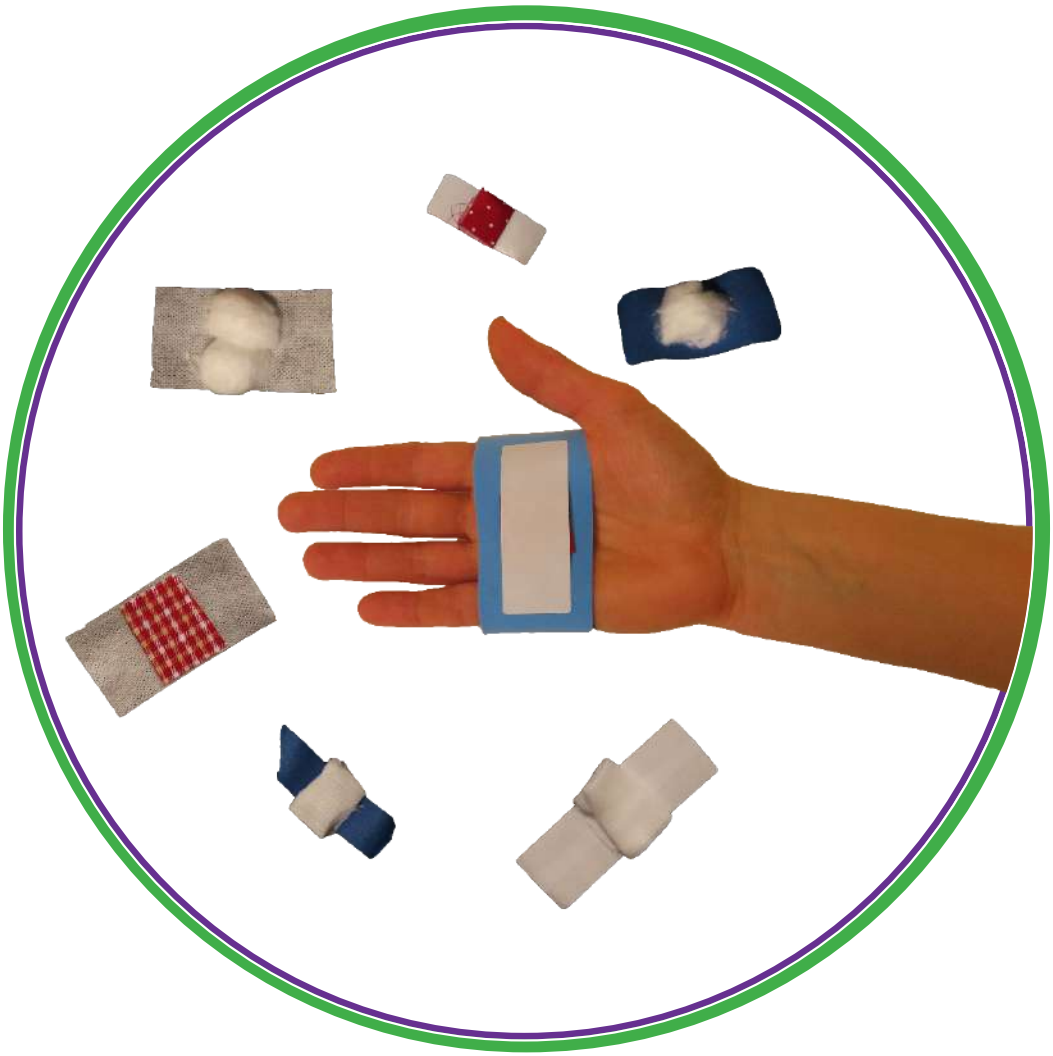
Massachusetts STEM Week 2025

Engineering Bandages

YES
Youth Engineering Solutions



EDUCATOR GUIDE

For Elementary Youth

Museum of Science.

10.2025

The Museum of Science, Boston, and Youth Engineering Solutions are proud to support this year's Massachusetts STEM Week.

Learn more about MA STEM Week here: https://www.mass.gov/info-details/stem-week

About This Design Challenge

Engineering is the process of using creativity and an understanding of materials, tools, mathematics, and science to design things that solve problems.

In this hands-on design challenge for elementary learners, youth work in pairs and use the Engineering Design Process to design a bandage that keeps a model cut clean. Youth apply the bandage to a model cut and complete an obstacle course to test how well the bandage works.

During the activity, youth work in pairs to imagine, plan, and create unique solutions to the problem. They test and improve their designs, then share their engineering work with one another.

This challenge is an abbreviated version of a longer unit. For the complete Youth Engineering Solutions *Engineering Bandages* unit, visit **https://yes.mos.org/unit/engineering-bandages/**

Massachusetts STEM Week 2025
Engineering Bandages

Activity Outline

Preparation: 35 min.

