

Foundational Fluencies: Is It Strong?

Teacher Lesson Plan

Overview:

In this lesson, students will explore how to make things strong. Students will discuss how to make “work” easier as they build, test and improve a flatbed truck.

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Unit Concepts & NGSS Alignment:

- Manipulate ROK Blocks to build increasingly complicated structures
- Explore a specific problem engineers often face (how to make things stronger)
- Understand that pushes on objects can have different strengths and that bigger pushes cause bigger changes in the object
- Match 3-dimensional objects to 2-dimensional pictures
- Test constructions for strength; Try to improve strength by using different designs
- Recognize symmetry

Scientific/Engineering Practice - Asking questions and defining problems

Crosscutting Concept - Cause and effect

Lesson Introduction:

Instructor: “In the previous lesson we learned about making a bridge strong. Engineers design a lot of different things to be strong. Today, we’re going to learn how to make a truck strong, but first, please tell me what you think of when you hear the word “work.” To further the discussion, you could use some potential prompts such as:

- Do you hear your parents or neighbors or brothers/sisters talk about going to work? What does that mean?
- Do you do work here at school?

Core Learning Activity:

- Instructor:** “Engineers and scientists have a special way they think about work. Work is the amount of energy it takes to make something move, change directions, or stop moving.” Engage the students in a discussion of how they do this. (Examples: Running, riding a bike, skates/skateboard, etc.)
- Instructor:** “When you or your parents need to move something heavy, what do you use to move it? (Use a shopping cart, wheel barrow, truck/car, hand truck/dolly.) What do shopping carts, cars, and wheelbarrows all include that make it easier to move something heavy? (They all have wheels.) Wheels make work easier. They make it easier to move something heavy.* If students ask or if you are doing an extended lesson on simple machines, you may wish to say, “Wheels make work easier because they reduce friction.”
- Instructor:** “Today we are going to build a truck.” Group students into teams of two. Make sure each team has a construction mat and the correct assortment of engineering materials listed above. Work with students on the first couple of steps, drawing special attention to the direction of pyramids in steps 1 & 2. Once students are headed in the right direction, let them complete the rest of the build on their own.

Activity Time:

30 Minutes

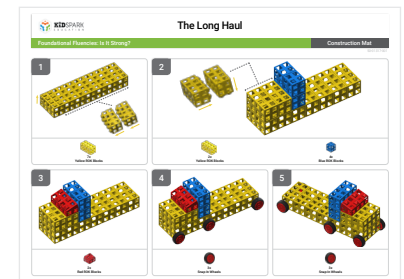
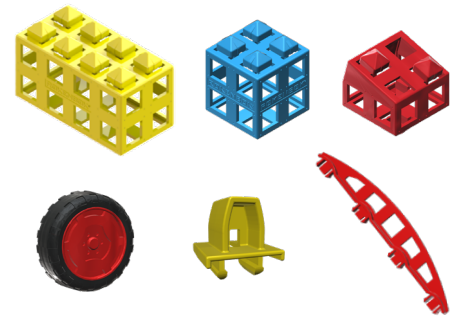
Kid Spark Mobile STEM Lab:

ROK Blocks

Materials Per Team:

Group students in teams of 2.

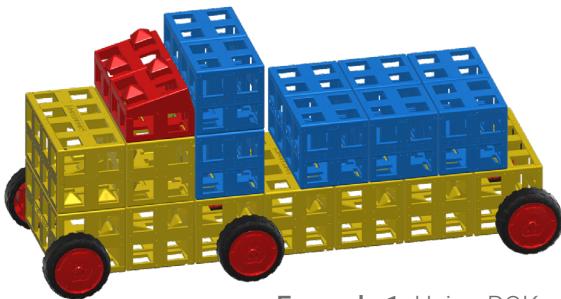
- 11 Yellow ROK Blocks
- 10 Blue ROK Blocks
- 2 Red ROK Blocks
- 6 Wheels
- 12 Gear Teeth
- 2 Girders
- 1 Construction Mat



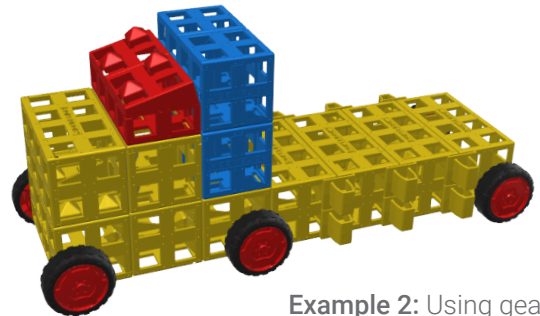
4. **Instructor: "Let's look at what we've built. What do you notice about the truck?"** To further the discussion, you could use some potential prompts such as:
- Is it symmetrical? (*Side to side, yes; Front to back, no*) How do you know?
 - Does the bed of the truck (point to bed) have any reinforcement? (*No*)
5. **Instructor: "This truck is supposed to make work easier by moving heavy things. Now, let's test it the way we tested our bridges. Put your truck on the table and put pressure on the middle of the truck bed (see image below). What happens? (It breaks.)"**



