Digging into Research:

Making & Tinkering in Afterschool

Afterschool Alliance

Today's Speakers

Molly Shea

Director of the Center for Informal Learning & Schools, Exploratorium

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Overview

1. Background on initiative (5 min)
2. Defining tinkering & making (5 min)
3. Panelist discussion (15 min)
4. Audience Q & A (10 min)
5. Audience Discussion: Using research in practice (10 min)
6. Upcoming research & opportunities (5 min)

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POPULAR KEYWORDS

NSF-funded, Identity, Youth engagement, Professional development, Museums, Interest, Discourse, Career, Motivation, Scientific reasoning, Afterschool/OST, Program design, Inquiry, Scientific practices, Equity, Culture, Sociocultural, Teaching, Science in society, Non-dominant populations

RELATING RESEARCH TO PRACTICE IN INFORMAL LEARNING ENVIRONMENTS

Browse short synopses of current peer-reviewed research relevant to informal science education (ISE). **Download** synthesis papers addressing hot topics in ISE. **Share** what's interesting to you by putting it on your public bookshelf.

Featured Research Brief

Tinkering, Learning, and Equity in an Afterschool Setting

This paper draws on ethnographic data to bring equity to the fore within discussions of tinkering and making. Vossoughi, Escudé, Kong & Hooper argue that equity lies in the *how* of teaching and learning through specific ways of: designing making environments, using pedagogical language, integrating students' cultural and intellectual...

KEYWORDS

Creativity, Equity, Identity, Inquiry, Interest, Learning Across Settings, Youth engagement

Resource Spotlight

Documenting and Assessing Learning in Informal and Media-Rich Environments

This MacArthur Foundation report summarizes an extensive review of the literature on the assessment of learning in informal settings, with a focus on the following types: After-school programs, Community center programs, Museum-based programs, and Online communities and forums.

KEYWORDS

Learning Across Settings, Museums

HOT TOPICS

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Connected Collections

Include:

- An overview and learning goals for a select topic
- 4-6 short synopses of recent research published in journals
- A set of overarching discussion prompts and links to other relevant resources

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Summaries of Research Briefs

Learning as a Cultural Process

To create more equitable learning opportunities for students from marginalized communities, educators can design learning experiences that help young people connect their everyday interests and knowledge to academic content. The authors synthesize research on how students use sophisticated math in everyday practices like playing basketball or dominoes, and selling candy. Then they explain how learning improves when varied student life experiences are made relevant in informal and formal learning environments.

Relating Culture to Prior Knowledge

This paper's findings illustrate the claim that young people's prior knowledge cannot be separated from the cultural context in which it is situated. Using detailed examples from a longitudinal ethnographic study of 13 children, the authors argue that in order to understand young peoples' interests and activities we need to understand the social and cultural systems in which their thinking is embedded.

Rethinking Diversity: Hybrid Language Practices in Classrooms

Within learning environments, children' talk can often be seen as disruptive or off task. However, Gutierrez and colleagues reframe the ways children's talk is often a sense-making opportunity. In this work, we learn that teachers can engage children' talk and linguistic practices to deepen learning and broaden participation. This article explores how teachers can arrange learning so that students can use local knowledge and make meaning in ways that can connect to the official curriculum in unexpected ways.

Supporting native science and ways of knowing in science education

In this study, the authors describe a conceptual framework for culturally based ways of knowing, and provide a brief description of their efforts to use this framework to design a community based summer science program with a Native American tribe. To address the call to attract culturally diverse students to STEM fields, the authors advocate supporting students in their navigation of multiple and perhaps conflicting epistemologies, and using the students' community as a resource to be leveraged, rather than overriding their personal epistemologies with canonical science. The authors also provide examples of how they drew on Native students' knowledge and community practices to impact student learning.

Professional Development to Support Culturally Relevant Science Teaching

For students from non-dominant populations, learning science in school can bring together three distinct cultures: science teaching, scientific practice, and home culture. This study examined the effectiveness of professional development that was intentionally designed to help teachers integrate Native American students' cultures within the classroom. The author studied the teachers' beliefs and practices and explored how the program contributed to improvement in science test scores. Educators interested in reaching non-dominant populations can use professional development to focus on cultural points of intersection between teachers, students, and community.

