A Wild Ride! Week 2

Day 5: How Can We Make It *Even* Better?

Teacher/Parent Background:

When scientists and engineers are faced with a challenging question or problem, they follow steps to best address their task. In engineering fields, engineers use the Engineering Design Process to propose solutions to problems in order to make the world a better place. Once engineers have established a plan, they create/test their designs and make improvements in order to propose the best possible solution.

Overview:

In this activity, students will utilize the steps of the Engineering Design Process in order to create, test and improve designs to address their challenge: *How can we design a roller coaster using force and motion concepts?*

Related Standards:

- Define problems and design solutions pertaining to force and motion.

Key Terms:

- Engineering Design Process: a set of steps engineers use to propose solutions to problems

Materials List:

- Parental/adult supervision
- Internet access
- Journal
- Pen/pencil
- Roller coaster Materials (see here & here for additional material ideas/pictures)
    - Foam tubing/pool noodles - cut in half lengthwise
    - Masking tape roll
    - Scissors
    - Ruler/measuring tape
    - Paper cups
    - Marbles - various weights
    - Various household objects, such as blocks, boxes, books, etc.
- *Student Resources - Pages 4-5*

- *Step 4: Create and Test*
- *Step 5: Improve and Re-test*

Activity Description:

- Today is finally the big day...we get to build and test our roller coaster designs! Before we jump right into building, let's first revisit our plans.
  - Ask students to review their design plans by referencing *Step 3: Plan*. Guide students through a "checklist" in order to evaluate their plans and move on to creating their designs:
    - Check your plans for the following:
      - Does your plan have a diagram with labels?
      - Does your plan have a materials list that includes both types and amounts?
      - Does your plan follow the materials and design requirements?
        - Review the *Challenge Details* with students.
    - If your plan is missing something, please take time with your team to address it.
      - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the "class". Act as a design team member by listening to their ideas and sharing additional thoughts/your ideas, if the plan is missing any requirements.
- Now that we have reviewed our plans, let's begin the creating process!
  - Guide and actively assist students through the "Create/Test" step of the Engineering Design Process by reviewing *Step 4: Create and Test*. Key details/directions include:
    - Build your design with your team!
    - Stick to your plan, including only using the types and amounts of materials you asked for.
    - Test it out! How did your solution work; what did and did not work well? Record the testing results.
      - When appropriate, review testing results using *Step 4: Create and Test*, including the *Success Criteria* section, to assist students in reflecting on what did/did not work well.
      - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the "class". Act as a design team member by sharing the building, testing and reflecting responsibilities.
- Our time is up! How can we make your design even better?
  - Next, guide and actively assist students through the "Improve" step of the Engineering Design Process by reviewing *Step 5: Improve and Re-test*. Key details/directions include:

- Based on your testing results, discuss and decide what your team can do to make your design even better. Remember to still stay within the material and design requirements!
  - Review the *Step 5: Improve and Re-test*, including the *Team Suggested Improvements*, to assist students in discussing and deciding what to improve and how they will do so.
    - **Note:** Depending on the status of the materials, some may be able to be re-used and some may not.
    - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the "class". Act as a design team member by sharing the reflection/discussion responsibilities.
- Begin to re-create and re-test your improved design!
  - **Note:** Depending on the learning environment, the adult/parent may be the only other person in the "class". Act as a design team member by sharing the rebuilding and retesting responsibilities.
- Our time is up! How did your solution work this time?
  - Prompt students to discuss, once again referencing the *Success Criteria* to determine what worked/did not work well.

Closure:

- As we approach the end of our week-long challenge, let's reflect!
  - What was the most enjoyable part of this process? Why?
  - What was the most challenging part of this process? Why?
  - Overall, how successful would you rate your final design, on a scale of 1-5 (1 is unsuccessful)? Explain your rating.

Extensions:

Continue the Investigation: Prompt students to extend the challenge with the following prompts:

- How can you make your design *even* better?
  - What improvements would you make now? Why?
  - What were the testing results of this version?
- How can you make a roller coaster with two hills?
- Using a stopwatch and marbles of different weights, time each marble's ride down the coaster.
  - Which one is the fastest? Why do you think?
  - Which one travels the farthest? Why do you think?

Student Resources

Step 4: Create and Test

What Worked Well?	What Didn't Work So Well?

Success Criteria…

- Did you only use the available material amounts and types you planned for?
- Did the track length stay within 48 inches or approximately 122 cm?
- Did the design include one hill?
- Did the design include one loop-de-loop?
- Was the train/cart able to successfully travel from the start of the track to the end of the track?

Step 5: Improve and Re-test

Team Suggested Improvements
We have decided to improve… **To improve this, we will...**

Re-testing Results

What Worked Well?	What Didn't Work So Well?

Did you only use the available material amounts and types you planned for?

Did the track length stay within 48 inches or approximately 122 cm?

Did the design include one hill and one loop-de-loop?

Was the train/cart able to successfully travel from the start of the track to the end of the track?