

Foundational Fluencies: Does It Move?

Teacher Lesson Plan

Overview:

In this lesson, students will build a tractor and explore how different forces, like pushes and pulls, can be used to move objects.

[Click here](#) to explore the entire Kid Spark Curriculum Library.

Unit Concepts & NGSS Alignment:

- Manipulate ROK Blocks to build objects that move
- Explore a specific problem engineers often face (making things move)
- Understand that pushes/pulls on objects can have different strengths and that bigger pushes/pulls cause bigger changes in the object
- Match 3-dimensional objects to 2-dimensional pictures
- Compare and contrast vehicle types and how different vehicles do work by moving

Scientific/Engineering Practice - Developing and using models

Crosscutting Concept - Cause and effect: mechanism and explanation

Lesson Introduction:

Instructor: "A vehicle is used for transporting people or things. Today we are going to build a tractor and explore how it can be used to move objects."

Core Learning Activity:

1. Give each team of two students a Pushes and Pulls Construction Mat and the assortment of engineering materials listed in the box to the right.
2. Instruct teams to follow the instructions on the construction mat to assemble two tractors.
3. Once teams have assembled their tractors, bring them together into a large group. **Instructor:** "This vehicle can move because it has wheels. Imagine if we needed to transport something that was heavy using the tractor. How could you do that?" (Put things on top of the tractor, use the tractor to push, use the tractor to pull)
4. **Instructor:** "We can put objects on top of the tractor." Place a Green ROK Block on the top of the tractor, but don't actually connect it. **Instructor:** "If we just put objects loosely on top of the tractor, when the tractor moves, the vibrations will make the object fall off." Show how the Green ROK Block falls off the tractor when it is moved back and forth. Students can also experiment by putting a Green ROK Block on their tractors and driving them around.



Activity Time:

30 - 40 Minutes

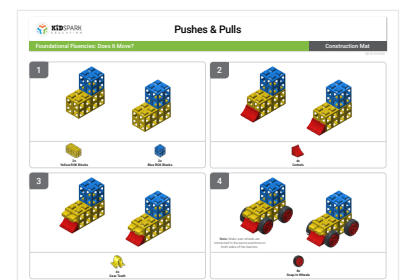
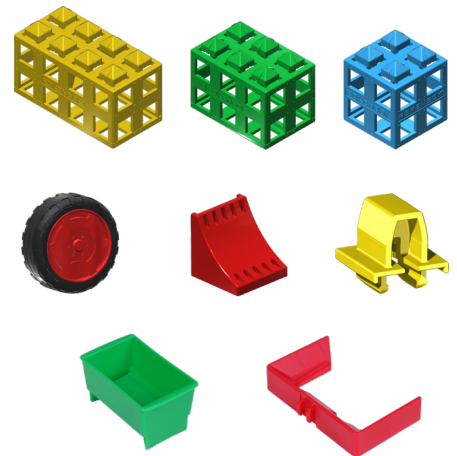
Kid Spark Mobile STEM Lab:

ROK Blocks

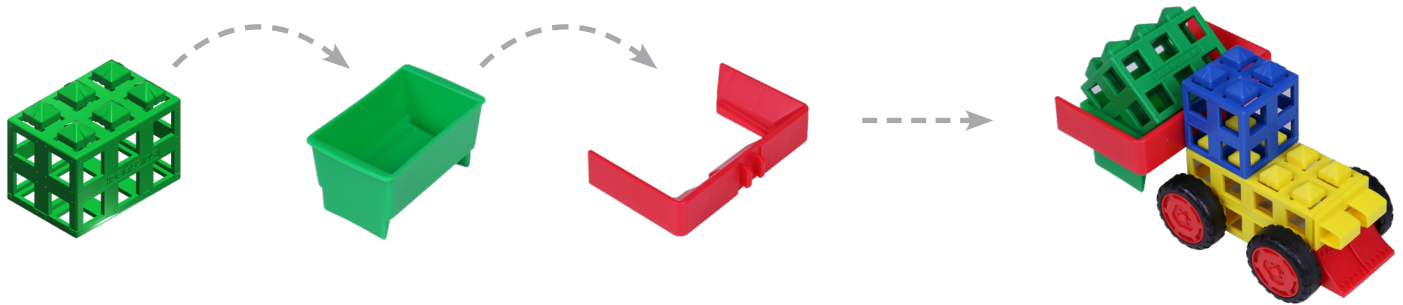
Materials Per Team:

Group students in teams of 2.