Introduction: 15 min.

- Introduce engineering.
- Read and discuss the story.

Exploration: 35 min.

- Create and test a bandage.

Wrap-Up: 10 min.

- Reflect on the engineering experience.

Optional Kahoot! quiz:

- *What is Biomedical Engineering?*

Guiding Question

How do engineers solve problems?

Learning Objective

Youth will be able to

Engineer a bandage that can cover and protect a cut.

The Massachusetts STEM Week 2025 engineering challenge is designed to be completed in **one hour**, followed by an optional Kahoot! quiz that will take additional time.

The Engineering Design Process

Engineers use a structured, iterative process called the Engineering Design Process (EDP). This is not a rigid process. Rather, engineers move back and forth among phases. After proceeding through the basic phases, youth improve their design by repeating the cycle.

Elementary youth engage with a simple, five-phase process.

Ask: Youth define the problem, then identify the requirements for the design (criteria) and how their choices may be limited (constraints). This phase includes considering the needs of users and implications of the solution. Youth explore materials and consider which are best suited to the challenge.

Imagine: Youth creatively brainstorm ways to solve the problem.

Plan: Youth share and select their best ideas to generate one design per group. They sketch their plan and list the materials it uses.

Create: Youth work in groups to make the solution they designed.

Test: Each group tests its solution. Groups share and analyze data to determine where they can improve.

Improve Cycle: Groups improve their designs by going through another iteration of the process.

Materials

The Materials and Preparation for the unit assume a group size of 24 youth. Adjust amounts as needed.

Digital Resources

- ☐ Slides: *MA STEM Week: Engineering Bandages*
- ☐ optional: Kahoot quiz

Physical Materials

For the whole group:

- ☐ dish or hand soap, blue or green
- ☐ towels or paper towels
- ☐ 1 permanent marker
- ☐ 4 Testing Stations (see Preparation)
  - ○ 4 cups of soil
  - ○ 1 half cup measuring cup
  - ○ 8 aluminum trays, 9" × 13"
  - ○ 16 rulers
  - ○ 96 stacking objects (cubes, dice, erasers, etc.)

For each pair:

- ☐ 1 model cut cuff (see Preparation)
  - ○ 3 sheets of craft foam, 9" ×12"
  - ○ 1 roll of masking tape
- ☐ 1 piece of wax paper, 6" wide

Physical Materials (cont.)

For the Materials Table:

- ☐ 6 pairs scissors
- ☐ Sticky Materials
  - ○ 1 roll of cellophane tape
  - ○ 1 roll of gauze
  - ○ 1 roll of masking tape
  - ○ 1 roll of painter's tape
  - ○ 1 roll of surgical tape
  - ○ 24 label stickers
- ☐ Pad Materials, about 24 of each
  - ○ aluminum foil, 2" × 2"
  - ○ cheesecloth, 2" × 2"
  - ○ cotton balls
  - ○ cotton fabric, 2" × 2"
  - ○ gauze, 2" × 2"

Print Materials

- ☐ *Engineering Bandages Poster* (available digitally or as a print poster)
- ☐ *Obstacle Signs*

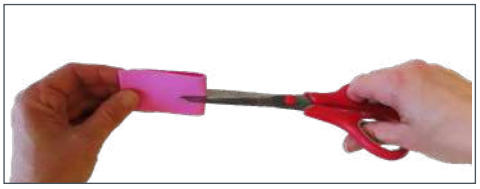
For each pair:

- ☐ *Materials Glossary*
- ☐ optional: *Plan Our Bandage*

Preparation

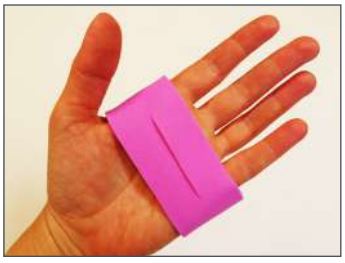
Create model cut cuffs for each pair.

- ☐ Cut 2 pieces of craft foam: a 1.5" × 7" strip and a 1" × 2" piece.
- ☐ Fold the larger strip of foam in half to help cut a 1 in. slit in the middle of the strip.




- ☐ Place the smaller (1" × 2") piece of craft foam over the slit and secure it with masking tape.


- ☐ Curve the strip around your hand to find an approximate size. Staple the strip to form a loop that can fit over a child's hand.

- ☐ Gather dish or hand soap to use as model blood. When youth are ready to test, you will squeeze a few drops into the model cut by pinching the craft foam to open the slit.


- ☐ Save the scrap pieces of craft foam for the Imagine phase.

Preparation

Set up the Materials Table.

