineering design process
Artifact Think Aloud	• Allowing youth opportunities to talk about their engineering design work in detail • Mid year (December) – 3D Google SketchUp model of design, sketch up notebook, and initial prototype • End of year (May) – Final prototype, sketch up notebook, and movie
Artifact collection	• Youth's sketch up notebook, 3D Google SketchUp model of design, worksheets, prototype, movie, etc.

Supporting Youth Development



Youth Makerspace Manifesto

"A makerspace is a place where you can invent, have fun, and make stuff to save the world… If you don't feel welcome then you won't want to go help people build stuff. If we help people learn about what this stuff is, they'll know.

"A makerspace is a community because it's all of us there."

"It should be kid-friendly, colorful, and have a lot of space and things that you can make stuff with -- tools, lockers, computers/tablets, 3D printers, safety goggles/gloves, a first aid kit, safety precautions, and instructions/rules/schedules on white-board and chalkboards walls, whiteboard tables, chalkboard doors, storage carts, snacks, sliding "teacher chairs" with wheels and armrests, and shelves under the tables, and lots of power outlets on tables and hanging from the ceiling with extension cords, so we don't have to go all around the room so we can just stay where we're working and get more work done."

"Kids should have more opportunities like that. Most kids don't. Instead of people asking "what's a makerspace?" they will know because it's open to ALL kids. And the kids will tell their parents and their parents will tell their friends, and their friends will tell the whole entire world from generation to generation. And it's all because of us."

Equity Oriented Design Principles

1. Sustained and mutual engagement allows for playfulness and deepening understanding to co-exist, and for the emergent tensions to be *productive spaces of learning*
2. Broadening the range of maker identities for minoritized youth
3. Unpacking "community" in a community-based makerspace for youth from minoritized communiti
4. Expanding views of engagement: Critical, Connected & Collective

Youth Making Practices in an Equity Oriented Makerspace

1. Practices as rooted in community

- Expert insider knowledge & practice
- Positioned with insider-status.

2. Nodes of Criticality

Practices as enactments of their deep and critical knowledge and care for the needs their communities face

- Economic (e.g. affordable designs)
- Environmental (e.g., designs reduce their carbon footprint & support local ecologies)
- Social (e.g., positive peer relationships, healthy well-being, community ownership)
- Urban infrastructure (e.g., lighting & warmth on cold, dark days).

3. Practices as pivot points

- Navigational indicators to secure a productive launching space for science & identity work
- Specifying and refining technical design work in dialog with community interests
- Facilitating social negotiations towards broadening possibilities for becoming in STEM

Space-Making & Entry/Re-entry

1. What does youth entry and re-entry into the spaces look like and mean? What are they entering into and from?
2. What are the tools, people and resources that make this entry and re-entry possible? How are these resources activated?
3. Time? Constant entry/re-entry