Hanging Heights: Exploring Stability and Design in STEM

Grade Level: 2nd-5th Grade

Subject: STEM (Science, Technology, Engineering, Mathematics)

Duration: 1 hour

Objectives:

- Students will collaborate to design and construct a tall and stable structure capable of hanging upside down.
- Students will apply the engineering design process to brainstorm, plan, build, test, and improve their structures.
- Students will consider factors such as stability, weight distribution, and material properties in their designs.
- Students will measure and test their structures to determine if they can hang upside down without any components detaching.
- Students will demonstrate teamwork, creativity, and problem-solving skills throughout the challenge.

Standards:

- Next Generation Science Standards (NGSS):
    - NGSS.2-PS1-3: Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
    - NGSS.3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
    - NGSS.3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Common Core State Standards (CCSS):
    - CCSS.MATH.CONTENT.2.MD.A.1: Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

- CCSS.ELA-LITERACY.SL.3.1: Engage effectively in a range of collaborative discussions with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

Lesson Plan:

Introduction (10 minutes):

- Begin by discussing the importance of teamwork and problem-solving in STEM fields.
- Introduce the Hanging Heights: Exploring Stability and Design in STEM Challenge: Explain that students will work together to design and build a tall and stable structure capable of hanging upside down.
- Show examples of materials provided for the challenge, such as pipe cleaners, tape, Dixie cups, paper clips, and straws.
- Discuss key factors to consider in their designs, such as stability, weight distribution, and material properties.

Activity (35 minutes):

- Divide the students into small groups of 3-4.
- Instruct each group to brainstorm and draw out their design for the upside-down structure, considering the provided materials and key factors discussed.
- Provide time for students to construct their structures according to their designs, encouraging collaboration and problem-solving.
- Once the structures are built, measure their height using appropriate tools (e.g., rulers, measuring tapes).
- Test each structure by hanging it upside down for a designated amount of time, observing if any components detach.

Reflection and Discussion (15 minutes):

- After testing their structures, gather the students together for a discussion.
- Ask each group to share their experiences, including challenges they encountered and solutions they devised.
- Facilitate a discussion on the engineering design process, focusing on the steps they took to plan, build, test, and improve their structures.
- Encourage students to reflect on what worked well in their designs and what they would do differently next time.

Conclusion (5 minutes):

- Summarize the key points of the lesson, emphasizing the importance of teamwork, creativity, and problem-solving in STEM.
- Congratulate the students for their efforts and successful completion of the Hanging Heights: Exploring Stability and Design in STEMChallenge.
- Encourage students to continue exploring STEM concepts and applying them in hands-on activities.