Designing Our Tomorrow

Mobilizing the next generation of engineers

(DRL #1811617)

Project Overview

Engage families in engineering design challenges through a sustainability and biomimicry lens. Families will advance their engineering proficiencies while learning from nature to create a livable future.

Deliverables

Study 1 on engineering learning measures
Engineering design challenge framework
2000 sq.ft. bilingual (Spanish/English) traveling exhibit + programming
Study 2 on facilitation of engineering learning at exhibits
Professional development modules and host-site training

Collaborators

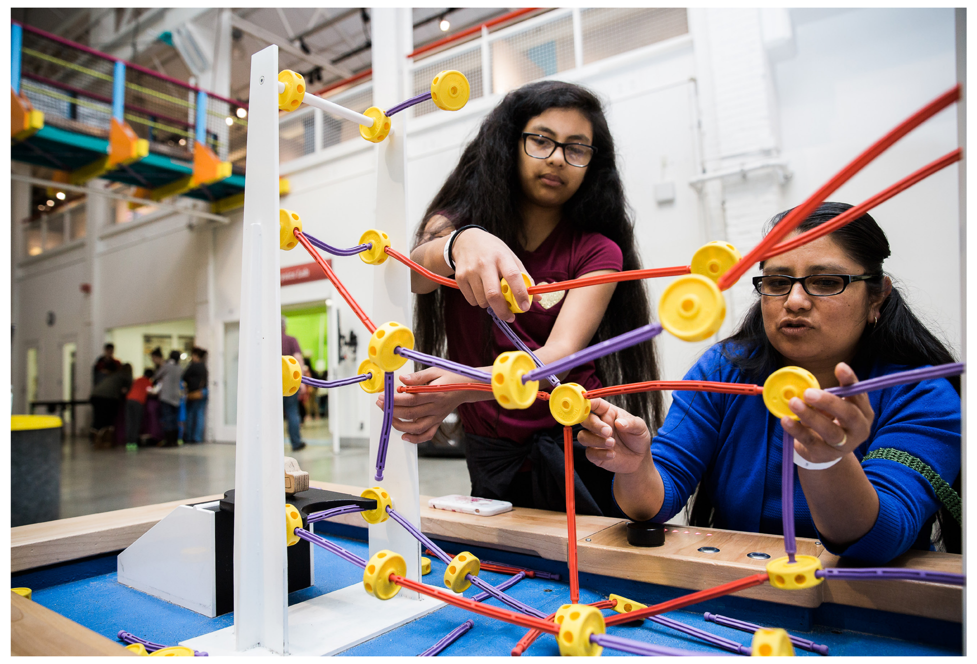
Designing Our Tomorrow is a collaborative project, with team members from the following institutions:

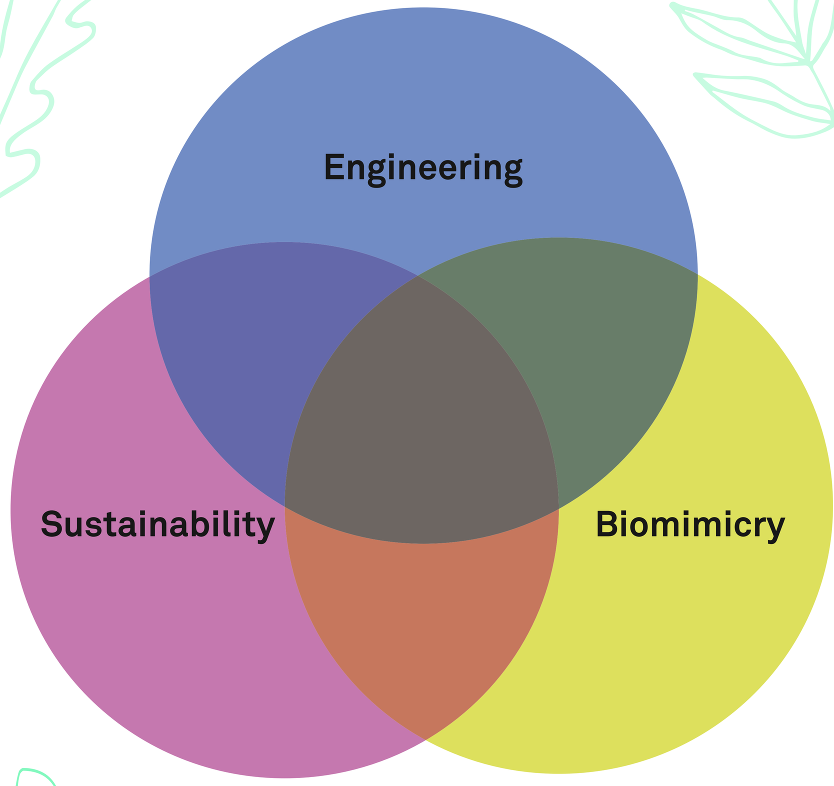
- **Oregon Museum of Science and Industry (OMSI)**
- **Adelante Mujeres**
- **Biomimicry Institute**
- **Fleet Science Center**

