What does "Funds of Knowledge" challenge in those of us who care about Math in Making?

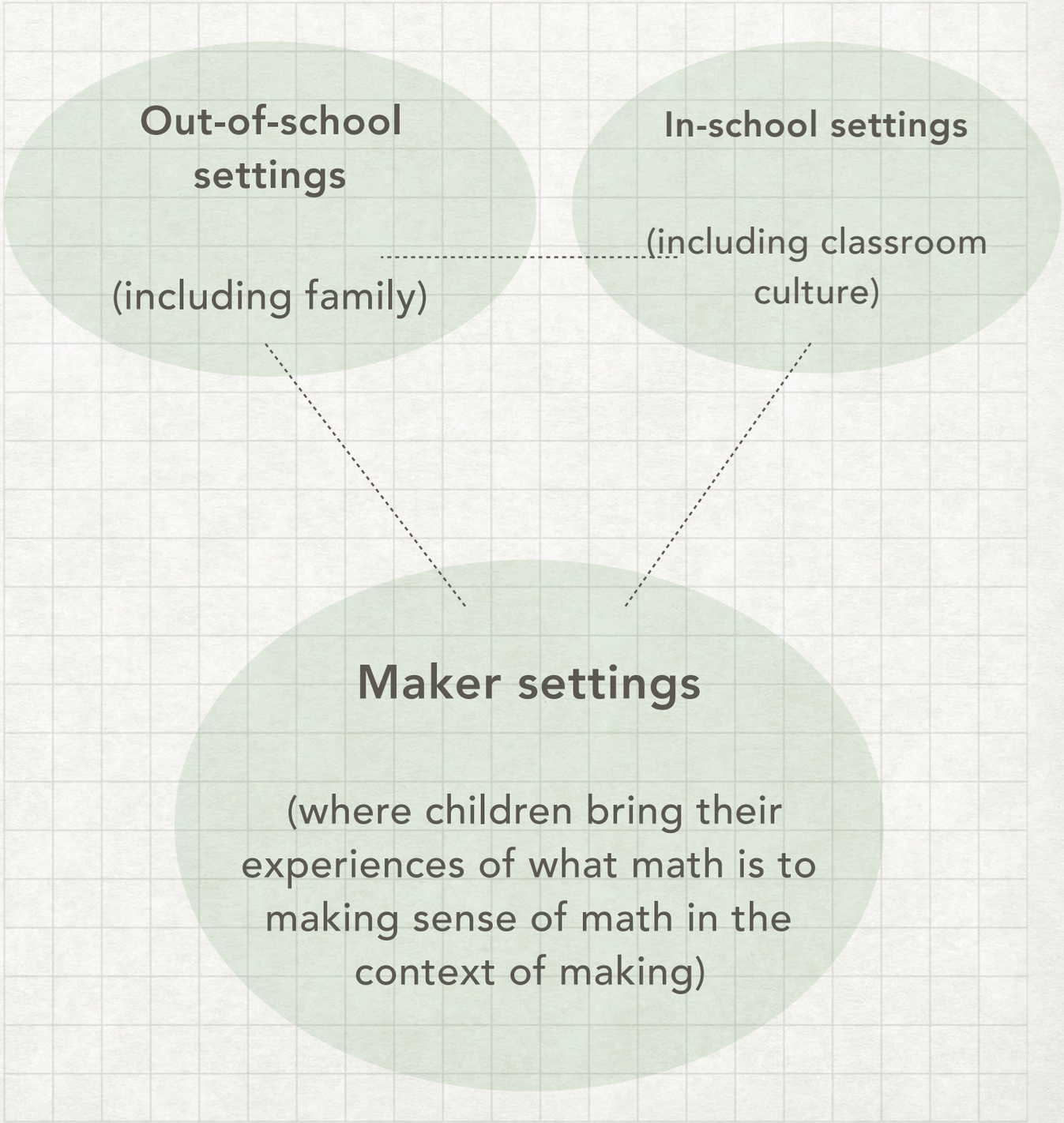
Discussant comments:
Paula K. Hooper, Ph. D.
Northwestern University
paula.hooper@northwestern.edu

CHALLENGE #1

FROM A FUNDS OF KNOWLEDGE PERSPECTIVE ... WHAT IS THE MATH IN MAKING? WHY DO WE HAVE TO THINK ABOUT WHAT CONSTITUTES MATH IN MAKING? HOW IS IT HELPFUL TO THINK ABOUT WHAT IS MATH IN MAKING?

