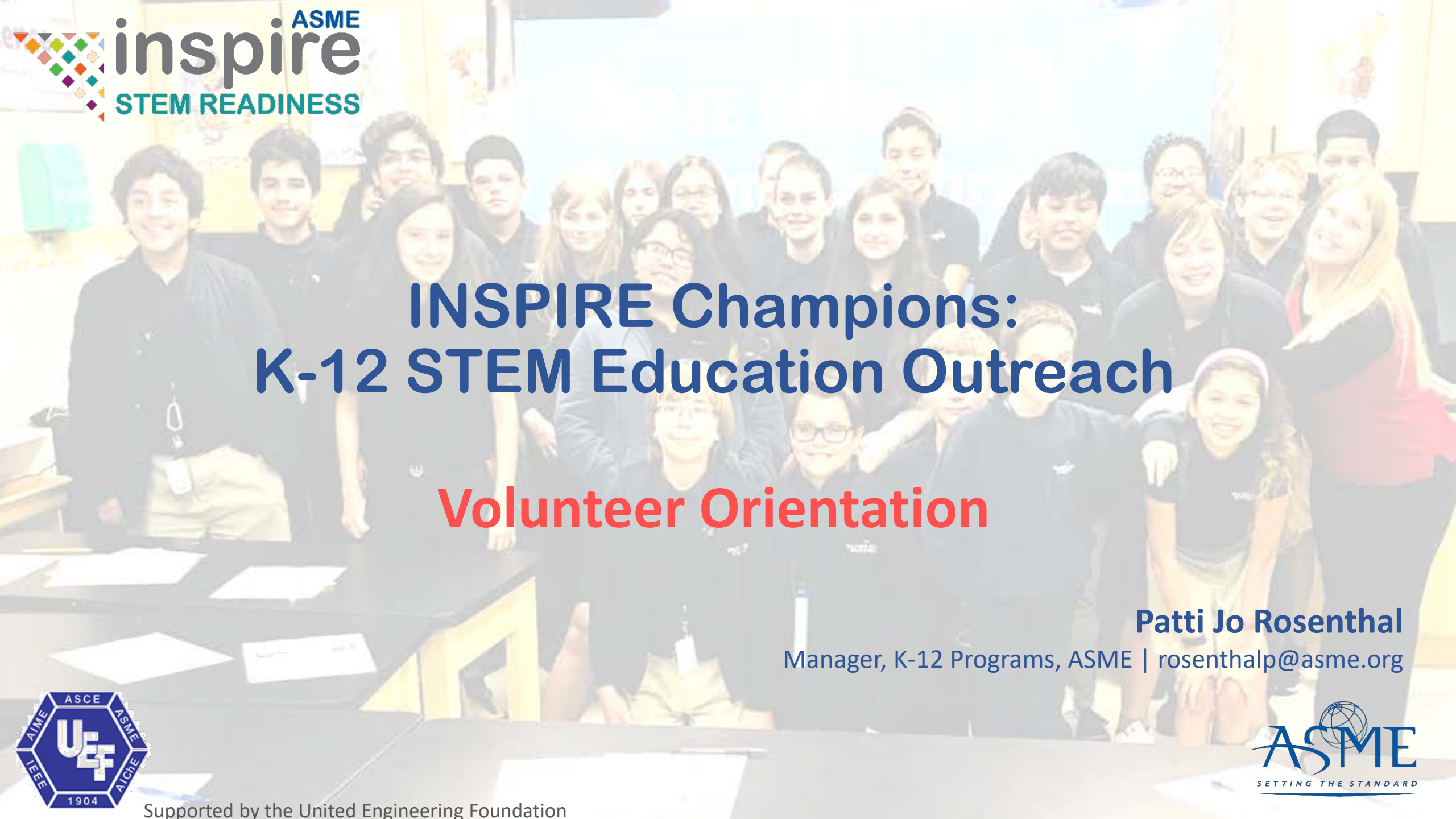

INSPIRE Champions: K-12 STEM Education Outreach

Volunteer Orientation

Patti Jo Rosenthal
Manager, K-12 Programs, ASME | rosenthalp@asme.org

Supported by the United Engineering Foundation

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INSPIRE Champions: K-12 STEM Education Outreach

Supported by the United Engineering Foundation (UEF), the goal of this initiative is to train a multi-society group of professional engineers/volunteers in K-12 STEM education outreach best practices to facilitate regional classroom interactions. The community of professional engineers largely share a like-minded goal within K-12 STEM education: to champion the development of a larger, better prepared and more diverse pipeline of K-12 students who are informed and energized to pursue STEM in high school and college.

