

Introduction to Engineering: Design Your Own Simple Machine

NGSS Standard:

3-PS2-4: Forces and Interactions

- Apply concepts of forces and motion to design a device that changes the speed or direction of an object.
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Objective:

- Students will design and build a simple machine (lever or pulley) that can move an object by applying force.
 - Students will use engineering principles to solve a design problem by testing and improving their machine to achieve the desired results.
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Materials:

- Popsicle sticks
 - Rubber bands
 - Paper clips
 - String
 - Scissors
 - Small toy or object (e.g., paper clip, marble)
 - Ruler
 - Markers or crayons (for design)
 - Worksheet for sketching and planning designs
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Safety Precautions:

- Handle scissors with care and under supervision to avoid injury.
 - Be cautious when using rubber bands and paper clips to avoid snapping.
 - Ensure that students are working in a clean area free of clutter to avoid accidents.
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Procedures:

1. Introduction:

- Discuss the role of engineers and how they solve problems using simple machines like levers and pulleys.
- Introduce the concept of force and explain that forces (pushes or pulls) can move objects. Show examples of levers and pulleys and explain how these machines change the direction or amount of force needed to move an object.

2. Designing the Machine:

- Have students sketch their ideas for the simple machine on their worksheet. The design should include:
 - The type of machine (lever or pulley)
 - A clear plan for how the machine will move an object
 - How forces will be applied to the machine
- Allow time for students to work on their designs and ask questions if needed.

3. Building the Machine:

- Students will build their machines using the materials provided. Encourage creativity while ensuring the machines meet the goal of moving an object.
 - During the building phase, students should test their machine frequently to make sure it works as planned. If it doesn't work, encourage them to revise and improve their design.
4. **Testing and Observation:**
- After building, students will demonstrate how their machine moves the object. Each group will explain:
 - What type of machine they built
 - How it uses force to move the object
 - What worked well and what didn't work as expected
 - Observe how different designs affect the movement of objects and discuss with students how forces are used in real-world applications of simple machines.
5. **Final Report and Reflection:**
- Have students write a brief report on their project. This report should include:
 - A description of their design and the machine they built
 - A reflection on what they learned about forces and simple machines
 - Any changes or improvements they made to their machine
 - Allow students to present their final projects to the class.

Note: Clean-up

After the project, students should carefully clean their workspaces, disposing of any waste materials properly. Scissors, rubber bands, and paper clips should be put away in a safe location, and any leftover materials should be collected for future use.