- ☐ Place the label stickers on the table. Tear ten 5 in. pieces of each sticky material and stick them to the edge of the table.
- ☐ Organize the pad materials and place them on the table.
- ☐ Place the scissors on the table.

Set up 4 Testing Stations.

- ☐ Each Testing Station will have 3 obstacles. Line these up so youth can easily move through them:
  - ○ Obstacle 1: Tower Stacking
    - Place 24 stacking objects in a tray.
    - Place 4 rulers in the tray.
    - Post the *Tower Stacking* obstacle sign.
  - ○ Obstacle 2: Jumping Jacks
    - Use masking tape to mark 4 Xs on the floor about 3 feet apart.
    - Post the *Jumping Jacks* obstacle sign.
  - ○ Obstacle 3: Get Dirty
    - Pour about 1/2 cup of soil into each tray.
    - Post the *Get Dirty* obstacle sign.

Tip: Consider the mobility needs of your group. If needed, change jumping jacks to another action involving rapid movement of the hand wearing the bandage.

Introduction (15 min.)

Introduce "engineer."

1. Tell youth that today they will be engineers and make something that solves a problem. Ask:

   - **Have you ever heard of the word "engineer," or do you know anyone who is an engineer?** *Accept all answers.*
   - **What do you think engineers do?** *Accept all answers.*

2. Explain that an engineer is **a person who thoughtfully designs something to solve a problem.**

3. Define **engineer** using the slide.

Tip: If your youth are familiar with engineering, start with Step 4.

Tip: Include the verb form of the word "engineer": *To thoughtfully use a process to design something to solve a problem.*

Introduce the engineering challenge.

4. Show the *Engineering Bandages Poster*.

5. Read aloud the story:

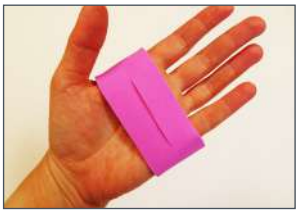
> In this engineering unit, we'll be working to solve a problem involving a cut. Mateo and Tomás are playing in their room when Mateo cuts his hand.
>
> Tomás goes to get a bandage, but the box is empty!
>
> Because they don't have any more bandages, Mateo and Tomás decide to engineer their own.
>
> Mateo doesn't like to wear bandages. They fall off when he is playing and his cut gets dirty. Tomás thinks they can engineer a better bandage that will stay on while they play and keep his cut clean.

6. Display the Slide: *Think About It*. Have youth turn and talk:

   - **What is the problem?** *Mateo and Tomás don't have a bandage to cover Mateo's cut. Bandages can fall off and don't keep cuts clean.*

- **What problems do you have with bandages?** *Accept all responses.*
- **What do Mateo and Tomás decide to do?** *They decide to engineer their own bandage.*

7. Explain that, just like the characters in the story, youth will be engineers and create a bandage to protect a model cut.
8. Show youth the model cut cuff.



9. Introduce the definition of **model** using the slide.
10. Demonstrate how the model cut cuff fits over youth's hands. The side with the cut should be on the palm.
11. Demonstrate how you will fill the cut with a few drops of soap, which is the model blood. Then, youth will apply the bandage on top of the cut.

Introduce the Engineering Design Process.

12. Display the Slide: *Engineering Design Process*. Point to the each **icon** and explain that engineers follow a process to

- **ask** questions and gather information about the problem.
- **imagine** many possible solutions.
- **plan** one design as a team.
- **create** a working design.
- **test** and evaluate the success of their design.
- continually **improve** by repeating the design process.

Optional: Use Slide: *Engineering Chant* to reinforce the phases of the Engineering Design Process.

LD

Promoting Equity:

While the EDP includes visuals to represent each phase, you can also use gestures to provide multiple access points for youth.

Exploration (35 min.)

Imagine and plan a bandage.

1. Explain that youth will work with a partner to imagine, plan, create, and test a bandage.
2. Show youth the Materials Table and review the available sticky materials and pad materials.
3. Explain that as they imagine ideas, pairs can get materials from the Materials Table to put on the scrap craft foam to determine which materials might work well for a bandage design.
4. Assign pairs and distribute a *Materials Glossary* and one piece of scrap craft foam to each pair.
5. Explain that engineers often use models to test their designs before creating the final design. They will use model cut cuffs to test their bandage designs.
6. Give pairs a few minutes to imagine bandage designs. Encourage youth to use the sentence frames on Slide: *Imagine a Bandage* to guide their thinking:
   - I think we could use _____ so the bandage stays on when playing.
   - We should try _____ to help keep the cut clean.
   - The _____ might fall off because _____.
   - What if we made the bandage with _____ so it doesn't get dirty?
7. Have each pair talk about their design ideas, then select one of their ideas to plan, create, and test. Each pair will create one bandage design to test.
8. Display Slide: *Working Together,* and tell youth they may use the sentence frames to help support their discussions and come to decisions.