- Arizona State University
- Exploratorium
- Museum of Science Boston
- Oakland Museum of California
- Oregon State University
- Rockman et al
- Science Museum of Minnesota
- TERC
- University of Notre Dame
- Yellow Cow Consulting

Primary Audiences

Public Audience: Families with children, particularly with girls ages 9-14
Professional Audience: Exhibit Developers, Designers and Facilitators





Moving engineering skills from beginner to informed

Engineering Proficiencies	Indicators: Beginner	Novice	Informed
Understanding the challenge	• Perceives goal as straight forward • Prematurely attempts challenge	• Reads or listens to information provided • Becomes familiar w/ materials • Identifies/assigns roles • Looks at model and building station • Watches other people test • Explores/compares materials and tools to use • Discusses/plans design other than materials • Brainstorms ideas	• Delays design decisions • Explores problem • Identifies constraints • Discusses questions/ideas about process w/ others • Relates content to prior experience • Decides on one best possible solution • Restates goal • Looks at feasibility of problem • Adds context • Considers benefits and trade-offs of materials
Testing	• Few or no tests of prototype confounded variables • Qualitative assessment of goal completion	• Observes testing • Quantitative assessment of goal completion • Identifies what happened • Completes multiple tests • Diagnoses issues	• Focuses on problematic subsystems • Discusses solutions • Identifies pros/cons of design • Compares to own past performance or record • Explains results • Tests specific variables • Continues testing to optimize performance
Iteration of designs tested	• Haphazard re-design • Single run through cycle • Makes decisions based on aesthetic or superficial characteristics	• Increases efficiency by making a physical change • Makes needed improvements to help prototype reach goal	• Completes multiple iterations • Systematic changes based on feedback • Iterates based on feedback (verbal or physical) • Optimization of design and materials • Reevaluates the goal • Brainstorms ways to make successful prototype better (small changes to improve working design)
	• Watches others • Attempts the activity	• Repeats the activity • Positive affect	• Refers to past experiences • Seeks/shares information • Makes connections

Current Questions

How is this project situated among fields of engineering, biomimicry, and sustainability?

What are strategies for connecting with people personally and culturally?

What are valid instruments for measuring family engineering proficiencies in exhibit experiences?

What are exhibit, activity, and facilitation strategies for eliciting engineering proficiencies?

What are learning and community pathways that we can promote to families for their next steps?

Year 1 of 5

The project team is:

- Organizing, connecting, information gathering, and planning
- Synthesizing products from a literature review
- Conducting research study 1
- Conducting exhibit front-end research
- Planning a partner meeting

Indicators references

Assessing Exhibits for Learning in Science Centers: A Practical Tool (Barriault and Pearson 2012)

Learning Through STEM-Rich Tinkering: Findings From a Jointly Negotiated Research Project Taken Up in Practice (Bevan, Gutwill, Petrich &Wilkinson 2014)

The Informed Design Teaching and Learning Matrix (Crismond & Adams 2012)

Capturing the Design Thinking of Young Children Interacting with a Parent (Dorie, Cardella & Svarovsky 2014)

Examining Children's Engineering Practices During an Engineering Activity in a Designed Learning Setting: A Focus on Troubleshooting (Ehsan, Leeker, Cardella & Svarovsky 2018)

Facilitation Research for Engineering Design Education (Lussenhop, Auster & Lindgren-Streicher 2015)

Museum of Science Design Challenges Observation Instrument (Museum of Science 2012)

Design Squad Global Summative Evaluation Report (Paulsen & Burke 2017)

Ingenuity Lab: Making and Engineering through Design Challenges at a Science Center (Wang 2013)

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Everyday Encounters with Science