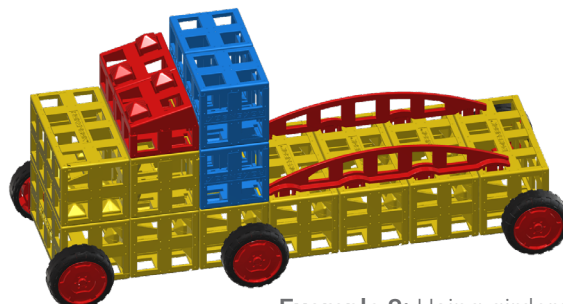
6. **Instructor: "How do you think we can make our truck bed stronger so that it can hold more weight?"**
7. Instruct students to use some of the extra materials to try and make the bed of the truck stronger (add braces, use materials across joints....see examples below). Once they are finished, have students put pressure on the truck bed to see if it is stronger than the original design. **Note: girders work great but may be too difficult for some students to snap into openings. Demonstrate how to easily connect girders by snapping one end of the girder into an opening, and then pressing down on the remaining tabs to snap into place.**



Example 1: Using ROK Blocks across joints



Example 2: Using gear teeth across joints



Example 3: Using girders across joints

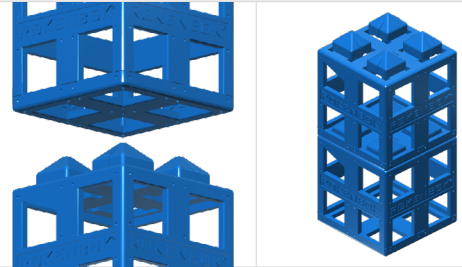
8. Have students put small objects on their trucks and move them around their desks or the floor. Point out that when the truck is moving objects it is doing work, and that when they make their truck move, they are doing "work" too.
9. ***Instructor: "Today we built a truck and explored ways to make it stronger. We also learned that engineers have a special meaning for the word 'work.' To an engineer, work means the energy it takes to move something, change directions, or stop something that is moving."***
10. Instruct students to break down their builds at the end of the lesson. If you wish, have students correctly pack all engineering materials back in the ROK Blocks Mobile STEM Lab using the ROK Blocks Inventory & Organization Guide.

Building Basics

The following tips will be helpful when using Kid Spark engineering materials.

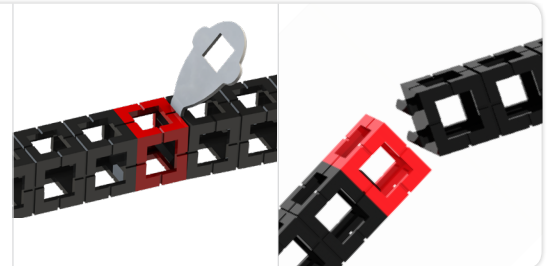
Connecting/Separating ROK Blocks:

ROK Blocks use a friction-fit, pyramid and opening system to connect. Simply press pyramids into openings to connect. To separate blocks, pull apart.



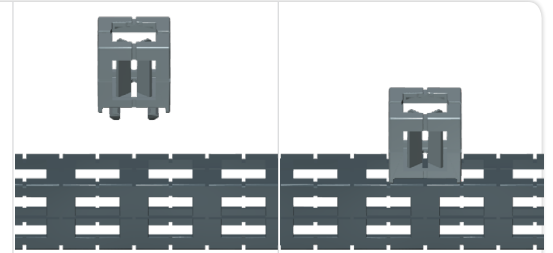
Connecting/Disconnect Smaller Engineering Materials:

Smaller engineering materials use a tab and opening system to connect. Angle one tab into the opening, and then snap into place. To disconnect, insert key into the engineered slot and twist.



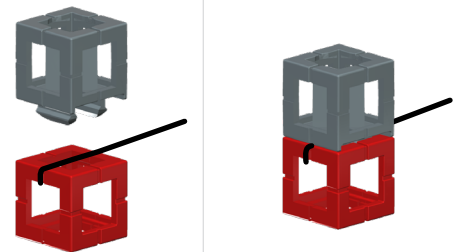
Snapping Across Openings:

Materials can be snapped directly into openings or across openings to provide structural support to a design. This will also allow certain designs to function correctly.



Attaching String:

In some instances, string may be needed in a design. Lay string across the opening and snap any component with tabs or pyramids into that opening. Be sure that the tabs are perpendicular to the string to create a tight fit.



Measuring:

The outside dimensions of a basic connector block are 2 cm on each edge. This means the length, depth, and height are each 2 cm. To determine the size of a project or build in centimeters, simply count the number of openings and multiply by two. Repeat this process for length, depth, and height.