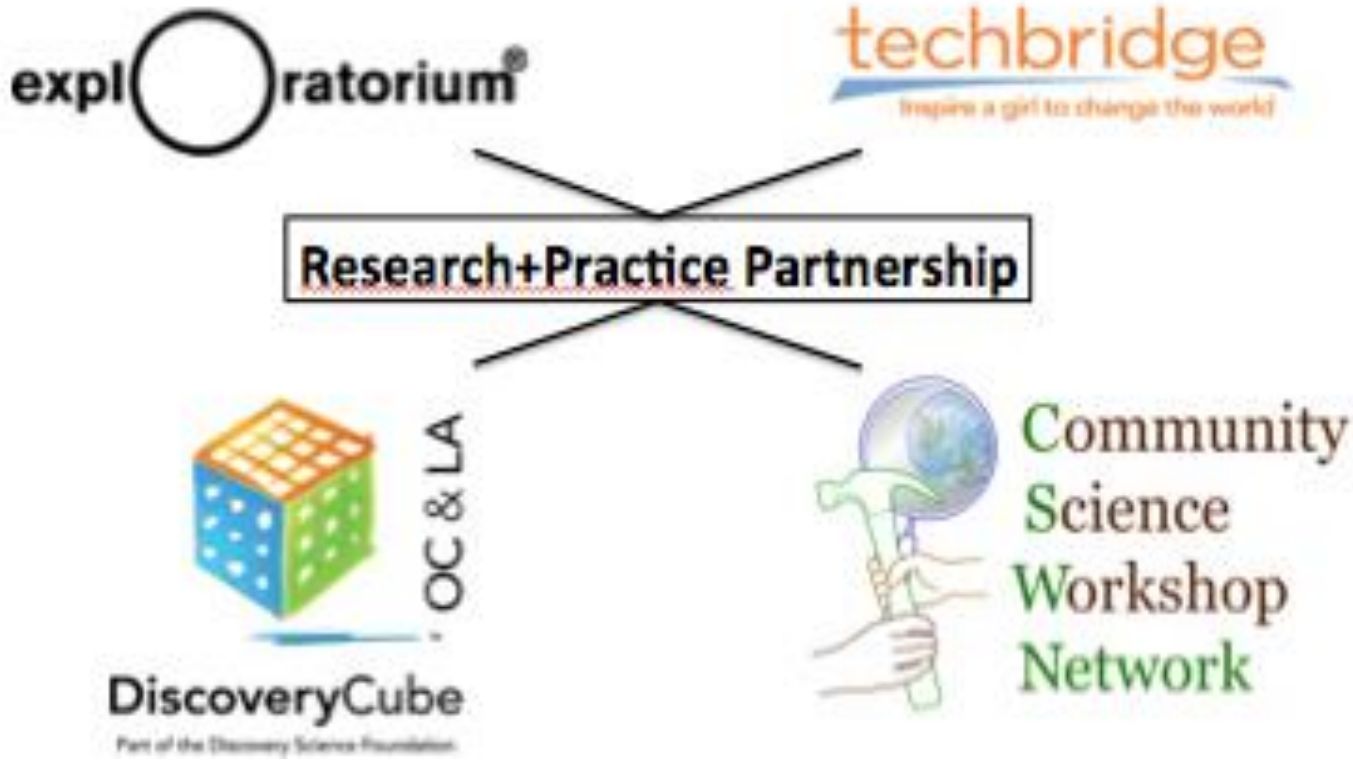
DISCUSSION PROMPTS

- What stood out to you about the authors' definition of equity? How might this contrast with other definitions? What does it mean that learning is a cultural process?
- Why do you think it is important for science learning to be related to experiences that students have beyond the science classroom?
- Which classroom practices help develop students' long-term interest in science?
- How can teachers prompt multiple ways of knowing and students' experiences outside of the science classrooms to enhance in school science experiences?