This – coupled with a desire to raise a generation of future professionals who know how to think like an engineer and embrace being a problem-solver with confidence and gusto – is the foundation for this exciting effort. In addition to ASME, supporting organizations include ASCE, AIChE, IEEE and NSBE.

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Facilitator

Elizabeth “Liz” Parry

engineer, engineering educator and consultant

- Principal Consultant, Elizabeth Parry Consulting
- Founding professional learning partner and collaborator for the Museum of Science Boston’s Engineering is Elementary
- The Engineering Place at in the Dean’s office of North Carolina State University’s College of Engineering
- Founding Chair, ASEE P12 Engineering Education
- Awarded the prestigious Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM)in 2015 by President Barack Obama
- Fellow in the American Society for Engineering Education, 2016

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Overview

- Hone effective communication strategies within a K-12 education environment.
- Become knowledgeable of educator expectations and curriculum requirements in STEM education.
- Develop appropriate level content and related hands-on activities.
- Learn how to efficiently outreach to a school to schedule and organize a classroom visit.

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Communication Strategies

- Acknowledge myths and debunk ‘em!
- Demystify Engineering = Problem-Solving for Good
- Leverage the Engineering Design Process as a collaborative way to solve a problem
- Engineering is an action, not a thing
- Cultivate an experience that enforces Engineering Habits of Mind

Erase any stereotypes about engineers.

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Communication Strategies

Engineers

=

Problem-Solvers for Good

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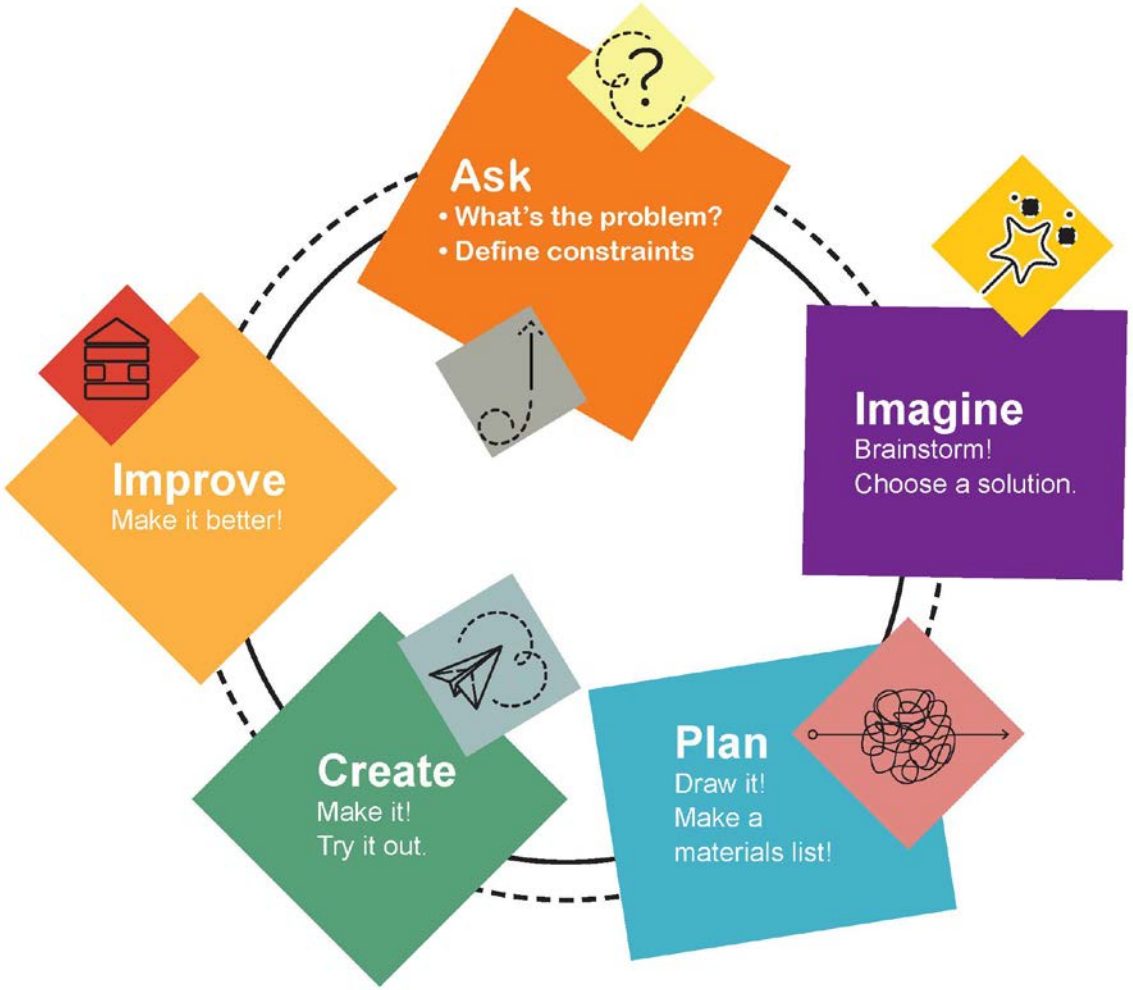
Communication Strategies



