ENGINEERING CHALLENGE - BUILDING A BALLOON BRIDGE

Grade Level: 5th Duration: 55 Minutes

PROJECT DESCRIPTION

In this engaging session, students will dive into the world of engineering by taking on the challenge of building a balloon bridge. The goal is to design and construct a bridge using only 2 classroom chairs and 15 balloons that can hold at least 5 textbooks. This hands-on activity will demonstrate the concept of atypical stress and the importance of problem-solving in engineering.

STEM CONCEPTS

1. Engineering Design Process: Students will follow the Kids N Technology Design Process to prepare, plan, build, test, and tweak their balloon bridges, learning a systematic approach to solving engineering challenges.

2. Structural Engineering: Students will learn about atypical stress and its effects on structures, exploring load-bearing capacity, forces, and tensions that impact their balloon bridges' stability.

3. Materials Science: Using latex-free balloons, chairs, and safety glasses, students will understand how material properties influence their designs' strength and durability.

4. Physics - Forces and Tension: Students will see how balloon tension affects chair movement and bridge stability, learning about forces in structures.

5. Geometry and Measurement: By measuring distances accurately with rulers, students ensure chairs are placed correctly for their bridges, applying geometric principles.

6. Problem-Solving and Critical Thinking: Students will address building and testing challenges, fostering problem-solving skills.

7. Collaboration and Communication: Working in teams, students practice effective communication, idea conveyance, task delegation, and observation sharing.

8. Data Collection and Analysis: Students collect and analyze performance data to determine if their bridges meet criteria.

9. Reflection and Iteration: Students reflect on designs, testing, and improvements, refining solutions iteratively.

10. Career Exploration: Through discussions on bridges and engineering careers, students learn about various STEM professions and their societal roles.

BUILDING A BALLOON BRIDGE

GOALS AND OBJECTIVES

GOALS:

- Understand the concept of atypical stress in bridge construction.•Develop problem-solving skills through hands-on engineering activities.
- Apply the Kids N Technology Design Process to plan, build, test, and adapt a balloon bridge.
- Explore potential engineering career paths related to bridge construction.

Lesson Objectives:
By the end of this lesson, students will be able to:

1. Explain the concept of atypical stress and its relevance to bridge construction.
2. Follow the steps of the Kids N Technology Design Process to plan, build, test, and adapt a balloon bridge.
3. Collaborate in teams to construct a bridge using classroom chairs and balloons that can hold at least 5 textbooks.
4. Evaluate their balloon bridge designs and make necessary improvements based on testing results.
5. Recognize the importance of reflection, redesign, and rebuilding in the engineering design process.

MATERIALS:

- Latex-free balloons
- 2 classroom chairs
- Safety glasses (optional)
- Ruler
- Rubric: Balloon Bridge Challenge

VOCABULARY

Vocabulary Words:

1. Atypical stress: Unusual or unexpected forces that act on a structure, potentially causing it to behave differently than under normal conditions.
2. Engineering: The application of scientific and mathematical principles to design and create structures, systems, and devices.
3. Adaptation: Making changes or modifications to a design or plan based on observations and testing results.
4. Tension: The state of being stretched or strained, often resulting from forces pulling in opposite directions.
5. Load-bearing: The ability of a structure to support and carry weight without collapsing.

BUILDING A BALLOON BRIDGE

Engage (Duration: 5 minutes)

- Students will share descriptions and drawings of bridges they've seen, leading into a discussion about the significance of bridges and potential engineering careers.

Explore (Duration: 10 minutes)

- Explore (10 minutes): The 5E's framework and the Kids N Technology Design Process will be introduced. The project's objectives and the connection between atypical stress and bridge construction will be explained.

Explain (Duration: 20 minutes)

Explain (10 minutes): The steps of the Kids N Technology Design Process will be detailed, and the importance of each step will be discussed in the context of the balloon bridge project.

Elaborate (Duration: 40 minutes)

Elaborate (25 minutes): Students will be divided into groups and provided with materials including balloons, classroom chairs, safety glasses, and a ruler. Guided by the Design Process, they will work collaboratively to construct their balloon bridges.

Evaluate (Duration: 15 minutes)

Evaluate (5 minutes): Each group will present their balloon bridges to the class. The provided rubric will be used to assess their designs, creativity, and adherence to project goals.

Adaptations and Reflection (5 minutes):

Adaptations and Reflection (5 minutes): The concept of adaptation in engineering will be explored, and students will reflect on their design and building process. They'll consider challenges faced and improvements made.

Closure: The lesson will conclude with a summary of key takeaways, highlighting the value of problem-solving, adaptation, and planning in engineering. Students will be encouraged to explore further into different engineering career possibilities

.**RUBRIC: BALLOON BRIDGE CHALLENGE**

Student Name: _____

CATEGORY	10	6	4	0
Function	Structure functions extraordinarily well, holding up under atypical stresses.	Structure functions well, holding up under typical stresses.	Structure functions pretty well, but deteriorates under typical stresses.	Fatal flaws in function with complete failure under typical stresses.
Plan	Plan is neat with clear measurements and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.
Construction -Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
Construction - Care Taken	Great care taken in construction process so that the structure is neat, attractive and follows plans accurately.	Construction was careful and accurate for the most part, but 1-2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3-4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.