RELATED RESOURCES

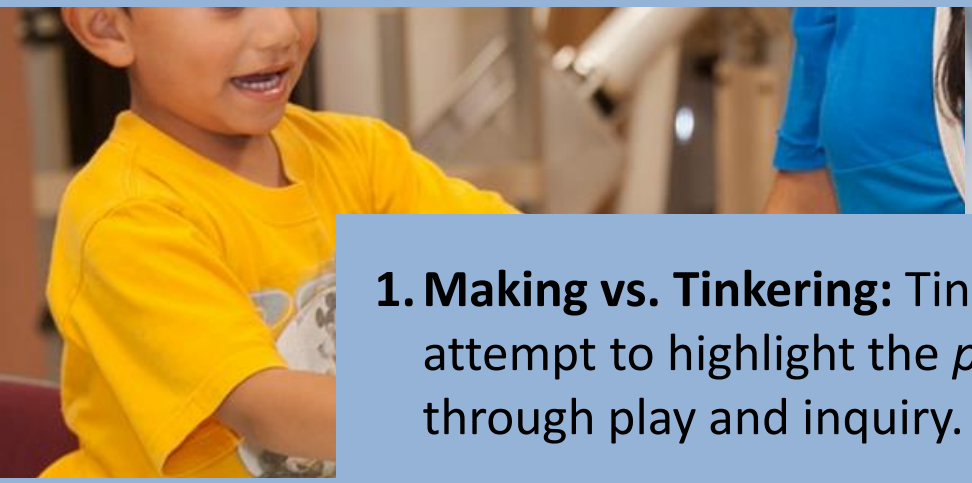
- The LIFE / Center for Multicultural Education Diversity Presentations & Report
- A Framework for K-12 Science Education, NGSS & Case Studies
- How can we promote equity in science education?
- Implementing Meaningful STEM Education with Indigenous Students & Families
- Engaging English learners in the science and engineering practices

California Tinkering Afterschool Network:
A research-practice partnership

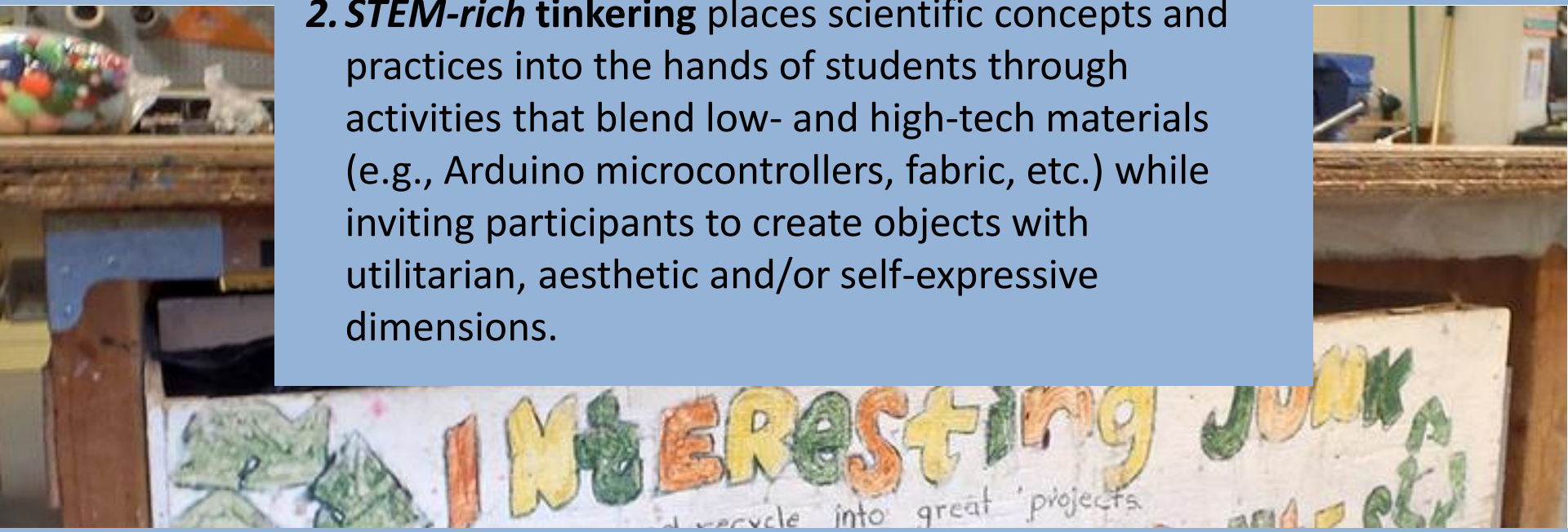


Network serves over 2,000 K-12 *non-dominant* students in low-income communities through 5 different afterschool programs offering equity-oriented, STEM-rich tinkering.

