Designing engineering activities that use narratives to evoke empathy and support girls' engagement: A guide for practitioners (Resource exchange)

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Overview: This resource exchange shares a practitioner guide that describes how narrative elements can be used to evoke empathy and support engineering design practices. The guidebook is intended to support educators and activity developers in reframing engineering activities in more inclusive and socially relevant ways. In particular, our research showed the impact of narrative approaches on girls' use of engineering practices.

Target age range: Elementary and middle-school learners, ages 7-14

Learning environments: Formal and informal settings that offer hands-on engineering design activities.

Time needed for activities: 20-45 minutes

Instructional Approach: The guidebook is grounded in prior research on humanistic engineering education, which defines empathy as an integral part of the engineering design process (Walther et al., 2017; 2020). This approach reframes engineering as a human-centered discipline, inviting a wider range of perspectives and identities into the field. Our approach to activity development involves layering elements of narrative (characters, settings, or narrative problem frames) onto engineering tasks in order to evoke learners' empathy by encouraging them to consider who they are designing for and why. Activities and design principles were developed and tested with over 400 girls ages 7-14, and this approach has the potential to benefit all groups of learners who are more engaged by opportunities to solve human-centered problems rather than decontextualized or techno-centric engineering challenges.

Learning goals

Engagement with Narratives	Expressions of Empathy	Engineering Design Practices
- Referencing narrative elements: characters, settings, and/or problem frames - Elaborating on narratives: adding details about characters or scenarios	- Affective responses: concern, compassion for the users of a design - Cognitive perspective-taking: imagining what it is like to experience a problem or use a designed solution - Prosocial behaviors: taking action to help others	- Problem scoping: defining aspects of the problem that the design should address - Ideation: generating potential solutions to the problem - Testing: trying out a design (or part of a design) to see how it functions - Iteration: revising a design based on some form of feedback or testing

What's included:

1. **Design principles and facilitation tips** for integrating narrative elements into hands-on engineering activities, developed through a three-year design-based research project.

Start with engineering goals.
What are the parameters of the engineering problem? What types of engineering concepts and practices are you aiming to support?

Use characters and settings to evoke empathy in different ways.
Does the activity lend itself to adding a character, a setting, or both? How can learners relate to these narrative elements and design with them in mind?

Choose a point of view.
Whose point of view do you want learners to take? Are they imagining themselves in a novel situation, or taking someone else's perspective?

Use the narrative to spark learners' own ideas.
How can the narrative tap into learners' prior knowledge or imagination? Should narrative elements be realistic or fantastical?

Provide choice in defining users and their problems.
Is there room for children to decide who to help, what problems to solve? Can children elaborate on the narrative to make it their own?

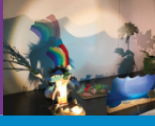**Reinforce narratives with both materials and facilitation.**
Is the narrative frame established through the materials, facilitation, the work that learners create and leave behind, the name of the activity, or some combination?

Test, observe, and iterate.
Do children talk about the narratives or elaborate on them? When and how do they express empathy? Which engineering practices do they use, and how often?

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2. **Six activity case studies** illustrating how narrative elements were added to traditional engineering challenges.

1. Emergency structures: Use dowels and rubber bands to construct a stable structure that can protect your group from an earthquake

2. Help The Pets: Design a contraption using simple machines to take care of a bored, hungry, or lonely pet

3. Help Grandma: Design and build models of novel inventions to solve problems grandparents face in everyday life, like carrying groceries or climbing stairs

4. Around The World: Design a wind-powered vehicle that can help someone travel around the world over different landscapes

5. Safe Landing: Use recycled and repurposed materials to design something to help an alien or astronaut land safely on a planet

6. Shadow Stories: Create shadow puppets and scenes with everyday materials

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3. **Indicators of empathy and engineering practices** that we observed in our research, along with an observation tool and follow-up questions for learners that educators and activity developers can use to document these outcomes and iteratively refine activities they create.

Observation Tool

Activity: _____ Child's age/gender: _____ Start time: _____ End time: _____

Group composition/context: _____

Indicators:
Which indicators did you see?

Quotes and notes: What did learners say or do?
What parts of the activity did they respond to?

☐ Describing/referencing the narrative in the activity (or inventing a narrative in a non-narrative activity)
☐ Elaborating on or adding to the narrative/story

☐ Affective responses: Talking about how the user feels, concern for their well-being, or expressing how you might feel in response to the problem/situation
☐ Perspective-taking: Talking about/acting out how someone will use the design or what it's like for them

Follow-up Questions

What problem are you trying to solve here?
What are you trying to make this do?
What did you have to change or fix while you were working on this?
What were you thinking about while you were making this?
Who did you make this for? What do you think would be helpful for them? How would they use this design?

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To download the complete guidebook, visit: https://bit.ly/empathyandengineering

For more information about this project, contact: sletourneau@nysci.org, dbennett@nysci.org

For other engineering curricula and activities for this age group, check out: The Go-To Guide for Engineering Curricula, PreK-5: Choosing and Using the Best Instructional Materials for Your Students (Cary Sneider), Engineering Is Elementary (www.eie.org), TeachEngineering (www.teachengineering.org)