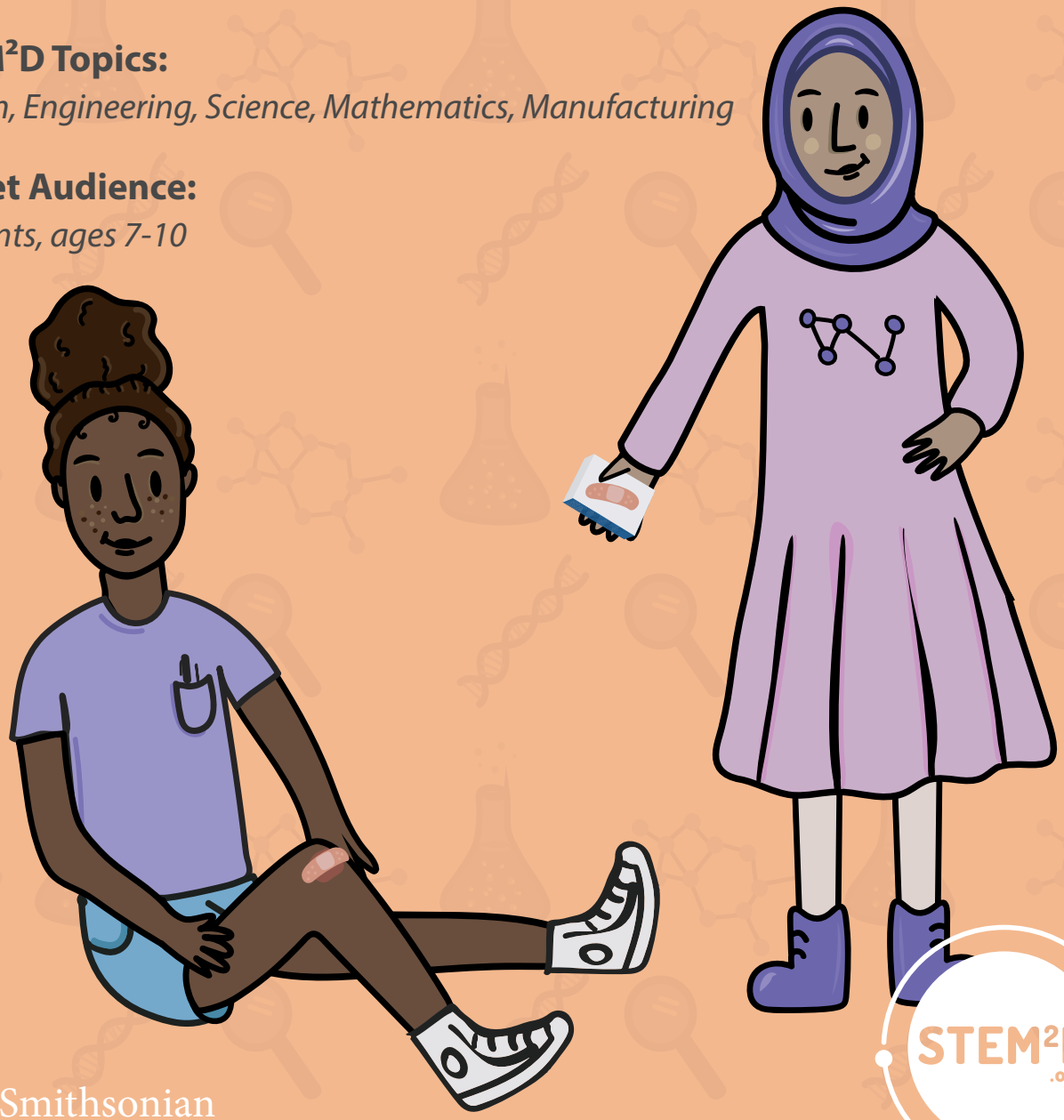
OUCH! I NEED A BANDAGE:

DESIGNING, CONSTRUCTING, AND PACKAGING A BANDAGE

STEM²D Topics:
Design, Engineering, Science, Mathematics, Manufacturing

Target Audience:
Students, ages 7-10



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OUCH! I NEED A BANDAGE: DESIGNING, CONSTRUCTING, AND PACKAGING A BANDAGE is part of the STEM²D Student Activity Series. The content and layout were both developed by the Smithsonian Science Education Center as part of Johnson & Johnson's WiSTEM²D initiative (Women in Science, Technology, Engineering, Mathematics, Manufacturing, and Design), using a template provided by FHI 360 and JA Worldwide. This series includes a suite of interactive and fun, hands-on activities for girls (and boys), ages 5-18, globally.