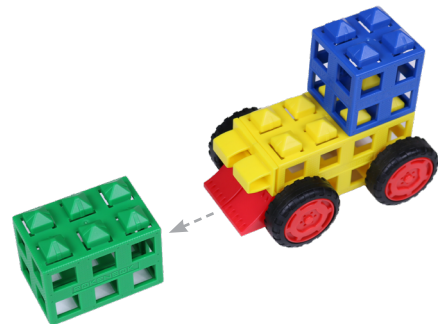
- 2 Yellow ROK Blocks
- 1 Green ROK Block
- 2 Blue ROK Blocks
- 8 Snap-In Wheels
- 4 Corbels
- 4 Gear Teeth
- 1 Box
- 1 Box Rack
- 1 Construction Mat



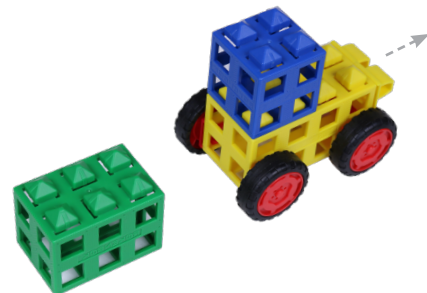
5. **Instructor:** "How could we make sure things don't fall off? (Tie them down, brace them, cover them)"
6. **Instructor:** "In your ROK Blocks Lab, you have a component designed by engineers called a **box rack**." Show the box rack and box. **Instructor:** "You can connect the box and box rack to the tractor and then transport the **Green ROK Block safely**." Instruct students to attach a box and box rack to one of the tractors they built. Once they have everything connected, instruct them to place a Green ROK Block in the box and practice driving the tractor around.



7. **Instructor:** "Did the box and box rack do a good job at transporting the **Green ROK Block safely**?" Instruct students to remove the box and box rack from the tractor when they are finished.
8. **Instructor:** "Vehicles can do work by pushing and pulling things." Ask students if they can think of any examples of things they "push" to make them move (**shopping cart, throwing a ball**) and examples of things they "pull" to make them move (**a wheeled backpack, cart, or cooler**). Bring student's attention to the fact that you have to hold/grab something to be able to pull it.
9. **Instructor:** "Let's try to push an object with our tractor." Demonstrate with a Green ROK Block. **Instructor:** "We are using a push force on the **Green ROK Block to do the work of moving it**." Instruct students to use their tractors to practice pushing the Green ROK Block around.



10. **Instructor:** "Now, let's try to pull an object with our tractor. Can our tractors use a pull force to move something? Let's try." Place the Green ROK Block behind the tractor and show the students that the block is not moving (because it is not connected to the Green ROK Block).



11. **Instructor:** "Why is the tractor not pulling the **Green ROK Block**?" Discuss with students that in order to pull something you have to grab it or connect to it. Demonstrate how to connect the Green ROK Block to the back of the tractor using an axle block. Instruct students to practice pulling the Green ROK Block using the tractor.

