March 2015

Equity in Out-of-School STEM Learning

Professional Development Needs and Strategies

A Research+Practice Collaboratory Inquiry Group Report

How can professional learning for out-of-school staff be organized to promote equity in STEM learning?

This is the question a group of out-of-school educators and educational researchers gathered to discuss at the Exploratorium on January 30-31, 2015. The meeting was sponsored by the Research+Practice Collaboratory, an NSF-funded project that develops and tests new models for integrating research and practice perspectives for the improvement of science and mathematics education.

Although there is significant interest in expanding STEM learning activities in afterschool, weekend, and summer programs, to date there has been little discussion of how these programs can be designed and implemented in ways that promote expansive and equitable learning. By expansive we mean that they are intellectually and socio-emotionally rich and meaningful to learners. By equitable we mean that they are implemented in ways that (a) recognize (see, hear, and honor) the cultural and personal resources young people bring to the learning experience and (b) leverage those resources to deepen each young person's social and intellectual participation.

To open the meeting, Kris Gutiérrez led a conversation on equity that included Angela Booker, Michael Funk, and April Leuhmann.

Research-practice teams from the California Tinkering Afterschool Network (including Techbridge, the Community Science Workshops, and the Exploratorium Tinkering Afterschool in partnership with the SF Boys & Girls Clubs program) shared their work to develop strategies and resources to promote and document equity-oriented facilitation moves in their afterschool tinkering programs.

Groups self-organized to discuss the kinds of professional learning tools needed to support afterschool staff to provide equity-oriented STEM learning programs for youth from economically marginalized communities.

Equitable Instruction recognizes (sees, hears, and honors) the cultural and personal resources young people bring to the learning experience and leverages those resources to deepen each young person's social and intellectual participation.

Four big ideas for supporting equity-oriented facilitation emerged from the group's discussions.

1. Seeing, hearing, and honoring

To promote equity, educators need to be supported to recognize the ideas, capacities, and interests of young people in order to more deeply engage them in learning activities. Many educators may have particular ideas about what or how STEM knowledge or interests manifest themselves. For instance, a young person's silence might be recognized by some as focused attention and by others as disaffection. Because cultural values shape how we teach and learn, it is essential that out-of-school educators develop ways of seeing and hearing, and then honoring, student assets and ideas that may be unfamiliar to them. Professional learning strategies that can support educators to do this include:

- Engaging staff in STEM learning activities designed for multiple ways of engagement, allowing educators to reflect on the variation of their questions and approaches, and what this may look like with young people.
- Including explicit discussions about deficit versus asset-based views of young people in professional workshops and conversations. Using case studies that illustrate how youth assets are leveraged for success.
- Providing explicit strategies for how staff can reframe moments when things do not work as moments of productive learning and insight.
- Supporting staff to use stories to introduce ideas, activities, and concepts. When people tell stories they share some part of their own histories, interests, or understanding of activities. Stories can build learning communities that make space for young people to bring ideas from multiple parts of their lives into the after school context.

2. Reflecting on teaching, learning, and equity
The group highlighted the importance of creating time and a safe social space for staff to reflect on what they are noticing and hearing young people do in their learning. When noticing what children bring to the experiences, and reflecting on facilitation moves that helped or hindered their full participation, educators begin to identify opportunities for active intervention that could support fuller participation in the learning activities. Professional learning mechanisms for supporting educators to do this include:

- Providing time for daily debriefs, as little as 10 minutes, to discuss what has been noticed about young people.
- Encouraging journaling before sharing thoughts in debriefs to allow educators time to collect thoughts.
- Supporting opportunities for co-teaching, so educators can both facilitate and observe learning.
- In professional conversations, leading with questions, not answers; avoid do's and don'ts.

3. Adopting asset-based approaches to staff development
Staff charged with teaching for equity need to experience equity in their own learning. To support out-of-school staff's professional learning, it is essential that workshops or trainings be organized in ways that see, hear, and honor the insights and experiences that the staff themselves bring with them to their professional learning experiences. Mechanisms for designing equity-oriented professional learning to promote equity-oriented facilitation include:

- Formally surfacing and naming staff's goals, experiences, and insights as to what is important in the work.
- Creating opportunities for staff to be vulnerable (to not know, to take creative risks, to share thoughts and concerns), and building in time for meaning-making.

4. Foregrounding equity to shape program activities
In professional learning conversations, explicit discussions of political and historical inequities that participating children may be experiencing in their lives can help educators avoid reproducing them in the learning environment. Program activities can be designed to surface and challenge inequities to expand children's agency. For example, connecting home practices of repairing material goods to the high-tech practices in the "maker movement" honors children's cultural assets. Other PD ideas include:

- Document important community events or histories that have helped to shape current inequities.
- Review a list of equity-indicators to guide program debriefs (see next page).