Design and illustrations by Sofia Elian

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Topics: Design, Engineering, Science, Mathematics, Manufacturing
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ACTIVITY DESCRIPTION

In this engineering design activity, young students have fun working in teams to construct and package an adhesive bandage for a specific injury using everyday materials provided for them. In addition to measuring, problem-solving, decision-making and creativity, students use interpersonal skills needed in STEM²D careers such as presenting ideas, negotiating, organizing and working as a collaborative team.

ESTIMATED TIME:
This session typically takes 1 hour to complete.

STUDENT DISCOVERIES

Students will:

- Participate in a team-based learning experience
- Learn how STEM²D—science, technology, engineering, mathematics, manufacturing, and design—subjects are used in the designing, constructing and packaging of a bandage
- Build important STEM²D skills such as measuring, decision-making, and problem-solving
- Consider STEM²D concepts including, material properties such as flexibility, adhesion, sterility and absorption, weight, balance, and gravity
- Recognize that STEM²D offers diverse and exciting career opportunities, including that of a packaging design engineer
- Have fun experiencing STEM²D

GETTING READY

Materials: Suggested materials preparation prior to the activity with students.

- Activity Leader Checklist
- Tell My Story form
- 1 Student Assessment Handout per student
- "I NEED A BANDAGE" Description Cards (A-G), 1 card per team
- Materials Test Sheets (1 and 2), 2 sheets (1 and 2) per team
- For each team (4 students):
    - Masking tape (24 mm wide), 30 cm (12 in) strip
    - Masking tape (36 mm wide), 30 cm (12 in) strip
    - 1 Pair of scissors
    - 6 Squares of toilet paper
    - 1 Paper towel sheet
    - 1 Metric ruler
    - 1 Eye-dropper
    - 1 Cup for water
    - 30 cm (12 in) long sheet of waxed paper
    - 30 cm (12 in) long sheet of parchment paper (non-stick)
    - 30 cm (12 in) long sheet of aluminum foil
    - 4 Cotton balls
- 2 Measuring tapes (both English and metric)
- 1 Red, washable marker
- 1 Roll of clear tape
- 1 Container with water (2 liter/2 quart)
- Crayons or colored markers
- 1 Box of bandages
- Certificates (optional), 1 per student
- Camera (optional)

Estimated Materials Cost:
Activity leaders can expect to spend less than $20.00, (assuming scissors, rulers, container of water, crayons or colored markers are available) in material costs when completing this activity with 24 students organized into six teams of four students.

ACTIVITY LEADER PREPARATION

1. Read **Spark WiSTEM²D.** This is essential reading for all volunteers interested in working with youth, as it provides important background knowledge about STEM²D, strategies for engaging female students, and tips for working with groups of students. Download at STEM²D.org.

2. Review the **Activity Leader Checklist** for details and specific steps for planning and preparing to implement this activity.

3. See the **STEM²D Student Activities Overview** for additional information.

CONVERSATION STARTERS: *LEARNING ACTIVITY*

- Is there anyone in the class who is wearing a bandage?
- Does anyone remember the last time they wore a bandage?
- Does anyone remember the last time they opened a bandage?
- Was it easy to open?
- Why do you think it was packaged the way it was?
- Was the bandage easy to put on your cut or scrape?
- Did it stay on a long time? What caused it to come off?
- Was the bandage able to keep the blood from getting all over the place?
- Are all bandages one color?

STEP-BY-STEP ACTIVITY:

OUCH! I NEED A BANDAGE: DESIGNING, CONSTRUCTING AND PACKAGING A BANDAGE

Welcome and Introductions (10 minutes maximum with this age group)

- Greet the students.
- Tell the students your name and your organization/company. Talk about your educational and career path. Use the **Tell My Story** form as a basis for your remarks. Be prepared to describe your job or a typical day, and provide information about your background including:
    - Your education – focus on secondary and post-secondary classes and courses
    - Current work projects
    - Interests and hobbies
- Why you love STEM²D, and how your work is connected.
- Write your introduction ideas here.

