Exploring Connections to Science and Engineering Practices with Visitors During Prototyping at a Natural History Museum

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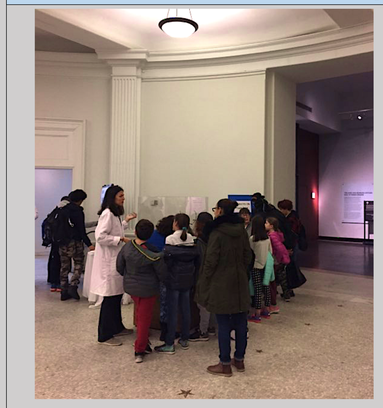
Background & Context of Prototyping

- Evaluations of two prototyping events on different content, both to inform design of new halls: *insects* and *gems & minerals*.
- Institutional goal to explore the degree to which activities and experiences could provide ways to help visitors make connections to Next Generation Science Standards (NGSS) — specifically understanding & engaging in science practices.
- Using term 'practices' scientists engage in as discussed in the *Framework* (NRC, 2012) and NGSS (2013) to emphasize that both knowledge and skills are required at the same time.
- Methods and data collection: observations, interviews, surveys with visitors, teachers, facilitators. Instruments designed to pay attention to what visitors say and do, as well as questions and conversations that surface.
- Attendance at two events combined: ~2,000

Literature Review

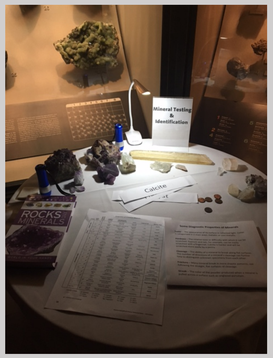
- Museums moving toward a more visitor-centric approach (Samis & Michaelson, 2017) echoes research development within education focusing on learning-centered pedagogy based on research on how people learn (NRC, 2000).
- NGSS structures science learning in formal learning environments such as schools (Falk, Osborne & Dorph, 2014). What might that look like in an ISEI or museum dedicated to sparking and cultivating visitor interest, and promoting lifelong science learning (Fenichel & Schweingruber, 2010; NRC, 2009)?

Insects Prototyping Evaluation

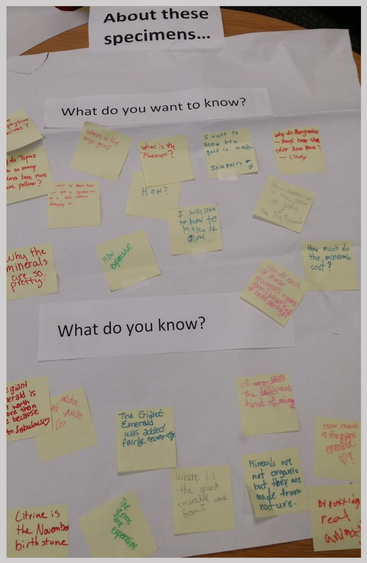


- Evaluation questions included: *What practices did visitors have opportunities to enact at the booths? Did they deepen their understanding of the practices in any way? If so, how?*
- Attendance = 1,433, mostly school groups
- Eight stations featuring insect collection including: insect identification in leaf litter, VR experiences, interactive puzzle game, and a tablet-based game.
- Focusing on a few specific connections to NGSS and making those explicit.
- "Stations" as fruitful design of spaces for learning.

Gems & Minerals Prototyping Evaluation



- Evaluation questions included: *What kinds of activities and approaches are visitors finding engaging and interesting? What questions surface at stations? What connections to NGSS come through?*
- Attendance = 514, mostly families and small groups
- 10 stations including: *Is it a Mineral?; Big Minerals, Big Questions; Mineral Testing & Identification*
- Visitors expressed interest in identifying and classifying specimens, designing & conducting small investigations, using evidence to answer questions and solve problems. Time spent at these stations seemed to heighten in duration and engagement with these types of activities.
- *Asking questions* particularly came through clearly in observations. The types of questions differed, as did the instigation of questions — sometimes they were posed by the facilitator, motivated by the design of the activity, or by the visitor.
- *The power of touch*: Across 8/10 stations, touchable specimens served as a vehicle to promote motivation, engagement, dialogue, and surface understandings.



Examples of visitors' questions that can lead to ***engaging in explanations***	Examples of visitors' questions that can lead to ***arguing from evidence***
• How do trees become petrified? • How does this (mineral) turn into (glass, rubies)? • How were these formed? • How do these rocks form in a volcano? • What is the difference between an element and a mineral?	• Is this real? • Why are these quartz samples different colors? • What about gems?

Discussion across Prototyping Experiences

- Evidence from evaluations indicate that even brief station interactions hold potential for meaningful engagement in science practices.
  - *Asking questions, constructing explanations,* and *engaging in arguments from evidence* might be promising practices to target and make explicit.
- Role of the facilitator involved drawing visitors into an activity, providing foundational information necessary to interact, encouraging discussion and interaction, guiding and scaffolding visitors through to completion of activities.
  - Providing explanations for phenomena and make connections within and across stations — *Why does engagement deepen/lengthen with the presence of a facilitator? What are the moves or strategies that facilitators use that help deepen such engagement? What can we learn from those 'facilitator strategies or moves' that might be used in exhibits that will ultimately be unfacilitated?*
- Designing stations that leverage points for learning to encourage and foster discourse between participants.

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