

Professional Development Situation: Activity Guide

Skill Focus: Enabling Active STEM Learning

Time Required: 60 minutes

BUILDING A GRAPE SMASHER

In this activity, participants design a small machine that when put into action will successfully smash a grape.

Learning Objectives

- Youth will be able to collaborate to design a small machine that will be used to smash a grape.
- Youth will learn the mechanisms of simple machines needed in order to create their grape smasher through application.
- Youth will be able to use the engineering design process throughout the activity testing and retesting with staff facilitation.

Key Terms

- *Lever*: a rigid bar resting on a pivot, used to help move a heavy load
- *Pulley*: a wheel with a grooved rim around which a rope passes through, changes the direction of a force
- *Screw*: a short, sharp-pointed metal pin used to join things together
- *Wheel and Axle*: a wheel is attached to a smaller axle so that the two rotate together
- *Incline Plane*: a supporting surface tilted at an angle also known as a ramp
- *Wedge*: a triangular shaped tool, used to separate two objects or portions of an object, or hold an object in place

Materials

- Dowels (axel)
- Wheels of some sort (plastic, Lego, wooden, etc.)
- String (pulley piece) and pulley wheel

- Popsicle sticks
- Tape
- Glue
- Scissors
- Sand/Rocks/Beans for Counter Weight weights
- Plastic bags
- Paper and Pencils
- Any other conceivable supplies that could aid in the construction of a simple machine (be creative)

Advanced Preparation

- Gather all the materials needed.
- Set out pieces of paper and pencils at each desk.
- Create a PowerPoint or poster to introduce youth to the different types of simple machines (lever, pulley, screw, wheel and axle, inclined plane, and wedge).

Activity Instructions

Introduction (5 minutes)

Introduce youth to the lesson by asking the following questions:

- *What do you know about these different machines?*
- *How might these machines be used together?*
- *Have you seen or heard of any of these machines being used in real life?*
- *What other kinds of things could we use these machines for?*

Explain to the students that they will be taking on the role of an engineer. Review the [Engineering Design Process](#) and emphasize to youth that they will be following all the steps in the process to create their grape smasher.

- *“Today you will be designing a contraption that will smash a grape. You get to design this contraption/machine however you wish, using whichever items you wish. Before you build your contraption you need to design it, which I want you to do with the pencils and paper in front of you. So, get together with your table mate and brainstorm ideas and then draw out your design.”*

Brainstorming and Design (10 minutes)

Give youth 10 minutes to brainstorm and sketch a design for their contraption. As they are working, ask them open-ended questions about their design.

- *How does your design work?*
- *Why did you decide to build your design that way?*
- *How is the design going to smash the grape?*
- *What kind of shapes do you think are important for your contraption?*
- *Can you explain to me the design and why each of the pieces are needed?*

Build (15 minutes)

Give youth 15 minutes to build their contraptions. As they are working, ask them open-ended questions about their container.

- *Can you describe the different parts of your contraption and their purposes?*
- *What do you think will affect the results of each test?*

Test and Redesign and Test Again (20 minutes)

- As each group finishes test their design. Some groups may finish faster than other groups.
- Before each group tests the contraption have them explain why they think the contraption will work. It is important for active STEM learning to have youth describe what they have accomplished in their own words.
- Test and relate the failure or success back to why they thought the contraption would work. Have the partners identify what additions or subtractions to the contraption are needed. It is important for active STEM learning for youth to direct their learning and make decisions about how to improve their design.
- Have the participants' reconstruct/modify/redesign their contraptions. Emphasize that they should use knowledge gained from observing how their own contraption and the other groups' designs performed during the testing phase.
- Re-test the contraption.
- Continue this cycle until each group succeeds or until time runs out. Remember that active STEM learning requires time for youth to explore and build on their experiences.

Reflection and Discussion (10 minutes)

Follow up the activity with a think-pair-share about the design process. For each question, give youth 30 seconds to think about the answer on their own, 2 minutes to discuss in pairs, and then have pairs share out their answers with the large group. This will give all youth the opportunity to voice their thoughts about the activity. These times are suggested guidelines.

Please adjust them based on your students' needs and the nature of the question you are asking them to reflect on. Some possible discussion questions include:

- *Which design worked the best? Why do you think this design was the best?*
- *What elements from other groups' contraptions could be combined to improve your contraption's design?*
- *What other materials would have helped your design?*

After each question have each group also share their thoughts with you and the rest of the class.