Math in making is mathematical reasoning that is embedded in the process of making a personally meaningful artifact. This process is embedded within the social and cultural contexts of the making.

- The relationship between informal and formal mathematics is honored.
- FoK pushes us to see that mathematical reasoning takes place in family contexts for multiple authentic purposes



"Mathematics practices are always embedded within social context. Creating a zone of mathematical practice depends on not only the store of funds of knowledge, but the transformation of that knowledge into meaningful activity."

The math in making could be the math that is envisioned by Common Core?

if

We recognize that mathematical practices and content occur in personally meaningful and socially-constructed ways.

Mathematical understanding develops

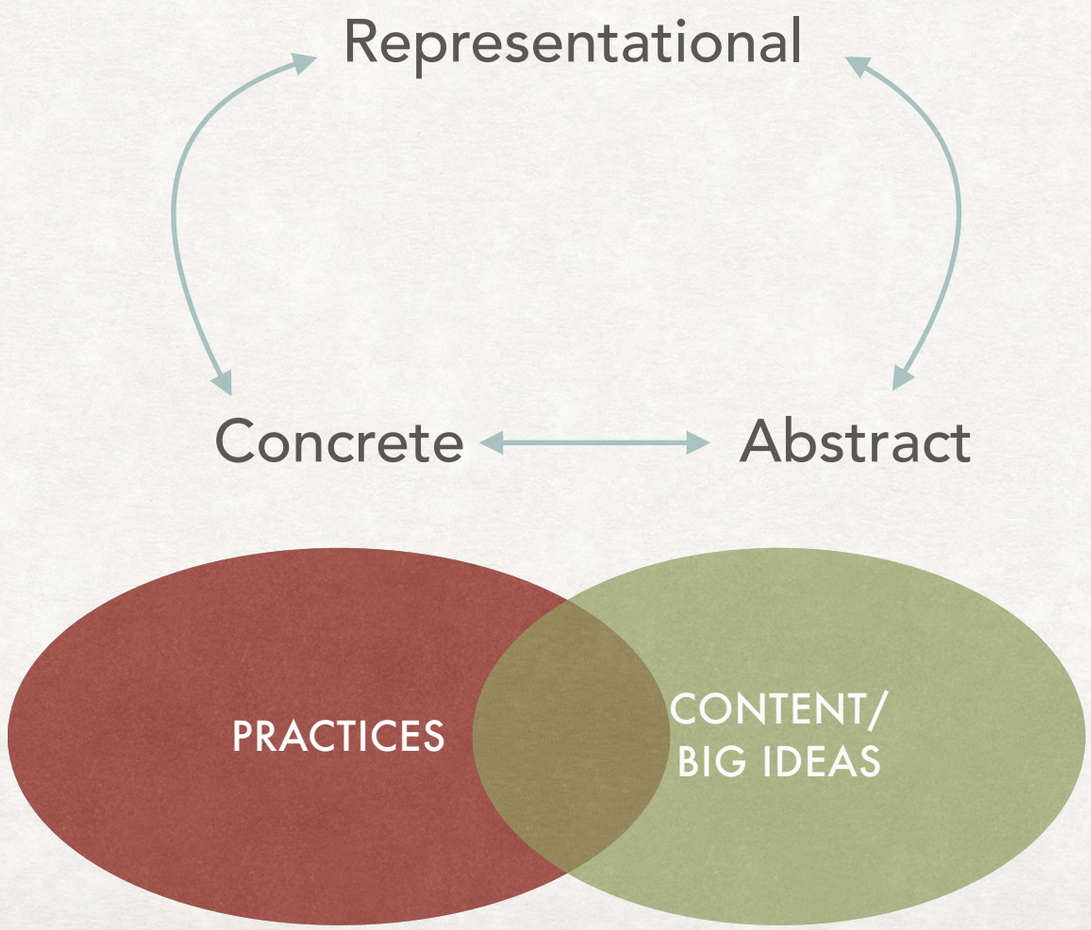
OLD VIEW

Concrete

Representational

Abstract

NEW VIEW



We are looking for something ...

