Hands-Off Building Challenge: Constructing Contraptions for Block Replication

Grade Level: 4th and 5th Grade

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

Duration: 1 hour

Objectives:

- Students will collaborate to design and construct a contraption using provided materials.
- Students will apply basic principles of engineering and physics to manipulate building blocks without using their hands.
- Students will demonstrate problem-solving skills as they refine their contraptions to interact effectively with the building blocks.
- Students will communicate and work as a team to achieve a common goal.
- Students will reflect on the engineering design process and identify areas for improvement.

Standards:

- Next Generation Science Standards (NGSS):
    - NGSS.4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.
    - NGSS.4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
    - NGSS.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.4.MD.A.3: Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.
    - CCSS.ELA-LITERACY.SL.4.1: Engage effectively in a range of collaborative discussions with diverse partners on grade 4 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 Hands-Off Building Challenge: Explain that students will work together to design and build a contraption that can manipulate building blocks without using their hands.
- Show the model structure made from blocks (e.g., Keva planks or Picasso tiles) that students will replicate using their contraptions.
- Present the materials available for the challenge, including skewers, string, straws, a limited amount of tape, and pipe cleaners.

Activity (30 minutes):

- Divide the students into small groups of 3-4.
- Instruct each group to brainstorm and design a contraption that will help them replicate the model structure without touching the building blocks.
- Encourage students to consider the principles of engineering and physics as they design their contraptions.
- Provide time for groups to build and test their contraptions. Encourage experimentation and iteration.

Reflection and Discussion (15 minutes):

- After the activity, 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 importance of trial-and-error and collaboration.
- Encourage students to reflect on how they could improve their contraptions if given more time.

Conclusion (5 minutes):

- Summarize the key points of the lesson, emphasizing the importance of teamwork, creativity, and problem-solving in STEM.

- Thank the students for their participation and effort in the Hands-Off Building Challenge.
- Encourage students to continue exploring STEM concepts and applying them in hands-on activities.