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Communication Strategies

Engineering Habits of Mind

- Communication
- Collaboration
- Optimism
- Systems Thinking
- Ethical Thinking
- Creativity

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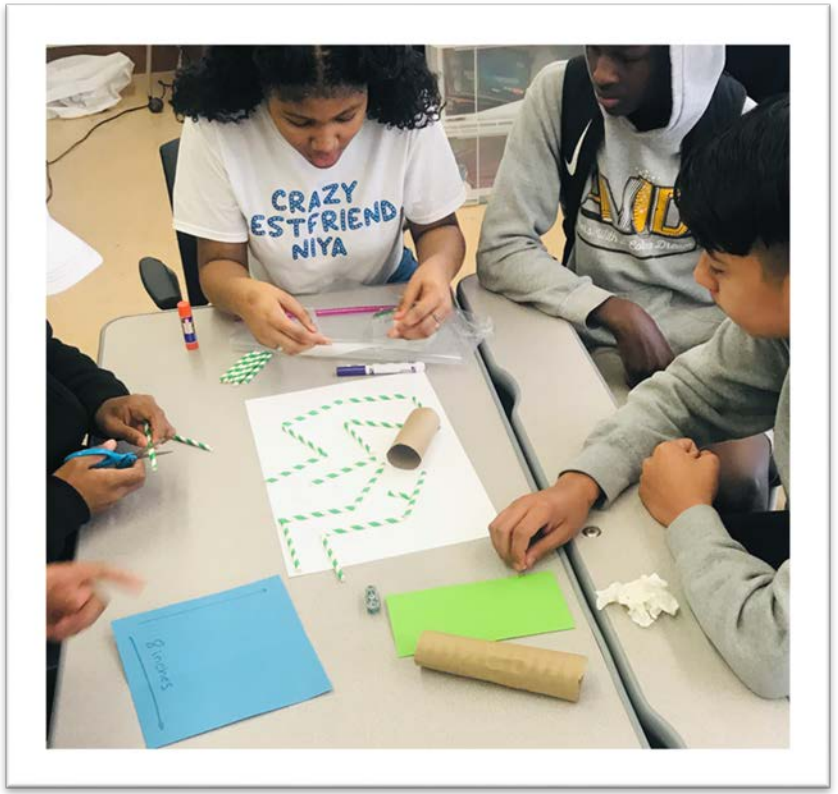
Educator Criteria & Constraints

- Accountability
- Expectations about inclusive and diverse teaching and learning
- State-specific standards (ex. Common Core)
- Time
- Cost



Remember public schools in the United States are teaching required state standards to ALL their students.