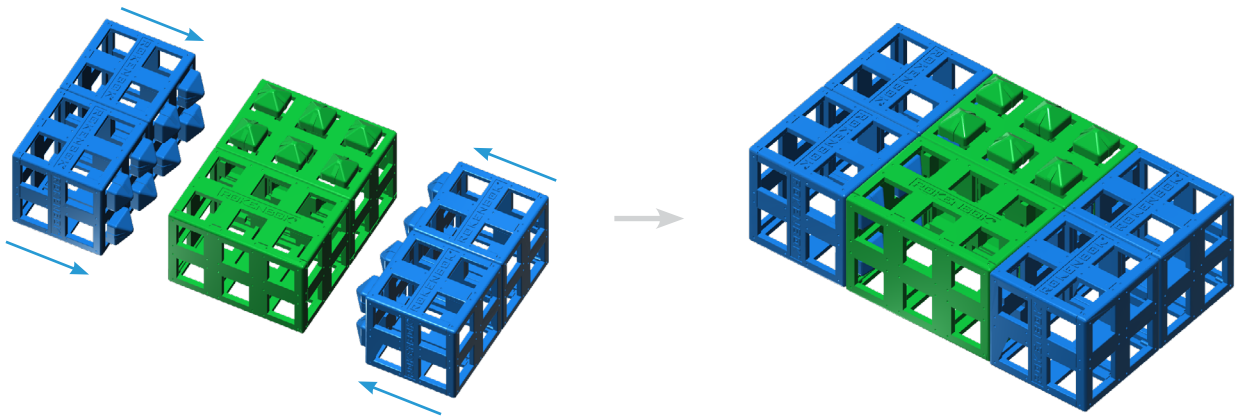


12. If time permits, complete the following learning extension activity. **Note: Make sure students do not disassemble the tractors they built for the first part of this lesson as they will be used to complete the learning extension activity.**

Learning Extension - Build a Push/Pull Mechanism

Instructions: Follow the steps below to assemble a push/pull mechanism that students can use with the tractors they built for this lesson. This build is a little more complex, so you can decide on whether to build it yourself, or have your students build it. **Note: Only one push/pull mechanism can be built out of a single ROK Blocks Mobile STEM Lab. This means that two teams (4 students) will share one push/pull mechanism.**

