brackitz®

FROM HERE TO THERE

U3 L5
V2.3

LESSONS

PULLEYS & CRANKS

CREATIVE POWER
PLAY LEARN GROW
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4th & 5th grade
teacher plan

Lesson 5: FROM HERE TO THERE

Students practice using pulleys to move things “across” rather than “up and down.”

Objectives:

Students will apply what they understand about pulleys to move something in a different direction, continuing to learn about this simple machine.

Vocabulary used in this activity:

Out, across, over, to the side, horizontally, situation, solve/solution, simple machine, pulley, design, cargo

Standards

NGSS 5-PS2 Motion and Stability: Forces and Interactions, 3-5 ETS-1 Engineering Design, ETS-1 Designing for a Need, ETS-1.A Defining Engineering Problems, ETS-1.B Design Solutions

CCSS-Math MP2, MP3, MP5, MP7

CCSS-ELA CCRA.W.3, CCRA.W.5.3, CCRA.W.5.3b,CCRA.W.5.2, L.4.1, L.4.3, CCRA.L.6,

Time needed: 35-45 minutes

Materials and Supplies:

Paper, pencils/crayons, two simulated castles or castle towers (boxes or shelves.) Each group will need a tray of Brackitz planks, 3 and 4 way hubs, 1-way pivoting hubs, and access to the pulley, crank, string, cup, and pulley-wheel connectors.

Resources/Optional Reading:

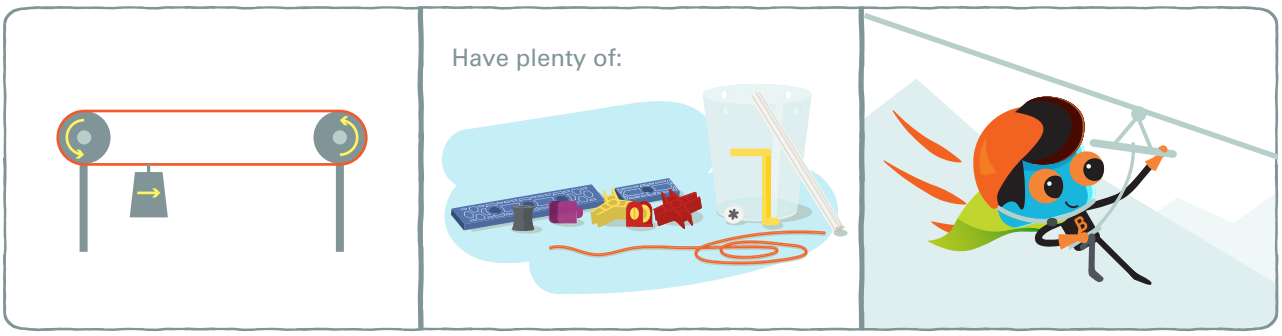
Evan Moor’s Simple Machines and John B. Beaver’s Simple Machines Grades 6-12 Force, Motion, and Energy

Set-up and Preparation:

Help students cooperatively form groups of 2-3 to work together.

Background Knowledge:

Prior to this lesson, students do not need special background knowledge. Introducing students to the ideas of simple machines and mechanical advantage from Unit 2 can be helpful.



brackitz connecting imaginations

Lesson 5: FROM HERE TO THERE

35-45 minutes

Whole Class 10 minutes

"If we imagined that the small creature was still staying in the castle, but had discovered another friend in a castle nearby, could pulleys help them send notes, share toys, or visit each other? How can pulleys help?" (Students are likely to mention cranes, elevators, and drawbridges since this is what they've practiced.) "Those are all ways to move up and down. What if I said we had a limitation, or a constraint, that today we couldn't move up and down but had to move between castles another way? How could pulleys help then? Can we brainstorm while we look at these model castles?"

Instructor Notes and Tips

It may be hard for students to break out of the "up and down" motion they've used with the pulley so often in this unit. Ask them to fold a piece of paper and to imagine it's a note they want to share with the student next to them. Tell students to hold the note and touch their toes by bending "down." Ask them to extend their arms to make them taller by reaching "up." "Can you pass the note this way? What way would you have to reach to pass the note?" Practice the vocabulary and direction at the same time, while reaching and passing notes: **out, across, over, to the side,** and **horizontally.**

Group Exploration 10 minutes

"How could the pulley be used to reach ACROSS from one castle to another? Can you draw it?"

After seeing students design drawings, ask, "How is moving things with pulleys and cranks across like this similar to or different from a bridge?"

Help students understand that they are rotating a pulley line from UP and DOWN to side to side, or ACROSS. Practice these words with directional hand motions, or even rotating the students' design drawings.

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Group Challenge 15 minutes

"Ok, now build your pulley to help pass notes or move our small friend from the taller tower to the shorter tower."

Students may need some help to rotate their pulley from vertical to horizontal.

Reflection 5 minutes

"What ways could we make our pulleys move across FASTER? Is faster always better? When is slower better?"

Students may need some help to rotate their pulley from vertical to horizontal.

CHALLENGE ADVANCED STUDENTS

In the group exploration and group challenge, you may allow students to consider either a zip line, gravity, or a manual traverse line to move things across or a manual where they push or pull the cup across. "Which will work best if they are moving heavy toys? Which will work best if the towers are the same height? Which will work best if one tower is taller than the other?"

SIMPLIFY FOR YOUNGER GROUPS

If building a zip line or traverse trolley is too complex for your students, you may build it for them and have it run between two castle towers. In this case, ask students to come up with the back-story. "Who needs to move things ACROSS and in which direction? What makes sense based on how you built it? What explains why this small friend and his/her friend need this pulley between the towers and how will they use it?"

As an intermediate step, you can also try turning the pulley they made in previous lessons on its side and move the string back and forth from here. This might help them picture how a pulley might work in an "across" orientation.

Name

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Student Worksheet

Draw the two castles and the pulley that will help move things between them:

Here is a canyon. There aren't enough building supplies to make a bridge, but we have a pulley and crank. Can we move a note across?