# Introduction to Engineering Design

**Standard:**
**NGSS 3-PS2-4:** Forces and Interactions – Students will design a device to change the speed or direction of an object using concepts of forces and motion.

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**A. GRADE LEVEL:**
3rd – 5th Grade

**B. SUBJECT:**
STEM/Science

**C. DATE:**
[Insert Date]

**D. DURATION:**
2-3 Days

**E. LESSON FOCUS:**
Engineering Design – Understanding how engineers solve problems and applying force to move objects using simple machines.

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**F. MATERIALS:**

- Popsicle sticks
- Rubber bands
- Paper clips
- String
- Small toy or object to move
- Scissors
- Markers or crayons for design and labeling
- Ruler
- Worksheet (for sketching and planning designs)

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**G. LESSON OBJECTIVES:**

- Students will understand basic engineering principles, such as how force can move objects.
- Students will design and build a simple machine (e.g., lever, pulley) to move an object.

- Students will apply problem-solving skills to build a functional machine that uses force to move objects.

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**H. PROCEDURES:**

1. **INTRODUCTION:**
    - Start by discussing the role of engineers and how they design machines to solve problems. Explain that engineers use forces, such as pushes and pulls, to move objects.
    - Introduce the concept of force. Show examples of simple machines, like levers and pulleys, and explain how they use force to move objects.
2. **EXPERIMENT:**
    - Divide students into small groups. Give each group materials to design a simple machine (lever or pulley) that can move a small object like a toy or a paper clip.
    - Provide students with a worksheet for sketching their design before they build it. Encourage them to think about how the forces they apply will move the object.
    - Allow students to build their machines and test them. If necessary, encourage them to make adjustments to their designs based on how well the machine works.
3. **OBSERVATION:**
    - After the machines are built, each group will demonstrate how their machine works. As a class, observe how the machines use force to move the object.
    - Ask the groups to explain how the forces in their machines help move the object. What worked well? What could be improved?
4. **GENERALIZATION:**
    - Discuss with students how engineers use simple machines to solve problems in real life, such as lifting heavy objects or changing the direction of motion.
    - Use examples from construction or transportation where forces and simple machines are applied.
5. **ASSESSMENT:**
    - Evaluate each student or group based on their machine design, the functionality of the machine, and their explanation of how the forces work.
    - Use a rubric that assesses the understanding of engineering concepts, problem-solving skills, and the ability to explain their design process.

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**Note 1: Safety Precautions**
Ensure that students use scissors carefully and are supervised while cutting materials. Remind students to handle materials such as rubber bands and paper clips carefully to avoid injury. Students should also clean up their workspace after the activity and dispose of any waste materials appropriately.

**Note 2: Accommodation for ELL, ESE, etc.**
For English Language Learners (ELL), provide visual aids to support understanding of the concepts, such as pictures of simple machines (levers, pulleys). Use simple and clear language

when explaining the tasks and provide vocabulary sheets with key terms (e.g., force, lever, pulley). For Exceptional Student Education (ESE) students, offer step-by-step instructions, extra time for tasks, and peer support. Allow flexibility in how students demonstrate their understanding (e.g., oral presentations, diagrams).