Engineering is one of the many careers considered to be high-demand and high-growth and will remain in demand over the next 10 years.

TIPS FOR STARTING CONVERSATIONS:

- Conversation Starters are provided throughout and include questions designed to introduce students to the activity topics. Use the questions—modify them, or add others—to engage your students.

- Ask the students or any volunteers helping today to introduce themselves.
- Use Conversation Starters to learn more about the students and their interests.
- Discuss the opportunities that exist in the local community to support students as they develop their interests and personal experiences.
- Tell the students that your career is only one of the many careers available in STEM^{2}D – science, technology, engineering, mathematics, manufacturing, and design.
- Explain that STEM^{2}D careers are high-demand, high-growth careers and are predicted to remain in demand over the next 10 years.
- Some STEM^{2}D careers do not require a college degree and offer young people exciting, high-paying opportunities. Stress the importance of gaining mathematics skills and engineering practices to succeed in any STEM^{2}D career.

CONVERSATION STARTERS: *CAREER PLANNING*

- When you consider your future, what are you most excited about?
- Do you see yourself working with others, for a large company, with your friends, for yourself? Why or why not?
- What does the perfect work day look like to you? Are you outdoors? Are you working alone, or with others? Do you solve problems? Do you fix or build things?

Instructions (30 minutes)

- As a class, discuss or make a list of things that are important when designing a bandage?
- Students should generate some of the following ideas:
    - It needs to stick but not to the cut. **(Adhesive)**
    - It must stop the bleeding. **(Absorb liquid)**

    - It must be clean. (**Sterile**)
    - It needs to be sealed so it doesn't leak. (**Occlusive**, air and water tight)
    - It should blend in. (**Camouflage**)
    - It should be able to move. (**Flexible**)
    - It should be easy to use in an emergency.
    - It can't be too heavy or thick or it will fall off.
    - Sometimes it must be waterproof.
- At this age level, ask the teacher in advance to organize the students into teams (3-4 students per team).
- Have each team pick an "I Need a Bandage" card.
- Each Team should work together to:
    - Read the "I Need a Bandage" card and choose one student to be the injured person who needs a bandage.
    - Measure and draw (with the red washable marker) the wound on the student as described on the card.
    - Plan and work together to design a bandage to meet the needs of the injured student.
- Note that the "I Need a Bandage" cards indicate how badly the injury is bleeding, letting the students know how much liquid (blood) the bandage needs to absorb.
- Students may use any of the materials provided. They may want to test them first to discover the properties of the materials. Are they absorbent, adhesive, sterile, flexible, or waterproof? Distribute the Materials Test Sheets provided for student use.
- Encourage everyone to participate in the material testing and bandage design process.
- Visit each team as they work and ask open-ended questions that will lead them to problem-solve for their specific card scenario.
    - Why did you choose this material?
    - Which materials are adhesive?
    - Which materials are absorbent?
    - Which materials are flexible?
- If the teams would like, they can add a design or words to their bandage.
- Once the team has designed a bandage to meet the needs of the injury, the team is challenged to design a package or wrapper for their bandage, again using the materials provided.
- The students can use their creative artistic skills to give their product a brand name, logo, or design for the wrapper and/or instructions for

opening the wrapper.

- Have each team pick one person to report out to the class.
- Upon completion of the bandage and the packaging of it, each team will be asked to talk about their product, the injury for which it was designed, and the materials that they chose and why?
    - If words like absorption, adhesive, flexible and sterile are used, make sure the students know what they mean. (see Vocabulary)
    - Give positive feedback to each team on their engineering designs.
- After a team presents their bandage design, it is time for them to open their wrapper and apply the bandage to the wound of the injured person. Encourage applause from the other teams as the bandage is put in place.
- This is a good time to take pictures.