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Educator Criteria & Constraints

Standards

- **Mathematics** *measurement, data, ratios*
- **Science** *life science, physical science, intro to engineering design*
- **English Language Arts** *informational text, literature, writing, speaking and listening*
- **Social Studies** *cultural and historical connections*
- **Arts** *patterns, geometry, flow, rhythm, art/music, history*

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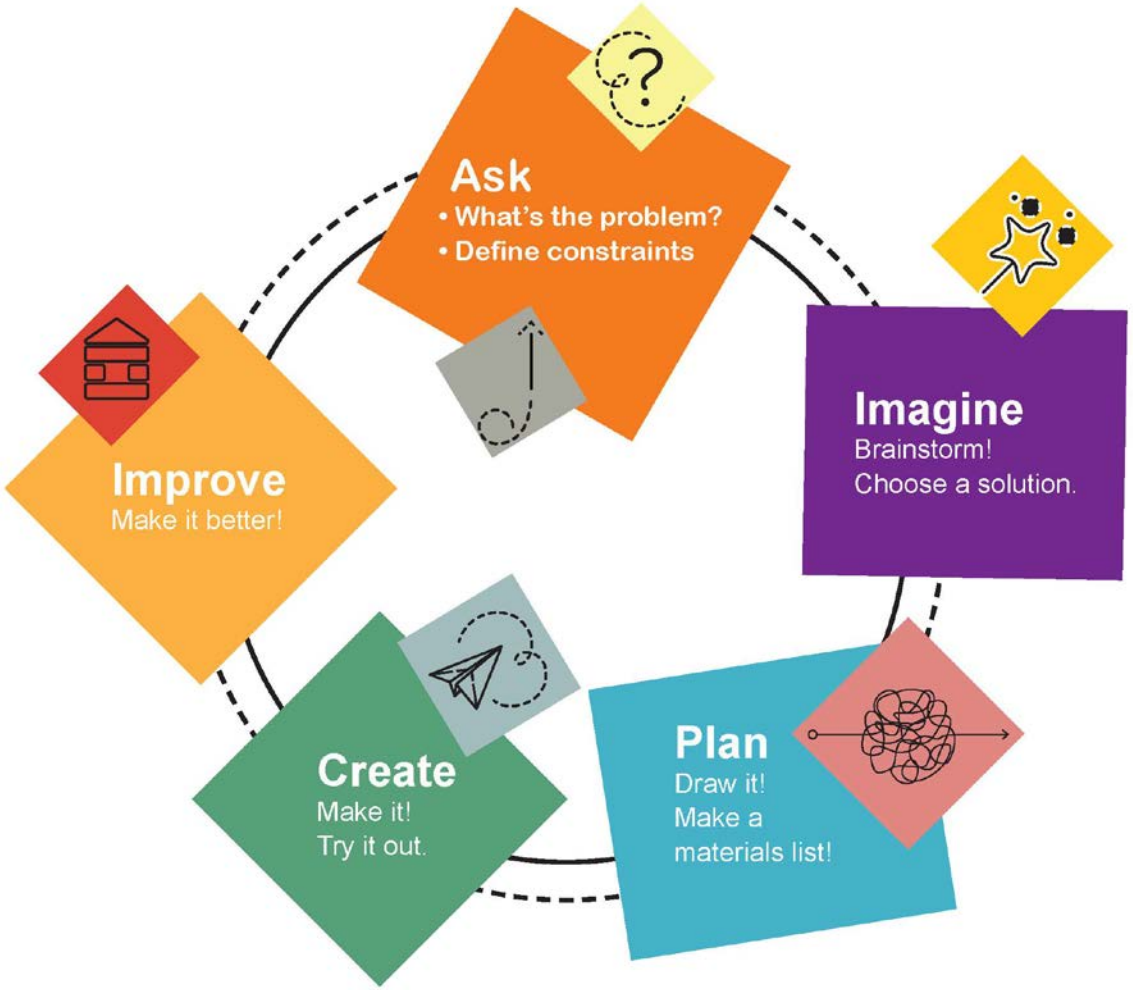
Educator Criteria & Constraints

