A Draft Roadmap for Practice-and-Research in Informal Science Education

Catalyzed by questions and challenges posed by a cross-section of the informal science education (ISE) field at the 2012 AISL Program Principal Investigator meeting, and in support of the core research and development areas of the NSF Education and Human Resources (EHR) directorate, i.e. Learning, Learning Environments, Broadening Participation and Workforce Development, the Center for Advancement of Informal Science Education (CAISE) has been investigating the current state of the field with regard to the dynamics between informal science education practice and social science research.

The CAISE Practice-and-Research (PaR) initiative began with an exploration of the relations between research and practice in other areas of learning and education. We reviewed the state of research in ISE as well as prior research and practice initiatives that have focused specifically on ISE. Finally, we explored potential research questions suggested by practitioners, as well as the forms of evidence they use as they make decisions about designing and implementing informal STEM learning experiences. As of May 2013, the initiative has been informed by the work and ideas of more than 230 ISE professionals who have participated in CAISE's activities.

One outcome of our initiative is this "Roadmap for Practice-and-Research in Informal Science Education." The first version of this document was developed in a April, 2013 working group of 16 professionals (researchers, practitioners and evaluators) who met to synthesize the input that the PaR initiative had gathered from the field up to that point. The idea of the roadmap was to identify a small number of topics from the synthesis that:

- Are of interest to both researchers and practitioners;
- Are sufficiently tractable that a coordinated effort by the field over the next few years would have the potential to lead to breakthroughs in knowledge;
- Are core challenges that could lead to innovation and improved practice;
- Highlight what we know is unique, valued, and powerful about ISE.

In constructing the draft roadmap, the working group focused on a number of examples of past research and practice work, including a research agenda from the National Council of Teachers in Mathematics[1], the afterschool research agenda from the Innovative Technology Experiences for Students and Teachers (ITEST) Resource Center, the Smithsonian's 21st Learning in Natural History Settings conference, the Institute for Learning Innovation's In Principle/In Practice conference and book, and the National Research Council's Learning Science in Informal Environments (LSIE) volume. Using these examples and others as lenses, the group first generated a list of potentially actionable questions that would apply across a variety of ISE sectors, e.g. informal science institutions, media organizations, out of school time programs and cyberlearning

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[1] Arbaugh, F., Herbel-Eisenmann, B., Ramirez, N., Knuth, E., Kranendonk, H., Quandar, J. (2008). Linking Research & Practice: The NCTM Research Agenda Conference Report, National Council of Teachers of Mathematics. Retrieved from Linking_Research_and_Practice.pdf

projects. Then through group discussion and a sorting process, we eventually organized those questions under the eight topic categories that constitute this roadmap:

1. LEARNING ECOLOGIES AND CHANGE OVER TIME. The notion of learning ecologies is currently popular. But the field still has an incomplete understanding of what makes for an effective learning ecology, how to support learning over time, how to assess impact of experiences over time, or why some learning trajectories seem to take off why others flounder. The diverse experiences and contexts that make up ISE provide a unique laboratory to study and understand this emerging theoretical orientation in the social sciences. (Maps to EHR Learning and Learning environments core areas)

2. IDENTITY. Established by NRC LSIE volume as one of the outcomes particularly important to ISE, identity is a rich area of future research and practice. ISE platforms are particularly good places to test innovative approaches for engaging underrepresented audiences, for exploring how values are created by and around learning, to investigate how and why people want to become connected to a community, or how students decide to become engaged in and persevere in the Science Technology Engineering and Math (STEM) workforce pipeline. (Maps to EHR Broadening Participation core area)

3. INTEREST, MOTIVATION AND CURIOSITY. This area was also highlighted in Learning Science in Informal Environments and remains an area of strong interest for ISE researchers and practitioners. Many informal STEM learning experiences are designed to spark curiosity or to motivate learners to want to engage further with STEM. What aspects of a learning experience make this happen? How do different kinds of experiences coalesce into moving interest from an initial state to a deeper engagement with STEM? (Maps to EHR Broadening Participation core area)

4. UNDERSTANDING LEARNERS AND LEARNING. Informal STEM learners are diverse and come to ISE experiences through a range of learning contexts and configurations. How does learning in families or peer groups change the experience and the impact? How different are the experiences of learners distinct in terms of a range of factors? For whom does ISE learning work effectively and under what conditions? Because ISE targets a wide variety of audiences, it is a particularly rich area to create and study diverse learning experiences. (Maps to EHR Learning core area)

5. "21ST CENTURY CITIZENS." ISE is the most visible part of STEM education that is concerned with learners who are not necessarily school-aged or on their way to being part of the STEM pipeline. What are the outcomes we should value for lifelong, life-deep and life-wide learning as distinct from pipeline goals? What's the best way for adults to continue their learning about science? How do we motivate and support adults who get involved in civic activities that connect with STEM? Is there a role for ISE to support workforce skills for people in non-STEM careers? How do people use STEM learning to make personal or civic decisions? (Maps to EHR Workforce Development core area)

6. DESIGN PRINCIPLES TO SUPPORT ISE LEARNING AND LEARNERS. This

category might be thought of as cross cutting the first five. As we explore the hot topics of ISE, we should keep in mind that of most direct interest to practitioners are design principles that can lead to creation of more effective ISE learning experiences. These principles are best put into practice when they are at the right grain-size. Because ISE is so diverse in sectors, topics, and audiences, we need to identify a number of principles that are context specific. There may also be some principles that are more general. Regardless, the working group felt a clear need to bridge the gap between the questions that researchers and practitioners ask about ISE. Establishing a set of principles that underlie the design of effective learning environments was seen as a strong step to closing this gap. (Maps to EHR Learning Environments core area)

7. METHODS, INSTRUMENTS, ASSESSMENTS. This category might also be thought of as cross-cutting the first five. The PaR working group recognized that the diverse contexts of ISE experiences and audiences necessitate continued development of methods, instruments, and assessments that are sensitive to ISE learners and learning environments. (Maps to all 4 EHR core areas)

8. CAPACITY BUILDING. A final category might be considered a meta-category. For a roadmap to be successful, it needs to be part of an ongoing culture in the field of professional development, sharing of research knowledge, and innovation in practice. What would the field of ISE need to look like to make this happen? How do we do effective professional development across the range of sectors and professionals in our field? What are the best and most sustainable models for research/practice partnerships? How do we link policy, decision making, and evidence in ISE? Just as researchers have studied professional development and policy implementation in the formal education world, ISE could learn about, implement, and share best practices for advancing the field. (Maps to all 4 EHR core areas)