Engaging Families:

Take photos! Sharing the process and final products with families and others helps youth connect engineering to their lives.

LD

Embedded Equity:

Sentence frames provide youth with examples of how they can verbally share ideas with their peers.

Optional: Distribute *Plan Our Bandage* for pairs to complete as they discuss and finalize their plans.

Review the test procedure.

9. Gather the group and explain that after they create their bandages, they will test the bandage using the model cut cuff.

10. Demonstrate how pairs will create their bandage on a piece of wax paper.

    - Show youth the wax paper and explain that this paper will act like the parts of a bandage that are peeled off to reveal the sticky sides.
    - Model how to place the pad material on the wax paper.
    - Then, youth will place their sticky material over the pad, pressing on the sticky material so it attaches to the wax paper.

11. Explain that when they are ready to test, they will bring the bandage to you. They will put a model cut cuff over their hand, you will put a few drops of soap in the cut, and then they will apply their bandage on top of the cut.

12. Display Slides: *Obstacle 1*, *Obstacle 2*, and *Obstacle 3*, as you review and demonstrate the test procedure:

    - Obstacle 1: Tower Stacking
        - One youth will use their bandaged hand to stack a tower that is at least 6 inches tall.
        - The other youth will hold the ruler to measure the height.
        - Before moving on, knock down the tower.
    - Obstacle 2: Jumping Jacks
        - One youth will stand on an X and do 10 jumping jacks.
        - The other youth should count the number of jumping jacks.
    - Obstacle 3: Get Dirty
        - One youth will place the palm with the bandage into the soil and move it around for 10 seconds.
        - The other youth should time their partner by counting to 10.
        - Before completing the course, brush off your hand over the tray of soil.

Tip: Instead of using rulers, cut a 6-inch piece of cardstock for youth to use.

Tip: Have youth do the Get Dirty obstacle last so excess dirt won't obscure the results of the other tests.

Support pairs as they create and test their designs.

13. Distribute a piece of wax paper to each youth.
14. Allow pairs to collect materials and create their designs.
15. As pairs finish creating their bandages, distribute a model cut cuff to each pair for testing. Allow pairs to begin testing.

16. As pairs test, support their engineering and collaboration by asing questions like:

    - **Does your bandage work the way you planned? Why or why not?**
    - **What parts of your bandage are working well?**
    - **How could you improve your design?**
    - **Why do you think these changes will improve yor bandage?**

17. As time allows, allow pairs to improve and retest their bandage designs.

18. After testing, use Slide: *Did Our Bandage Work?* to help youth reflect on the engineering challenge goal: designing a bandage that stays on and keeps the cut clean.

    - Read aloud each statement on the slide and have youth turn and talk, or share out, using the sentence starters to describe their bandage.
    - Encourage youth to state whether their bandage fell off, got dirty, or stayed on and kept the model cut clean, and explain why.
    - Congratulate pairs whose bandages stayed on and kept the model cut clean. For pairs whose bandages didn't work as planned, remind youth that engineers test, learn, and improve their designs. Emphasize that engineers flip the failure to help make their designs better.

Wrap-Up (10 min.)

Have youth do a gallery walk of designs.

1. Congratulate youth on their creative engineering solutions.
2. Tell pairs that they will share their designs by participating in a gallery walk. Establish norms, such as
   - Respect others' designs by only looking and not touching.
   - Travel with a partner or independently.
3. Have each pair place their model cut cuff with their bandage design attached in a designated location.
4. Display Slides: *Learning From Others* and review the questions and sentence frames.
5. Give youth time to look at the bandages and discuss their observations.
6. Have youth return to their groups to discuss their observations:
   - **What did the bandages have in common?**
   - **Did any design surprise you? Why?**
   - **If you had more time to improve, which idea would you use in your design?**
7. Have youth share what they observed with the whole group. Reinforce that there were many solutions to the same problem and that by learning from each other, engineers can continue to improve technologies.

Interested in more? Check out the complete *Engineering Bandages* unit here:

https://yes.mos.org/unit/engineering-bandages/

Optional Kahoot quiz (10 min.)

What is Kahoot!?

Kahoot! is a game-based learning platform that makes it easy to create, share and play learning games or trivia quizzes in minutes.

The Museum of Science partners with Kahoot! to pair content from the museum with curricula designed for youth.

Kahoot! requires a free account. Have youth follow the instructions to join the kahoot and play along.

Play the *What is Biomedical Engineering?* Kahoot!.

1. Use the link to open the Kahoot! connected to this activity: *What is Biomedical Engineering?*.
    - https://kahoot.it/challenge/00935841