Standards



Classroom Content

Model Classroom Visit Agenda

- Brief introductions and welcome remarks
- Introduce Engineering Design Process and how to think like an engineer
- **Hands-on activity with student/project teams**
  - Overview of engineering with real-world examples
  - Global engineering challenges and opportunities
  - Information share and observations
- "Charge" to students to be a Problem-Solver for Good
- Adjourn

7.7 billion people on earth

1 in 9 lack access to clean water
1 in 7 lack access to power/electricity

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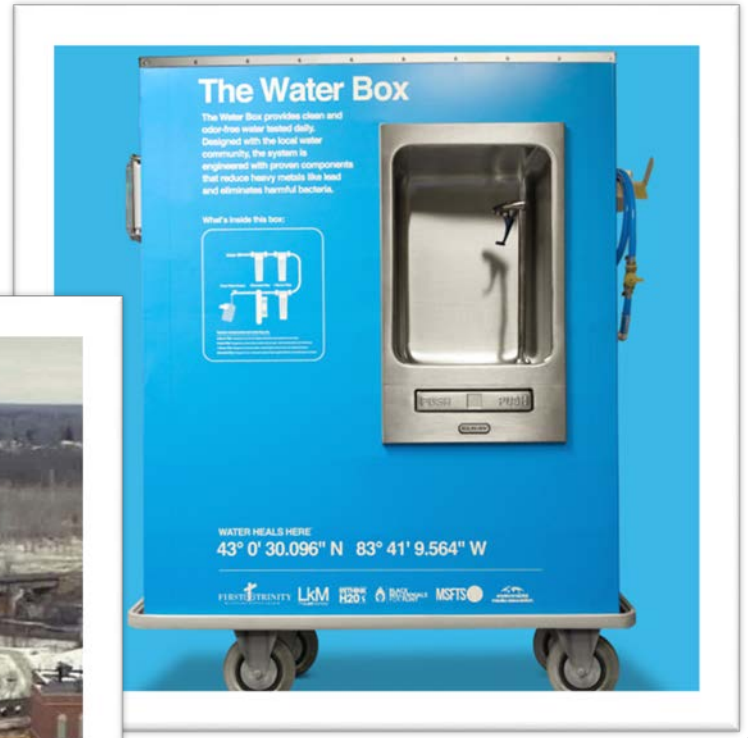
Classroom Content

The Grand Challenge: Provide Access to Clean Water

- Quantity
- Quality
- Transportation
- Storage
- Distribution
- Delivery



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Classroom Content | Hands-on Activity

Challenge: Water Delivery System

Design and create a system to deliver water from the water tank to a residence.

Constraints

- ✓ Work in teams of 3-4
- ✓ Use only materials provided
- ✓ Adhere to time limits

Classroom Content | Hands-on Activity

Challenge: Water Delivery System | Supplies

Suggested

Cardboard pieces, card stock, index cards, straws, rubber bands, binder clips, clothes pins, masking tape, small paper cups, large "Solo" cup (24 ounces), small bottles of water (8-16 ounces), paperclips, craft sticks, aluminum foil, wax paper, parchment paper, scissors

Scrap and recycled materials preferred.

Adapted by E. Parry from "Water Tower Challenge" at TryEngineering (www.tryengineering.org)

Classroom Content | Hands-on Activity

Challenge: Water Delivery System | Criteria

1. Water must travel 24 inches from tower to customer (aka cup).
2. Team members cannot be holding or touching the system while it is working, i.e. it must work independently without intervention.
3. The delivery must be controlled (i.e. can be stopped and started).
4. A successful system will fill the cup ½ full.