Do we already have some of it?

What can we gain by seeing mathematical practices within vignettes similar to those that characterize FoK?

"How they describe their work?"

CC Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

CHALLENGE #2

EQUITY MATTERS ...

How can making/tinkering settings be designed to support the learning of all students, particularly working class and students of color?

STARTING POINTS FOR EQUITY-ORIENTED RESEARCH AND DESIGN

- Critical analyses of educational injustice
- Historicized approaches to making as cross-cultural activity
- Explicit attention to pedagogical philosophies and practices
- Ongoing inquiry into the sociopolitical values and purposes of making/ making towards what ends

Vossoughi, S., Hooper, P., & Escude, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. 86(2), 206-232.

1) HOW AND WHY ARE CRITICAL ANALYSES OF EDUCATIONAL INJUSTICES NECESSARY FOR DEVELOPING EQUITABLE FORMS OF MAKING?

Questions that can support educators and researchers in noticing and re-mediating educational inequities within Maker spaces:

- Who has access to more intellectually complex activity within this space?
- Are there gendered or racialized patterns of tool use, participation or assistance?
- Are multiple pathways and ways of knowing supported or marginalized?
- What kinds of mentorship are available to help youth navigate everyday encounters with racism and other forms of marginalization?

Vossoughi, S., Hooper, P., & Escude, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. 86(2), 206-232.

2) WHAT DO HISTORICIZED APPROACHES TO MAKING AS CROSS-CULTURAL ACTIVITY OPEN UP WITH REGARD TO DESIGN, PEDAGOGY AND RESEARCH?

"Rather than working to 'bring' making to non-dominant communities, this assumption of human ingenuity positions researchers and educators as learners, inquiring into the ways of asking, knowing and relating involved in existing forms of making." (McDermott & Raley, 2011)

Man using a bicimaquina (bicycle machine) made at CASITA, Oaxaca, Mexico to remove kernels from corn.

Hooper, P., Vossoughi, S.,& Escude, M. (2016, April). Making Equity Explicit: On the Pedagogical and Socio-Political Dimensions of Making. Paper presented in poster session at American Educational Research Association meeting in Washington. D.C.

Vossoughi, S., Hooper, P., & Escude, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. 86(2), 206-232.