Student Reflection (10 minutes)

- Distribute the Student Handout. Have the students reflect on this activity by answering the following questions:
- Students should generate some of the following ideas:
    - What did you learn from this activity?
    - Was it fun? What made it fun?
    - Were you doing engineering or design? Why do you think so?
    - Are there ways you feel you could improve on your bandage design?
    - What other materials would you like to use? Why?
    - What was your biggest challenge in designing a package or wrapper for the bandage?
- After a few minutes ask the students to share their thoughts. If time permits, have the students discuss their response to the following question:
    - Have you ever thought about the people who designed and packaged the things we use every day? Think of all the packaging for the food, electronics, toys and other products we buy. The people that do this are called Package Designers, an important career that makes sure a product gets from the factory to the store, identified, protected, convenient, and promoted.
- Thank the students for participating.

EXTENDED LEARNING

Here are a few ways to extend the learning:

1. Design other tests for adhesive and absorbent materials.
2. Compare different bandages the students have brought from home. How are they alike? How are the different? Make a bulletin board Bandage Display.
3. Explore packaging design challenges. Ask students to bring in unique packaging designs.
4. Besides bandages, what other items should be in a first-aid kit?
5. Explore the science concepts of adhesion using positive and negative charged materials.

ACTIVITY LEADER REFLECTIONS

After the activity, take a few minutes to reflect on the following:

- What went well and what could be improved?
- What would you do differently next time?
- How comfortable did you feel leading the discussions? Do you have a better understanding of the STEM^{2}D concepts?
- How useful was the information presented in the **Spark WiSTEM^{2}D** to implementing this activity?
- Will you volunteer for this type of experience again?

VOCABULARY:

ABSORBENT: Able to soak up a liquid easily

ADHESIVE: Able to stick fast to a surface or object, sticky

STERILE: Free from germs, totally clean

OCCLUSIVE: Air and water tight

FLEXIBLE: Capable of bending easily and not breaking

CAMOUFLAGE: Hide or disguise the presence of something

BRAND NAME: A name given by the maker to a product

ACTIVITY LEADER CHECKLIST:

DID YOU . . .

- ☐ Read Spark WiSTEM2D? This is essential reading for all volunteers interested in working with youth. It defines the STEM2D principles and philosophy and provides research-based strategies and tips for engaging and interacting with female students. Download at www.STEM2D.org.

- ☐ Visit the implementation site and observe the young people? (optional) If visiting, take note of the following:
  - ☐ How does the site encourage orderly participation? For example, do the young people raise their hands when responding to questions or during discussions? How are interruptions handled? Do you see any potential problems with managing the class of young people?
  - ☐ What does the site do to make each student feel important and at ease?
  - ☐ How is the room arranged? Will you need to move desks or chairs for any part of your presentation?
  - ☐ How can you engage the site representative in your presentation?
- ☐ Meet with and finalize the logistics with the Site Representative?
  - ☐ Confirm the date, time, and location of the activity?
  - ☐ Confirm the number of students attending? Knowing this will help you decide how to group the students into teams, as well as the appropriate materials to purchase.
- ☐ Recruit additional volunteers, if needed?
- ☐ Prepare for the activity:
  - ☐ Read the entire activity text prior to implementation?
  - ☐ Customize the activity, if desired, to reflect your background and experiences, as well as the cultural norms and language of the students in your community?
  - ☐ Complete the Tell My Story Form, which will prepare you to talk about your educational and career path with the students?
  - ☐ If teams are needed for this activity, please ask the teacher in advance to organize the students into teams.
- ☐ Practice your presentation, including the hands-on, minds-on activity? Be sure to:
  - ☐ Do the activity; make sure you can explain the concepts to students, if needed, and that you know the correct answers.
- ☐ Obtain the required materials (see the Materials and Estimated Materials Costs sections) and, if asked for in the Getting Ready section, photocopy the Student Handouts and Materials Testing Sheets. In addition:
  - ☐ Organize the materials to ensure each team has everything listed in the Materials section—keep in mind some materials are shared among the teams.
- ☐ Prepare the space? Specifically:
  - ☐ Make sure tables and chairs are arranged to accommodate teams of students.
  - ☐ Bring a camera, if desired, to take photographs.
- ☐ Obtain and collect permission slips and photo release forms for conducting the activity if applicable?
- ☐ Have fun!

"Tell My Story" Form

This form will help volunteers serving as activity leaders prepare to talk about their STEM²D interests, education, and career path.