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Classroom Content | Hands-on Activity

Challenge: Water Delivery System | " Ta Da"

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Classroom Content | Hands-on Activity

Challenge: Water Delivery System | " Ta Da"

Adapted by E. Parry from "Water Tower Challenge" at TryEngineering (www.tryengineering.org)

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Classroom Content | Hands-on Activity

Challenge: Water Delivery System | " Ta Da"

Adapted by E. Parry from "Water Tower Challenge" at TryEngineering (www.tryengineering.org)

Classroom Content

Challenge: Water Delivery System | Debrief

- What are some skills you and your team used to complete this challenge?
- Why did you choose the materials you used?
- Was your final design your first idea?
- What was the hardest part of the challenge?

Outreach Best Practices

School Connect 101 | It's a process.

- School districts have strict and sometimes multi-step processes for adults to visit a school building.
- "Volunteers" often have procedures to follow to go into a school; check your school/district website (note: you may have to complete some paperwork PRIOR to your visit).
- On arrival, check into the school's front office; ditto when you leave

Reminder: bring your photo ID!

Outreach Best Practices

School Connect 101 | Follow school rules onsite.

- Be mindful of approved areas when in the building.
- Wear your badge/nametag at all times.
- Be on time and end on time.
- Bring any materials you will need for your visit/activity and be prepared to donate leftover supplies to the school.
- The school may have resource officers/police on campus.
- Use adult designated restrooms (ask school staff location/protocol upon arrival).

Talk less and spend more time on hands-on activities.

Onsite Best Practices

School Connect 101 | Engaging with students.

- Students will be excited; bring kindness and a smile.
- Introduce yourself as you would like to be addressed (ex. “Hi there, I’m Patti Jo!” or “I’m Mrs. Rosenthal!”)
- Respect a student’s personal space.
- Leave all food and drinks behind (a water bottle is “ok” to have on-hand).
- Check with school before taking pictures and/or posting on social media (note: never tag a student or refer to them by name).

Have fun! Your impact is invaluable.

Thank you!

Any questions?

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Classroom Content | Hands-on Activity

Challenge: Create Hexbug Maze

Design a course that a Hexbug can successfully complete from start to finish.

Constraints

- ✓ Work in teams of 3-4
- ✓ Use only materials provided
- ✓ Adhere to time limits

Classroom Content | Hands-on Activity

Challenge: Create a Hexbug Maze| Supplies

Suggested

11 X 17 card stock, 8 X 8 square card stock, paper towel tube, paper straws, tape, glue stick, scissors, small Hexbug

Scrap and recycled materials preferred.

Classroom Content | Hands-on Activity

Challenge: Create Hexbug Maze| Criteria

The completed course should have the following elements:

1. at least 3 measurable 45, 90, 135 degree angles
2. a 4” tunnel
3. one hazard (something the Hexbug must avoid/go around)

Classroom Content

Challenge: Create Hexbug Maze| Debrief

- What are some problem-solving skills you and your team used to complete this challenge?
- Was your final design your first idea?
- How did you adapt your design while working with the Hexbug?
- What was the hardest part of the challenge?
- What was the biggest surprise of the challenge?

Classroom Content | Hands-on Activity

Challenge: Straw Rocket Challenge

Design and build a rocket that will launch from a straw and travel the farthest distance horizontally.

Constraints

- ✓ You cannot use more than ½ sheet of an 8.5 X 11 inch piece of paper.
- ✓ The rocket must fit and be launched from the outside of the straw.

Classroom Content | Hands-on Activity

Challenge: Straw Rocket Challenge| Supplies

Suggested

straw, ½ sheet of paper for each participant (two different colors, one for each of two trials), tape, scissors

Supply list is meant to support two straw rocket "trial" launches.

Classroom Content | Hands-on Activity

Challenge: Straw Rocket Challenge| Test Process

Each student should stand at the same starting line when launching their rocket with a single blow. Leave the rocket where is lands per trial.

Hint: student trial results can be used to create data analysis exercise for post activity discussion.

Classroom Content

Challenge: Straw Rocket Challenge| Debrief

- What are some problem-solving skills you and your team used to complete this challenge?
- Was your final design your first idea?
- How did you adapt your design between trials?
- What was the hardest part of the challenge?
- What was the biggest surprise of the challenge?