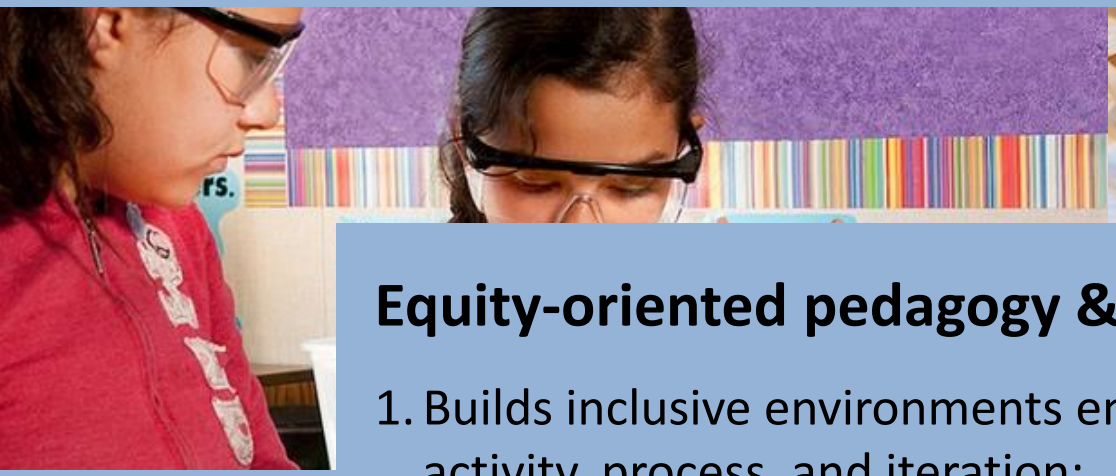
What is Tinkering?



1. **Making vs. Tinkering:** Tinkering is an intentional attempt to highlight the *process*—developing skills through play and inquiry.
2. ***STEM-rich* tinkering** places scientific concepts and practices into the hands of students through activities that blend low- and high-tech materials (e.g., Arduino microcontrollers, fabric, etc.) while inviting participants to create objects with utilitarian, aesthetic and/or self-expressive dimensions.