ABOUT YOU

Name: _____

Job Title: _____

Company: _____

When/Why did you become interested in STEM²D? _____

_____

_____

What do you hope young people, especially girls, will get out of this activity? _____

_____

FUN FACT

Share a little about your background. Ideas:

- Share a memory from childhood where you first had your "spark" or "interest" in STEM.
- Detail your journey; highlight what you have tried, what you learned, steps to success, etc.
- Failures or set backs are also great to talk about—difficulties, and/or challenges and how you overcame them.

EDUCATION AND CAREER PATH

What classes/courses did you take in secondary school and in college that helped or interested you most? _____

How did you know you wanted to pursue a STEM²D career?

_____

What was your postsecondary path, including the institution you attended and your degree? *If you switched disciplines, make sure you explain why to the students.*

_____

What your current position entails. *Be sure to include how you use STEM²D on a typical work day.*

_____

_____

"I NEED A BANDAGE" DESCRIPTION CARDS

A. I was riding my bike when I slid on some loose gravel. I fell and scraped my left knee. The area I need to cover with a bandage is 5 centimeters wide by 5 centimeters long. It is still bleeding a little. The bandage should absorb 15 drops of liquid (15 drops = 1.25 mL).

"I need a Bandage!"

B. I was playing hockey on our driveway when my friend hit me on my neck just below my right ear with a hockey stick. He did not need to do it. The cut is 5 centimeters long. It is bleeding quite a bit. The bandage should absorb 120 drops of liquid (120 drops = 10 mL).

"I need a Bandage!"

C. I was walking Shaggy, my dog, when she saw a squirrel. I tripped and fell and scraped my right elbow. The scrape is 3.75 centimeters wide and 5 centimeters long. It isn't bleeding too much. The bandage should absorb 30 drops of liquid (30 drops = 2.5 mL).

"I need a Bandage"

D. I just had a wart removed from the back of my left hand. The doctor said I should keep it covered with a circle bandage. The area I need covered is about 2.5 centimeters in diameter (across the circle). It isn't bleeding too much. The bandage should absorb 8 drops of liquid (8 drops = 6.25 mL).

"I need a Bandage"

E. Ouch! I just got my right thumb slammed in the car door and it looks like I'm going to lose my fingernail. Because I keep moving my thumb, it keeps bleeding. The bandage should absorb 30 drops of liquid (30 drops = 2.5 mL).

"I need a Bandage!"

F. I got too close to my uncle's motorcycle and burned my left ankle on the hot exhaust pipe. The burn is 7.5 centimeters wide and 7.5 centimeters long. It isn't bleeding now but it is oozing, and the skin looks like it will fall off. The bandage should absorb 15 drops of liquid (30 drops = 1.25 mL).

"I need a Bandage!"

G. I was roasting marshmallows with my family when my baby brother swung around, and his stick cut me across the back of my right hand. The cut is 4 centimeters from my little finger to the center of my wrist. It bleeds every time I make a fist. The bandage should absorb 60 drops of liquid (60 drops = 5 mL).

"I need a Bandage!"

MATERIALS TESTING SHEET 1

	Adhesive	Absorbent	Flexible	Sterile	Occlusive	Other
Masking Tape						
Clear Tape						
Toilet Paper						
Paper Towel						
Cotton Balls						
Waxed Paper						
Parchment Paper						
Aluminum Foil						

MATERIALS TESTING SHEET 2

	Toilet Paper	Paper Towel	Cotton Balls	Waxed Paper	Parchment Paper	Aluminum Foil
Adheres to Masking Tape						
Adheres to Clear Tape						
Absorbs 15 drops of liquid						
Absorbs 30 drops of liquid						
Absorbs 60 drops of liquid						
Absorbs 120 drops of liquid						

Other Observation Notes:

OUCH! I NEED A BANDAGE: DESIGNING, CONSTRUCTING, AND PACKAGING

Student Handout

Think about the activity. Record your answers to the questions using phrases or pictures in the space provided.

What did you learn from this activity?

Was it fun? What made it fun?

Were you doing engineering or design? Why do you think so?

Are there ways you feel you could improve on your bandage design?

What other materials would you like to use? Why?

What was your biggest challenge in designing a package or wrapper for the bandage?

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