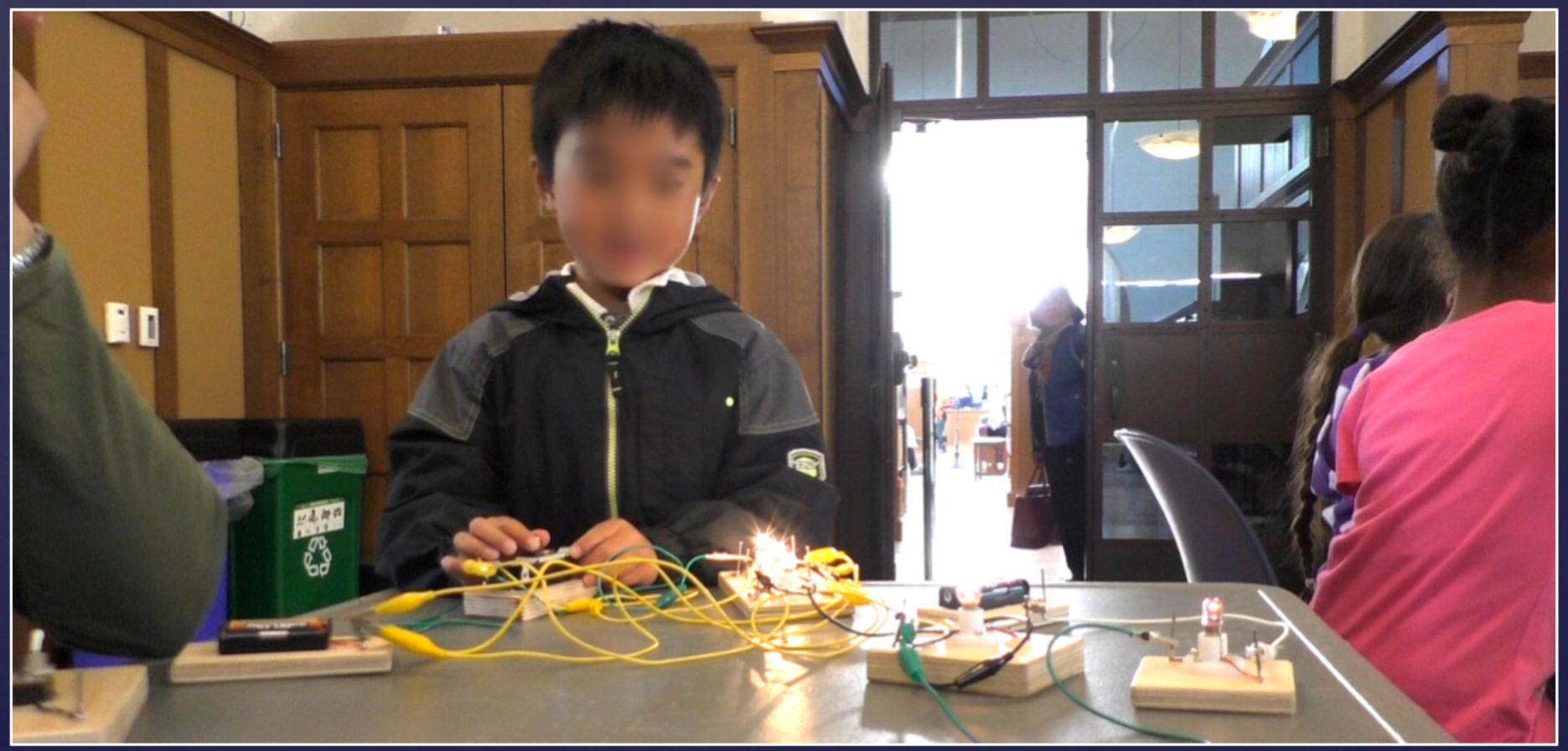
3) WHAT CAN BE GAINED FROM EXPLICIT ATTENTION TO PEDAGOGICAL PHILOSOPHIES AND PRACTICES WITHIN MAKING?

- How we see interactions that support learning matters …
- Individual - collective
- Vignettes are key to progressing the dialogue toward benefitting students of color and working class students
- Vignette: Walter's support of Arthur

