# Understanding how narrative elements can shape girls' engagement in museum-based engineering design tasks

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## About the Project

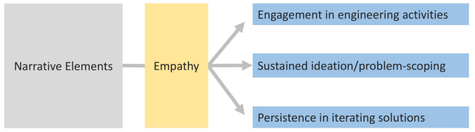
The New York Hall of Science, in collaboration with the Amazeum (Bentonville, AR), the Tech (San Jose, CA), and the Creativity Labs (Indiana University), are conducting a design-based research study to develop evidence-based guidance about how museums can use narratives to create more equitable and effective engineering experiences for girls.

## Theoretical framework

- Girls are often weakly engaged by abstract and challenge-based design activities.
- Using real-world contexts to frame engineering problems is more engaging for many learners.
- Narratives provide a relatable context through characters, settings, and problems.
- Narratives can evoke empathy and perspective-taking, skills that are critical to design thinking.

## Research questions

- How can museums add narrative elements to engineering activities?
- How can narratives evoke empathy in these tasks?
- Do narratives affect girls' engagement and persistence in the engineering design process?




## Study Design

*Activity Development:* NYSCI iteratively develops six matched pairs of engineering activities (narrative vs. non-narrative versions)

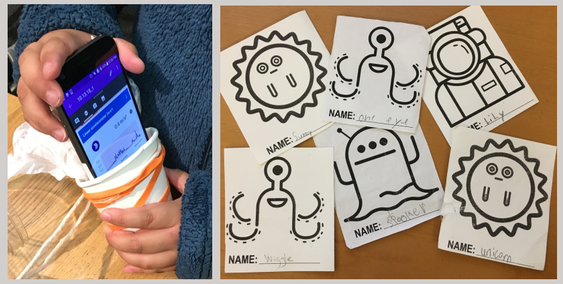
*Formative Research:* Compare narrative and non-narrative versions (girls' participation, ideation and iteration, empathy & perspective-taking)

*Impact Study:* Testing activities at 3 sites (NYSCI, Amazeum, the Tech)

| Where is the narrative located? | Whose point of view? | How is it communicated? |
|---|---|---|
| Character<br>Setting<br>Problem frame, challenge, or goal | Yourself (in a real/imagined situation)<br>Someone else (Specific/general, Real/imaginary) | Materials & Environment<br>Facilitation<br>Name of activity<br>Visitors themselves<br>Context/adjacencies (or a combination) |

**Narrative elements** include conceptual approaches and practical considerations in the implementation of narratives in engineering activities. Through iterative activity development, we are exploring ways of combining these elements to communicate a story, evoke empathy, and support the engineering design process.

**Dowel Structures:** Facilitators challenged visitors to create a structure that could survive an earthquake. The non-narrative version involved creating a structure that they could fit inside.




**Dropped Calls/Safe Landing:** Visitors used recycled materials to protect a phone from a 20-foot drop (non-narrative), or to help a character land safely on a planet (narrative). Visitors personalized their own characters and used an app to measure the impact of the landing.

**Chain Reaction:** Visitors designed chain reaction contraptions that would feed, pet, or play with pets, which contained interactive circuits that could become part of the mechanism.


**Help Grandma/Invention Challenge:** Visitors designed inventions to solve everyday problems faced by grandparents. Persona cards were provided in multiple languages. The non-narrative version involved design challenges without human users.

**Air/Wind Powered Vehicles:** Visitors designed vehicles that could move across different surfaces (non-narrative), or to help them travel around the world, across different kinds of landscapes (narrative).

## Measures

Observations and exit interviews to assess:

- *Engagement:* Participation, hold times
- *Empathy:* Emotional connection, perspective-taking, motivation to help
- *Engineering process:* Ideation, problem-scoping, iteration

## Emerging Findings

*Role of materials and facilitators in supporting narratives, empathy, and the design process:*

The careful selection of knowable materials shapes how visitors attend to aspects of a design challenge. Materials can suggest a relatable context for design problems, provide physical reminders of the users of a design, inspire visitors to consider multiple solutions, and allow for surmountable challenges.

Narratives can guide facilitation. Facilitators use narrative elements to introduce design problems, to prompt visitors to think about the end users of a design and their needs, and to help visitors decide how to improve their designs.

*Choosing narrative elements:*

Light touches of narrative are often most effective; elaborate framing can constrain the goals of activities or distract from relevant engineering concepts.

Narrative frames should be strategically chosen to align with and support engineering content.

## Questions for the Field

How do museums create inclusive environments that allow for creative expression and provide entry points for everyone, without colluding in stereotypical notions of masculinity and femininity?

Does a focus on empathy in engineering provide a new pathway to more inclusive design experiences?

How can researchers and practitioners within and across institutions work together to strengthen the design of inclusive STEM experiences and conduct more rigorous research?

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