Evolving Needs

OBJECTIVES

During this lesson, students will:

- Explore concepts related to supply and demand
- Assess solutions from a variety of perspectives
- Redesign an existing solution to meet a new need

OVERARCHING QUESTION

How can we use the engineering design process to repurpose solutions and meet new needs in our community?

STANDARDS

Next Generation Science Standards

- Engineering Design
    - MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

C3 Framework for Social Studies Standards

- D2.Eco.6.6-8. Explain how changes in supply and demand cause changes in prices and quantities of goods and services, labor, credit, and foreign currencies.

Common Core English Language Arts

- Writing:
    - W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

- Speaking and Listening:
    - SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
    - SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

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ACTIVITY OVERVIEW

Introduce

1. Begin by introducing students to (or reminding them of) the general concept of supply and demand.

   - *Supply* refers to the amount of goods or services available.

   - *Demand* refers to how much of a product or service people want or need.

   - *Suppliers* normally create the product, and *vendors* sell the product or service to consumers.

2. Share the following categories: transportation, health, recreation, and safety. Encourage students to brainstorm a few products or services within these categories that consumers demand as well as where they can find these products or services. For instance:

Recreation	
Demand	**Vendors or Suppliers**
Tickets to football games	NFL sales, stadium sales, third party ticket sale websites, etc.

3. Ask students to discuss:

   - Do the demands and needs of society always stay the same?

   - How might new or different needs affect supply and demand?

   - What may happen if demand were to increase but supply remained the same?

4. Explain that students are about to watch a short video that highlights how one company—Boeing—is approaching the new needs and demands of today's society.

View & Reflect

1. Play the Boeing Dreamlifter video twice. The first time students watch, ask them to listen for: How did demand change and what did Boeing do to help?

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2. Encourage students to think-pair-share* their responses after the initial viewing.

   *In a think-pair-share, students think about the question independently, discuss their answers with a partner, and then share their thoughts with the larger class.

3. Then assign each student one of the following perspectives:

   · Medical professional

   · Community member

   · Boeing employee

4. As students watch the video a second time, encourage them to consider how changing the Boeing Dreamlifter's usual mission may affect this person (i.e. their day-to-day life, their job, their future, etc.).

5. When the video is complete, encourage students to share their reaction to the Boeing Dreamlifter's shift from their assigned perspective. How may using the Dreamlifter to transport personal protective equipment (PPE) affect these different people?

CHALLENGE

1. Explain that the class will now be challenged to explore how Boeing's problem-solving strategy could be applied in their own community. Each student will brainstorm local needs or demands and begin the engineering design process as they consider how existing resources could offer efficient solutions.

2. Share the *Challenge* handout, and review the instructions before encouraging students to work independently.

CONCLUDE

1. Once the *Challenge* handout is complete, invite students to share the need they selected, their repurposed solution, and how this solution would effectively meet this need.

2. If possible, encourage students to compare and contrast the solutions they developed and consider how they could optimize their solutions based on the ideas of their peers.

3. Wrap up by encouraging students to keep this lesson in mind as they seek to develop solutions in the future. Sometimes the most effective and efficient solution may already exist, it's just being used to solve *another* problem or meet *another* need!

Directions: Read the engineering design process background section below and complete Steps 1–3 as you consider how the engineering design process could be used to repurpose solutions and meet needs in your own community.

Engineering Design Process Background:

The engineering design process is a series of steps that engineers use to develop a solution to a problem. While the exact steps may vary, the process generally includes:

- Define the need/problem
- Research the problem
- Brainstorm possible solutions
- Choose a solution
- Develop a model or prototype
- Test the protype
- Redesign and improve the design

Some problems require an entirely new design solution—whereas other needs can be met by repurposing solutions that already exist! There are pros and cons to both types of design solutions.

When solutions can be repurposed, the entire engineering design process may not be necessary. For this reason, it's possible that repurposed solutions may be available more quickly and less expensively than when an entirely new design must be created.

However, there's a risk that repurposed solutions are less effective than a tailor-made design. In addition, when a solution is repurposed, it may mean that it can no longer be used for what it was originally intended.

Step 1—Define & Research the Need

Think about some of the needs and problems in your own community, especially in the categories listed below.

- **Transportation:** Is it easy or hard to get from place to place in your community? Does public transportation exist?
- **Health:** How healthy and active are your community members? What health needs do community members have?
- **Recreation:** Are members of your community able to relax and have fun together? Is there a need for this?
- **Safety:** Are there any problems regarding safety in your community? What would make your community safer?
- **Optional:** Are there any other problems or needs in your community that come to mind?

Choose one need to focus on and explain it in more detail. You may perform Internet research, speak with family or community members, and/or use your own background knowledge to elaborate on the problem.

Specific Need: _____

Details about this need: (Such as: What is the problem? Why is this a need?)

_____

_____

_____

Step 2—Brainstorm Possible Solutions

If your community did not have the time or money to develop a solution from scratch, how could existing resources be leveraged and repurposed to solve this problem?

Keep the Boeing Dreamlifter solution in mind, and brainstorm two or three possible solutions below. Then consider the pros and cons for each one. Remember: These solutions must currently be solving a *different* problem!

Possible Solutions	Potential Benefits and Consequences
	Pros: Cons:
	Pros: Cons:
	Pros: Cons:

Step 3—Choose a Solution

Select one solution from above that you believe would best meet your community's needs. On a separate piece of paper:

- Describe your solution in further detail. What resources would you repurpose and why? You may include a sketch if it would be helpful!
- Explain the effect that this solution would have on at least three different community members. The effect may be positive *or* negative.
- Justify why this solution would be best for your community.