

## **Facilitation, Teaching, and Assistance at the Intersection of the Learning Sciences and Informal Science Education**

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**Abstract:** This poster focuses on approaches and strategies tied to pedagogy, facilitation, and assistance employed by members of the Informal Science Education (ISE) and Learning Sciences (LS) communities working toward informing understanding of teaching that accounts for the challenges and unique affordances particular to informal learning contexts.

### **Intersections**

This poster is part of a collaborative effort<sup>1</sup> among Learning Sciences (LS) and Informal Science Education (ISE) researchers and practitioners. The authors discuss principles that apply across diverse settings compared to facilitation within constrained settings whose dimensions are more easily described, how "good" pedagogy outside of schools may be defined, what informal facilitator content knowledge might look like, and productive researcher/practitioner partnerships that can help advance practice, using four research studies as examples that characterize the application of these principles.

### **Research Studies**

**Study #1: Sharing spaces: Examining the continuum of self-managed and community-managed learning and engagement in informal science environments**

As state and federal agencies in the U.S. increase their commitment to informal science, technology, engineering, and math (STEM) learning, the role of outreach in STEM learning has come under increasing scrutiny. LS approaches, including design experimentation, can highlight important aspects of the interplay between self-managed learning and community-managed learning in STEM outreach programs. However, it is important to highlight the effect that stakeholder involvement in STEM outreach has on participants' experiences, not only concerning STEM content learning, but regarding overall satisfaction with the outreach experience, including outcomes that may not be considered central to learning sciences approaches to STEM learning. Questions addressed by this study include: How is the viability of a design experimentation approach to improving STEM outreach affected by programs with an increasing numbers and kinds of stakeholders, including local, state, and federal agencies?; Does the nature of self-managed learning change when more (and more powerful) stakeholders are involved?; and Can we adapt best practices from both ends of the continuum despite the complexities and difficulties of meeting stakeholder interests?

**Study #2: Nonformal Science Learning within a Framework of 4-H Positive Youth Development**

This study focuses on pedagogical opportunities and challenges related to nonformal science learning within 4-H programs. 4-H programs are delivered through the extension offices of land-grant universities across the United States and serve over 6 million youth ages 8-18. In 2008, National 4-H announced a commitment to engage 1 million new youth within science, engineering and technology (SET). A recent report from year five of a longitudinal study by Lerner and colleagues (2009) found that 4-H youth are more than twice as likely as other youth to be in the highest trajectories of contribution to their communities and 41% lower on the risk behavior measure than youth who participated in other out-of-school activities. The study includes a review of abilities targeted within the 4-H program and how these are situated within the pedagogical structures of positive youth development. The analysis of abilities

presented considers opportunities and challenges of nonformal science learning within the 4-H model and highlights affordances for learning in the interactions linking youth, adults and educative materials. Case examples are shared in domains of robotics, GIS/GPS mapping, alternative energy and veterinary science. Study #3: Astronomical Concepts and Audience Self-Perceptions of Learning and Understanding Researchers and informal science education practitioners can work together to identify research questions and design appropriate tools to measure and assess STEM learning, with learning defined as a process of knowledge acquisition that is constructive in nature. Understanding informal science learning and tapping into cognitive processes at play during informal educational programs is challenging because of space and time constraints, but it is known that even brief interactions have had demonstrated impacts (Dunlop, 2000; Sunal, 1973). This study focuses on informal science learning during 55-minute planetarium shows and audiences' acquisition of content knowledge, understanding of concepts, and visitors' perceptions of their own learning. Findings include that, in general, audiences tend to be overly optimistic in their self-reporting, and more specifically, while visitors wanted most to learn how to identify constellations, they felt that finding constellations was the hardest idea discussed. Implications for practice relative to identified correlations across demonstrated ability, self-perceptions, and demographic information, are discussed. Study #4: Parent Pedagogy: Digging into Disciplinary Talk

Scientific practices such as observation are disciplinary specific rather than domain general in nature (Eberbach & Crowley, 2009), and this paper examines how parent disciplinary talk mediates family scientific observations of biological phenomena. In a controlled study, 79 parent-child pairs observed and talked about pollination during a visit to a botanical garden. In order to help parents elaborate upon children's observations, parents in the treatment groups were instructed in the use of four naturally occurring conversational strategies. To detect evidence of disciplinary talk, a Disciplinary Model that drew upon philosophy of science (Machamer, Darden, & Craver, 2000), disciplinary content, and emergent parent-child disciplinary talk was developed. The findings revealed that parents and children who knew more about pollination at the start of the study had higher levels of disciplinary talk in the garden, as expected. However, the use of the conversational strategies also increased the amount of disciplinary talk in the garden, independent of what families knew about pollination. In effect, the use of the four conversational strategies enabled parents to support more disciplinary talk whether they knew a lot or knew a little about pollination. These results provide new insights into how parent talk may support science learning in informal learning environments.

### Importance of This Work

This work on pedagogy, facilitation, and assistance builds upon recent work that summarizes what we know about learning outside of school in science-related fields. The authors, both researchers and practitioners, apply what we know about teaching in informal science environments to the building of more inclusive models of STEM learning in the Learning Sciences and the connecting of methods of research and methods of informal learning practice.

### Endnotes

- (1) Collaborative Research: *Building Capacity and Collaboration at the Intersection of the Learning Sciences and Informal Science Education* (Intersection project); National Science Foundation ISE awards: 0813874 and 0814831. Sandra Toro Martell, Heather Toomey Zimmerman, and Leslie Rupert Herrenkohl lead the Intersection project. Opinions expressed do not necessarily reflect the National Science Foundation.

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