Working Prototype ….. Equity Indicators v1.0

Angela Booker, Pam Buffington, Paula Hooper, and Kris Gutiérrez developed a list of questions that program staff could use to evaluate issues of equity in their programs.

1) How did we productively invoke class, race, gender, bodies, etc.?
2) What did we model in how we handled challenges, missteps, injuries? What did young people model?
3) What didn't we see or notice? Who was not here or is not here typically?
4) How did we negotiate challenges?
5) How did we elicit stories and listen?
6) How were we curious about how young people made sense of a phenomenon and how did we?
7) How did we make it known that ideas are welcome?
8) How did we value and build upon multiple ways of knowing? What did it look like?
9) How did we privilege dominant ways of knowing? What did it look like to value multiple ways of knowing at our site?
10) How did young people continue to bring in and build on their own ways of knowing?
11) What were the opportunities to broaden ways of knowing?
12) How did we support young people to effectively validate and advocate for their ways of knowing?
13) How did we support how young people build and follow curiosity about other ways of knowing?

Working Prototype ….. Facilitation "Muscles" v1.0

The California Tinkering Afterschool Network has identified a set of facilitation "muscles" that require ongoing development and exercise; these include:

1. Reframing failure / Designing for iteration & experimentation
2. Designing for generative sharing and feedback opportunities
3. Recognizing and cultivating potential in all students
4. Connecting ideas and activities to possible futures
5. Connecting learning across settings
6. Cultivating intellectual safety & risk taking
7. Encouraging/scaffolding student talk and sense-making
8. Identifying and building on student agency
9. Facilitating STEM connections

CTAN participants include Jen XXX**,** Veronica Cortez, Meg Escudé, Melody Felten, Emilyn Green, Shu Ping Guan, Erin Gutierrez, Benjamin Henriquez, Manuel Hernandez, Linda Kekelis, Emily McLeod , Paul Pooler, Jean J. Ryoo, José Sandoval , Mia Shaw, Molly Shea, Kayla Shields, Shirin Vossoughi, and Bronwyn Bevan

Working Prototype …. Value Mapping v1.0

Molly Shea, Jean Ryoo, and CTAN (see above)

Researchers and practitioners embarking on a shared inquiry answer key questions to surface the insights and values that guide their work. Ideas are written up on chart paper, discussed and clarified, and then grouped into clusters, to identify the key leading sets of values, priorities, and goals for participants. The value map serves as a document of record that can guide research questions, codes, and analysis. Question prompts include:

- "What key facilitation moves are important for supporting diverse learners?"
- "What goals do you have for student learning?"
- "Why is teaching in this afterschool program important to you?"
- "What professional development activities help you improve your practice?"

Next Steps and Needs

On the final day, the following types of professional learning resources and mechanisms were identified as needing further development and or testing:

- Mandated and paid time for regular staff debriefs and reflection.
- Effective prompts for reflection on activities, taking into account limited time available.
- A need for equitable curricula to support equitable practice; including learning activities that create space for integrating students' personal experiences and interests, and that provide local relevance. Activities with multiple pathways for engagement, no one right answer, and opportunities to iterate and evolve support equitable instruction.
- Video examples illustrating the critical pedagogical role of iterations (both for trouble-shooting, or getting it right, and for complexification, or taking it further) in supporting learning, and how to productively facilitate learning through iterations.

- Video vignettes that demonstrate what asset-based teaching and learning look like.
- Stories that serve as models and demonstrate how they can engage students in meaning-making.
- Support for professional developers and coaches who can provide equitable learning experiences to support equitable instruction for young people.

Key Research Resources

Bang, M., Marin, A., & Medin, D. (forthcoming). Community Based Design Research: Transforming Powered Relations Towards Just Socio-Ecological Futures.

Nasir, N., Rosebery, A., Warren, B., & Lee. C. (2006). Learning as a cultural process: Achieving equity through diversity. *Cambridge handbook of the learning sciences*, 489-504

Vossoughi, S., Escudé, M., Kong, F., & Hooper, P. (2013). Tinkering, learning & equity in the after-school setting. Paper presented at FabLearn, Stanford, CA. Retrieved on August 24, 2014 from: http://fablearn.stanford.edu/2013/papers/.

Key Practice Examples

- Community Science Workshops, Watsonville and Fresno CA
- GET City, Lansing, MI
- Girls Power, Rochester, NY
- SF Boys & Girls Clubs, CA
- Techbridge, Oakland CA

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Bevan, B., Ryoo, J.J. and Shea, Molly. (2015) *Equity in out-of-school STEM learning: Professional development needs and strategies*. San Francisco: Exploratorium.