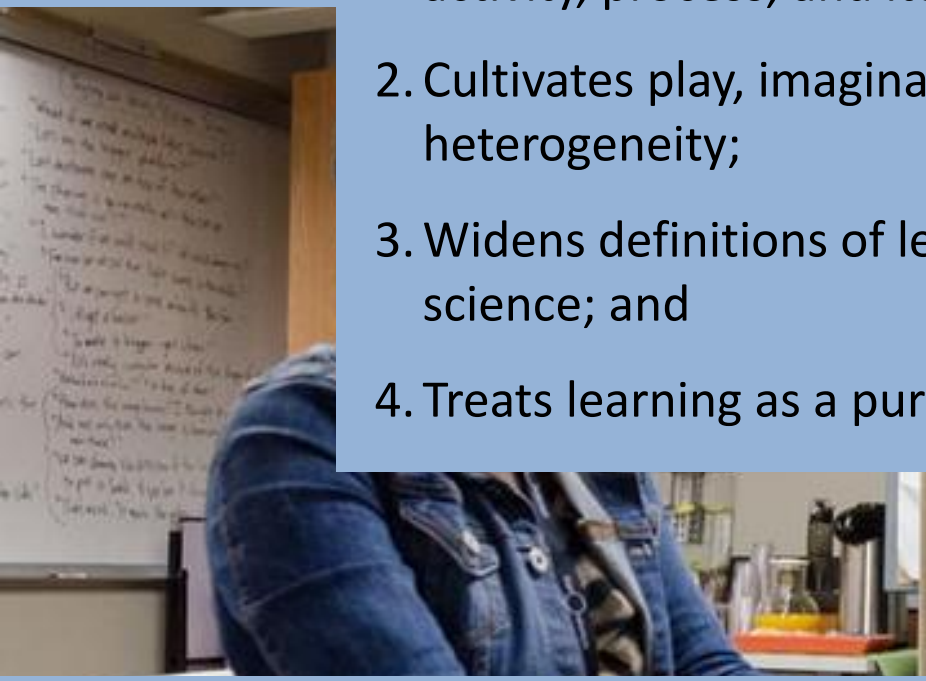


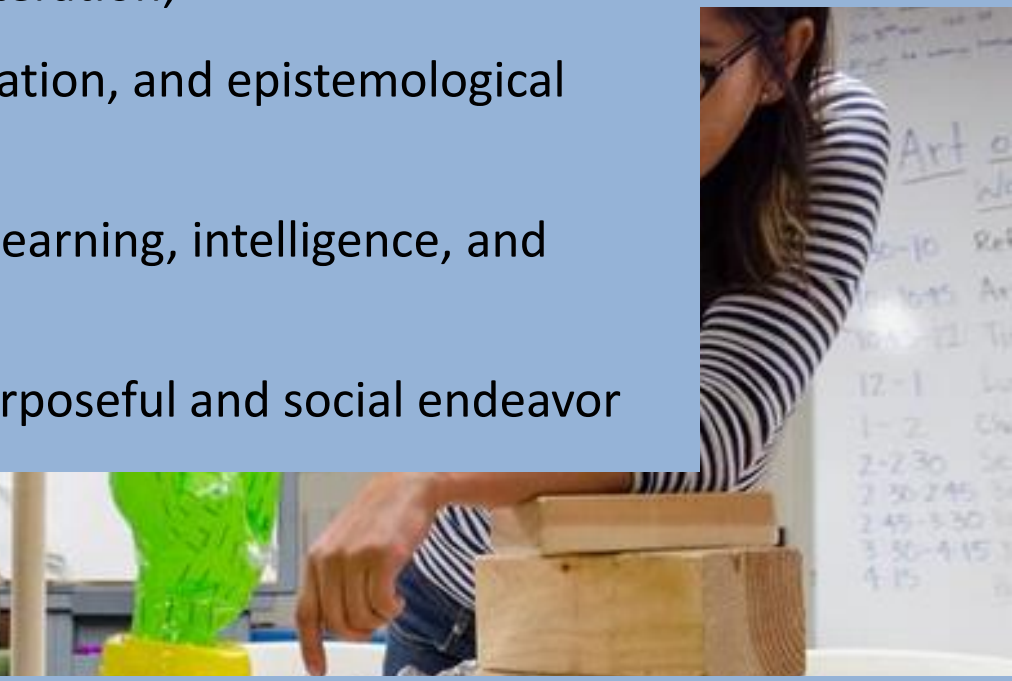
Equitable Learning Through Tinkering



Equity-oriented pedagogy & program design:

1. Builds inclusive environments emphasizing shared activity, process, and iteration;
2. Cultivates play, imagination, and epistemological heterogeneity;
3. Widens definitions of learning, intelligence, and science; and
4. Treats learning as a purposeful and social endeavor





Panel Discussion

Q1 | How do you know if an activity or project qualifies as “Making” or “Tinkering”?

Molly Shea

Jean Ryoo

Panel Discussion

Q2 | What is the connection between equity & tinkering?

RE: Vossoughi et al.

Molly Shea

Jean Ryoo

Panel Discussion

Q3 | How can educators support young people fully leverage the possibilities of making & tinkering

Take intellectual risks | Create original projects

Make connections to other settings

Molly Shea

Jean Ryoo

Panel Discussion

Q4 | How can educators balance the STEM content and other learning goals without diminishing the playfulness of tinkering?