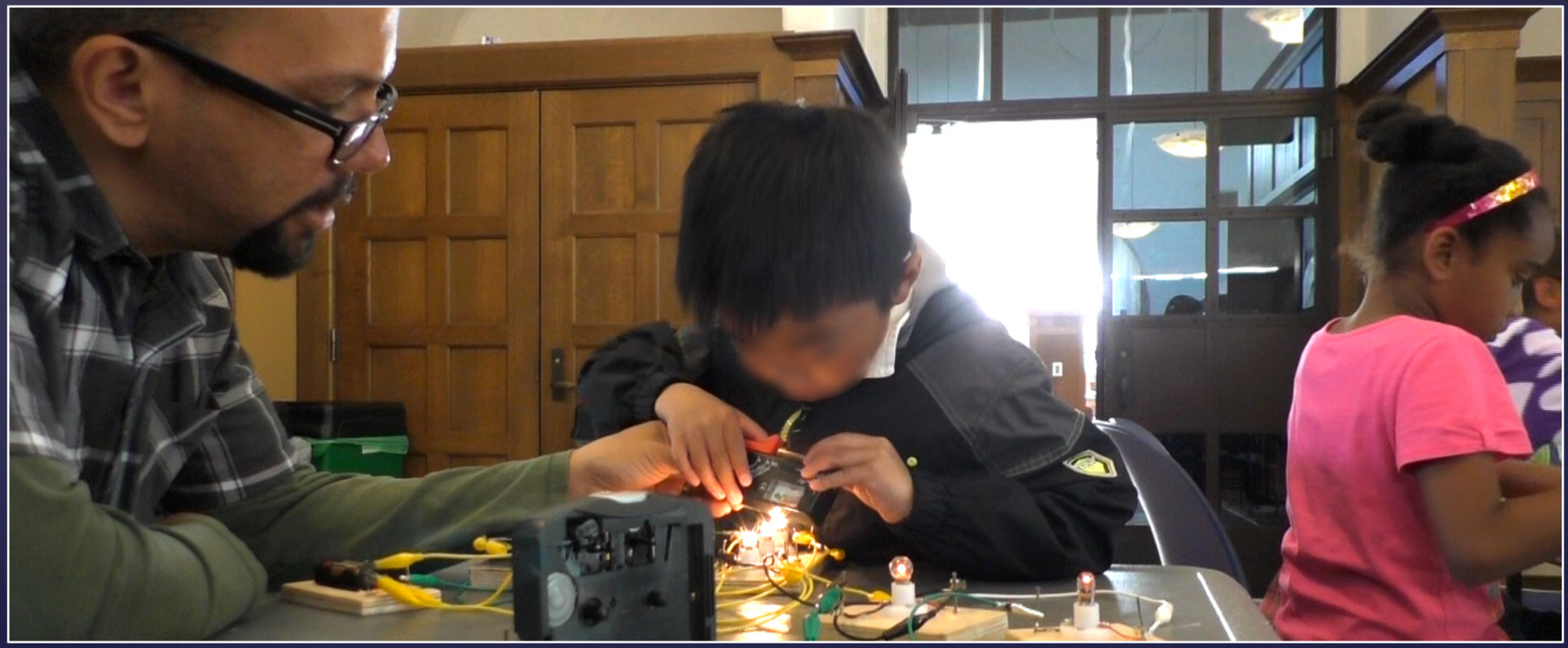
Vossoughi, S., Hooper, P., & Escude, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. 86(2), 206-232.

Vignette: Walter's support of Arthur

Arthur worked with Walter (a teacher) to explore circuitry. Arthur became excited when he realized that some of his lights were lit even though they weren't directly connected to the battery. He then called others over to point out that some lights worked "without even batteries." **Using Arthur's own phrasing, Walter affirmed and then re-framed this statement, helping to clarify what was happening, "without even batteries going directly to those light bulbs."**



Arthur then asked Walter about a battery tester that was available on the table. After Walter explained the uses of the tool, Arthur became fascinated and took a break from his circuit building in order to test all his batteries. Following this detour, he periodically switched off his circuits and spoke about the need to save their energy.



Arthur then decided to move around the room to check out the work of others, a practice that is encouraged in the setting. He spent some time as a guest at Aeden's circuit. Aeden pointed out interesting aspects of his own investigations and Arthur joined in the experiment. Aeden's own engagement with circuits seemed to ebb and flow on this day, which the educational staff later discussed as potentially stemming from his need for a greater challenge. During the end-of-the-day debrief, one staff member committed to working more closely with Aeden the following week.

Arthur then added more boards to his original parallel circuit. This opened up new questions and challenges as the lights furthest from the battery pack grew dim or did not light up at all. Walter commented that Arthur had built an "elegant circuit" and offered suggestions for ways to test and try out solutions. Some of Arthur's solutions surprised Walter, who expressed that he was also learning from Arthur's ideas, showing camaraderie in the effort. When a particular motor was added, Walter pointed out that it was affecting the intensity of light from some of the light bulbs. This threw Arthur into his final investigation of the effects his circuit boards were having on one another (Adapted from field notes by Shirin Vossoughi, 2014).

4) WHY IS IT IMPORTANT TO CONSIDER THE SOCIO-POLITCAL VALUES AND GOALS OF MAKING?

Latin American Makerspaces

> "UnLoquer, a hackerspace in Medellín,Columbia, describes its mission as contributing to the world by "creatively redefining technology." They elaborate: "We take a part and occasionally abuse technologies in search of understanding how they work in order to propose and construct devices for new uses. Included in un/loquer are empirical scientists, neighborhood inventors, cacharreros empedernidos['veteran tinkerers'], engalladores de carretas ['embellishers of horse carriages']."

Vossoughi, S., Hooper, P., & Escude, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. 86(2), 206-232.