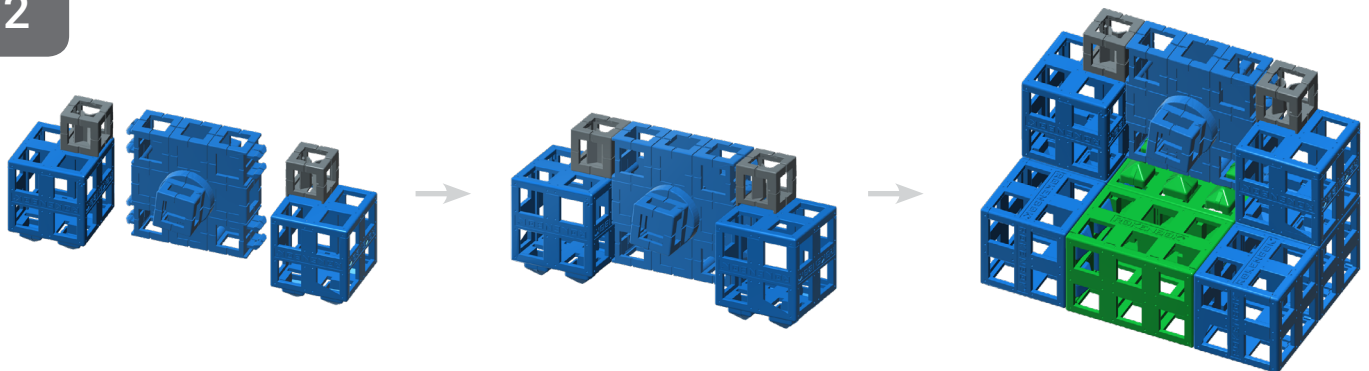
1




 2x
 Green ROK Blocks


 4x
 Blue ROK Blocks

2

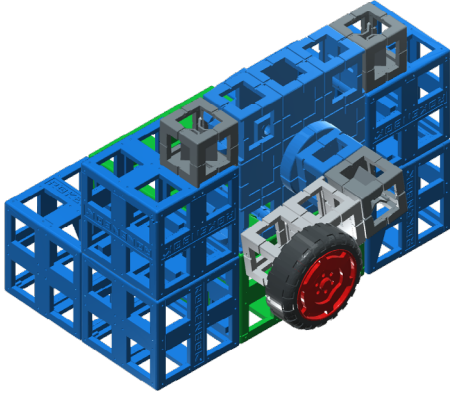



 2x
 Blue ROK Blocks


 2x
 Single Snap Blocks


 1x
 Bearing Module

3



1x
Single Snap Block

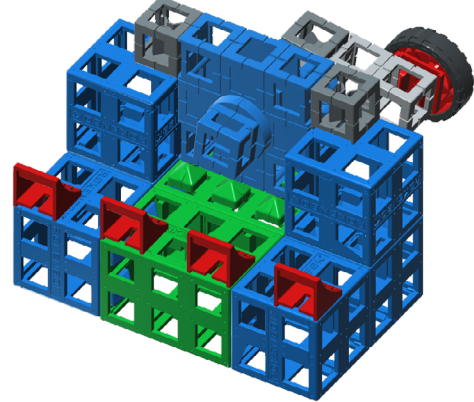


1x
Riser



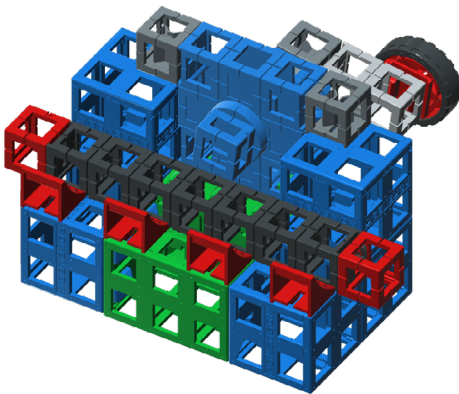
1x
Snap-In Wheel

4



4x
Corbels

5

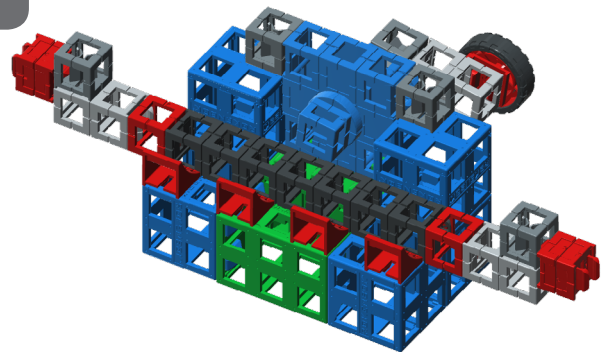


1x
Beam



2x
Blocks

6



2x
Axle Blocks

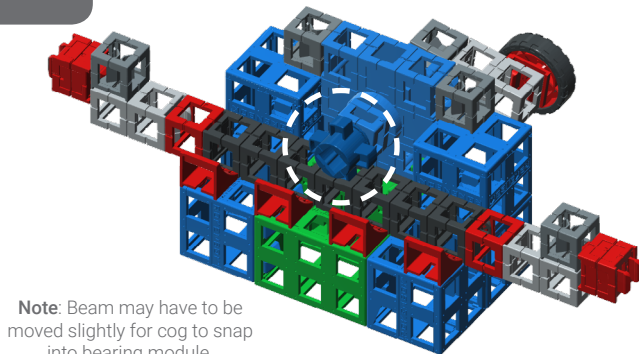


2x
Single Snap Blocks



2x
Risers

7

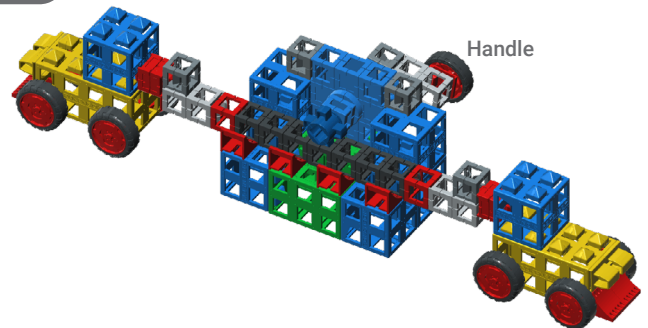


Note: Beam may have to be moved slightly for cog to snap into bearing module.