Molly Shea

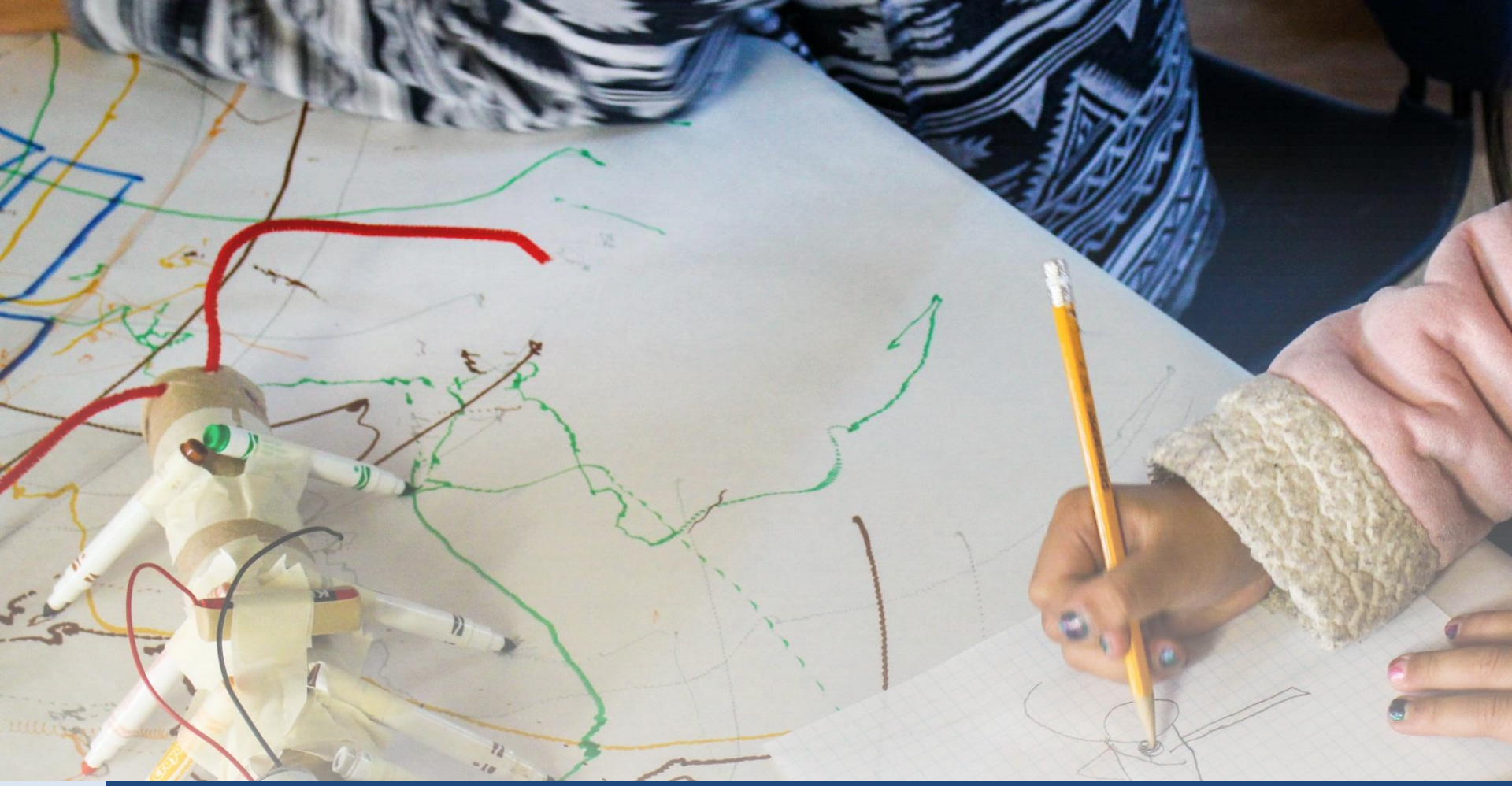
Jean Ryoo

Panel Discussion, cont.

Concluding Thoughts…

Molly Shea

Jean Ryoo



Audience Q & A

Audience Discussion:

How might you use a Connected Collection in your practice? Personally? With staff?

Audience Ideas:

Professional development for staff

Building language for training, reporting, grant writing & reflection

Dialogue with staff to improve practice

Communicate to importance of thoughtful pedagogy

Structuring activities & programs

Gaining support for programs

Grant proposals

Articulate value to funders & educational partners

Getting buy-in from principals or administrators

Documenting the research base of out-of-school time learning to support the field as a whole

CTAN's Upcoming Research

Goal: Describe what high-quality, equity-oriented, STEM-rich tinkering looks like and how to help staff continuously develop the necessary teaching skills

- **Summer 2015:** Coding and analyzing field notes & interview data
- **Through Winter 2015:** developing professional development resources to support high-quality, equity-oriented, STEM-rich tinkering pedagogy

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Thank you for attending!

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