OVERALL TIME *60- to 90-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards

3-5-ETS1-3

(4th grade and up)

Plan and carry out fair tests in which variables are controlled, and failure points are considered to identify aspects of a model or prototype that can be improved.

OBJECTIVE

Kids will apply the Engineering Design Process to solve a problem.

OVERVIEW

Kids will have the opportunity to work together as a team to solve a problem using the Engineering Design process. The team will engage in the engineering process to guide them as they brainstorm ideas, plan, test, modify, and retest their design. Teams will record data to see which team's structure can hold twelve thin books.

MATERIALS

- **ROK Blocks, Foundational Fluencies, or STEM Pathways kit**
- **Timer**
- **Chart paper**
- **Markers**
- **Tape**
- **Rulers**
- **12 thin books**

Variation: use a different amount of books or other objects as weights

PREPARATION

Set up an area where mentees can complete the weight test. Create a Class Data Chart with the headings, "Team," "Height," and "Books." Write down the job roles with task assignments and the challenge on chart paper. Have one Engineering Design Process sheet and a piece of tape per team labeled with the team's name or number.

*Kids will only be able to use the materials from the ROK Blocks, Foundational Fluencies, or STEM Pathways kit for the challenge.

LAUNCH *10 to 15 minutes*

Review the Engineering Design Process and the challenge with the group. Each kid will have a job in the challenge. Share the list of job roles and tasks assigned to each one. Provide teams with two minutes to decide on the different job roles.

Organizer: helps decide roles, holds all kids accountable, and keeps track of time.

Technician: measures, sketches, and records data.

Programmer: completes the test, final demonstration, and is in charge of making modifications.

Reporter: takes notes on Engineering Design Process sheet and reports conclusions.

ACTIVITY

A new office building needs to be constructed. The company is requesting the tallest structure possible to allow for maximum office space. However, with the harsh winters in this region, the design needs to support the extra weight of snow and ice during the winter months.

Design the tallest standing structure using the materials in the ROK Blocks, Foundational Fluencies, or STEM Pathways kit that can support the weight of twelve thin books representing snow and ice.

EXPLORATION *45 to 60 minutes*

Teams will be given 25 minutes to design and build the tallest structure. Walk around to each group.

Possible questions to ask:

- *What are your ideas for the design?*
- *How did you decide?*
- *Did everyone contribute?*

After 20 minutes have gone by, give teams a five-minute warning.

Test *5 to 10 minutes*
Have teams test their structures as they are ready.

Modify *10 to 15 minutes*
Kids can take this opportunity to make modifications to their structure.

Final demonstration *10 to 15 minutes*
Choose a team to go first. The **Organizer** will keep track of time. Each team will have two to three minutes to perform the demonstration. Have the **Programmer** from the team come up to complete the test. Then, have the **Technician** record the team number, and the number of books the structure can hold on the class chart. Continue until all teams have had the opportunity to complete the weight test.
**Encourage teams to cheer each other on.*

CLOSING *10 to 15 minutes*

Call on the **Reporter** from each team to answer the following questions. If they need help, they can call on someone from their team to respond. *A variation could be to have each kid answer the following questions on an exit slip.*

- *What changes did you make after the practice test?*
- *Why do you think your design met or didn't meet the challenge?*
- *If you could go back, what would you do differently now?*
- *How did each of your teammates work together?*

Take time for teams to thank each other for being a part of their learning community.

CLEAN-UP *5 minutes*

Have groups break apart the structures and use the materials in the ROK Blocks, Foundational Fluencies, or STEM Pathways guide to put all the materials back in the box.

NEXT STEPS OR TAKE HOME CHALLENGE

Allow kids to complete a similar challenge by exploring other materials, such as blocks, paper, or cards, to build a tall structure. Weights could be dice or pencils. Be creative!