1x
Cog

8



Handle



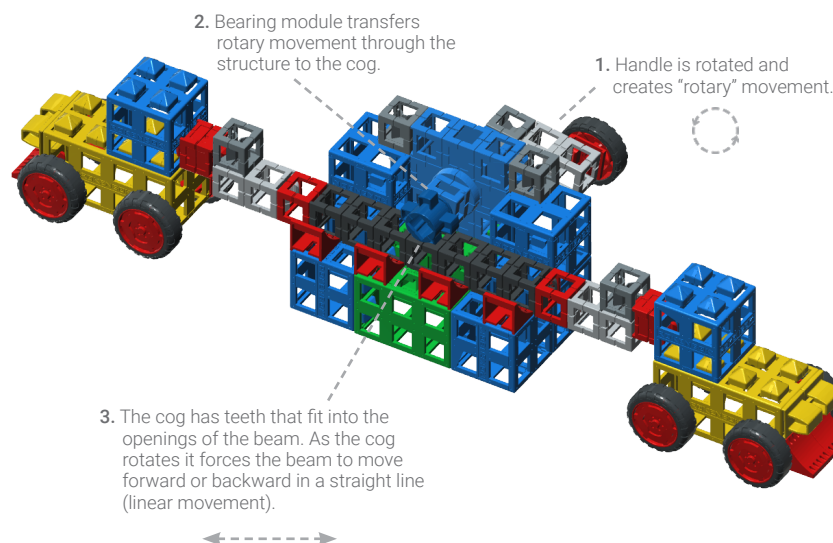
2x
Tractors

Using the Push/Pull Mechanism

After the tractors have been connected to the push/pull mechanism, have students rotate the handle and observe how the tractors move back and forth as they are being pushed or pulled by the mechanism. Make sure students recognize when one tractor is being pushed, the other is being pulled.

Explaining How This Mechanism Works

Discuss with students how the new engineering materials used in this build create the push/pull type of movement (Bearing Module and Cog). As the handle is rotated, it is creating "rotary" or "rotational" movement (movement that turns round in a circle). The bearing module allows rotary motion to be transferred through a structure and to the connected cog. Point out how the cog has teeth that fit into the openings on the beam. As the cog rotates, it forces the beam to move. Since the beam moves forwards or backwards, and in a straight line, this mechanism is converting rotary motion into linear motion (movement in a straight line).

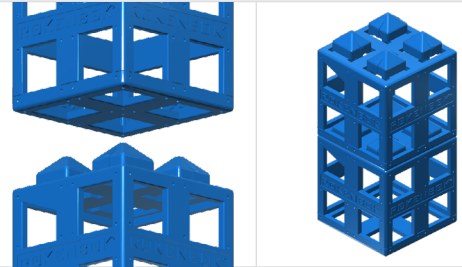


Building Basics

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

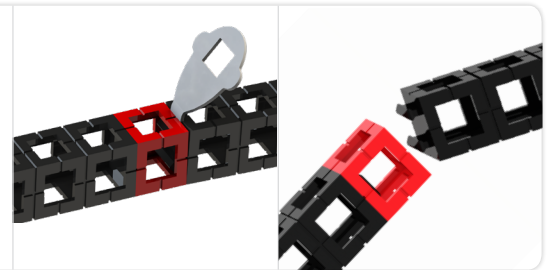
Connecting/Separating ROK Blocks:

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



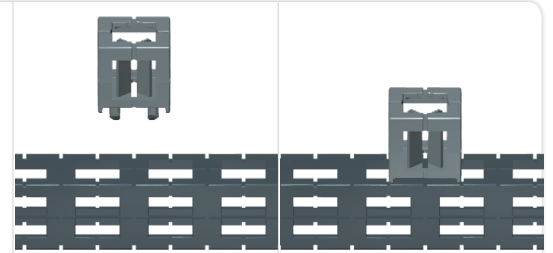
Connecting/Disconnect Smaller Engineering Materials:

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.



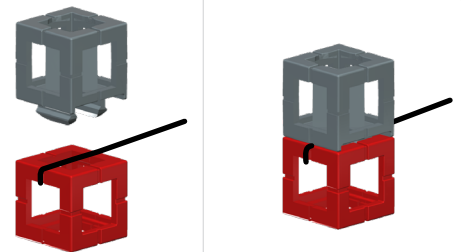
Snapping Across Openings:

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.

