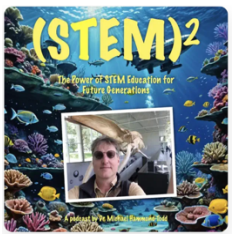

The Power of (STEM)² Podcast Lessons

Dear STEM Teachers – This free lesson plan comes from the educational podcast (STEM)² on NASA's Artemis 2 program and is designed for 3rd-8th Grade learners with a sample NGSS standard. Click here for more Artemis lessons & resources.

(STEAM)² Sample Lesson #3: NASA's Space Launch System and Rocket Engineering

Grade Level: 4th to 7th Grade
Duration: Two 40-minute sessions
Subject Areas: Science, Engineering, Art
NGSS Standards:

- **4-ETS1-1:** Define a simple design problem that can be solved through the development of a new or improved object, tool, or process.
- **5-ETS1-3:** Analyze data from tests to determine similarities and differences among the designs.
- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

Day 1: Understanding the Space Launch System and Building AXM Paper Models

Session 1: Introduction to the SLS and Paper Model Creation (40 minutes)

Objectives:

1. Learn about NASA's Space Launch System (SLS) and its components.
2. Begin constructing AXM paper models of the SLS.

Materials Needed:

- Access to computers or tablets for downloading AXM templates
- AXM paper model templates of the SLS (printed)
- Scissors
- Glue or tape
- Markers or colored pencils (for decoration)
- Sample images of the SLS for reference
- Science journal and markers

Lesson Outline:

1. **Introduction to the SLS (10 minutes)**
    - Start with a question: "What do you think makes a rocket successful in launching into space?" Allow students to share their thoughts.
    - Provide an overview of NASA's mission and the importance of the SLS for deep space exploration.
    - Discuss the main components of the SLS: core stage, solid rocket boosters, and the Orion spacecraft, using diagrams for clarity.
2. **Discussion on the Engineering Design Process (5 minutes)**
    - Explain the engineering design process:
        - Define the problem: Build a model of the SLS.
        - Develop solutions: Work together to assemble the model.
        - Test and evaluate: Assess the model's accuracy.
3. **AXM Paper Model Activity (25 minutes)**
    - **Form Triads:** Divide students into groups of three.
    - **Distribute Materials:** Give each group AXM paper model templates, scissors, glue, and markers.
    - **Model Creation:**
        - Instruct students to cut out and assemble their SLS models using the templates.
        - Encourage them to decorate their models and label key components.
    - **Monitor and Assist:** Walk around to provide support and answer any questions.
4. **Wrap-Up (5 minutes)**
    - Allow groups to briefly share their models and discuss what they learned about the SLS.
    - Encourage reflection on any challenges they faced during assembly.

Day 2: JPL Straw Rocket Experiment

Session 2: Rocket Experimentation and Analysis (40 minutes)

Objectives:

1. Conduct the JPL Straw Rocket experiment to understand rocket propulsion.
2. Analyze and discuss results from the experiment.

Materials Needed:

- Straws (various sizes)
- Tape
- Scissors
- Data recording sheets
- Stopwatch or timer
- Measuring tape
- Science journal and markers

Lesson Outline:

1. **Introduction to the JPL Straw Rocket (10 minutes)**
    - Explain the purpose of the JPL Straw Rocket experiment (click here for the template and resources), focusing on propulsion and flight principles.
    - Discuss the forces acting on a rocket during launch: thrust, drag, gravity, and lift.
2. **Prepare for the Experiment (10 minutes)**
    - **Form Triads:** Keep the same groups from Day 1.
    - Distribute materials for the Straw Rocket.
    - Instruct each group to design their straw rocket, emphasizing the engineering design process:
        - Discuss criteria for success (e.g., distance, stability).
        - Allow time for brainstorming and sketching designs before building.
3. **Conduct the Experiment (15 minutes)**
    - Have each group assemble their straw rockets and prepare for launch.
    - Conduct launches, timing each rocket's flight and measuring the distance traveled. Use a stopwatch and measuring tape for accuracy.
    - Record results on data sheets for each group, including the distance traveled and any observations about the rocket's flight.
4. **Analysis and Discussion (5 minutes)**
    - Gather students to discuss their findings. Prompt questions such as:
        - Which design was most effective and why?
        - How did the design impact the rocket's flight?
        - What changes would you make if you could redesign your rocket?
5. **Wrap-Up (5 minutes)**

- Conclude with a reflection on the engineering design process and the importance of testing and revising designs.
- Encourage students to think about how these principles apply to real-world rocket science and NASA's missions.

Assessment:

- **Participation and Collaboration:** Observe student engagement during discussions and activities.
- **Model Accuracy:** Evaluate the paper models for accuracy and completeness.
- **Experiment Data:** Assess how well students recorded and analyzed their experimental results.

Extensions:

- **Research Project:** Students can research a specific mission planned with the SLS or the technology used in rocket design.
- **Design Challenge:** Have students redesign their straw rockets with specific goals (e.g., maximum distance) and conduct a second round of experiments.

This two-day lesson integrates hands-on engineering with critical thinking and collaboration while deepening students' understanding of NASA's Space Launch System and the fundamentals of rocket science.

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