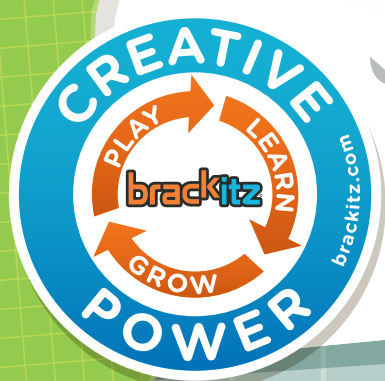


LESSONS

WHEELS & AXELS



★ Lesson 1: LETS MOVE IT! ★

Students are introduced to a need for mechanical advantage and efficient transportation by encountering the problem of moving items without wheels.

Objectives:



Students will explore the idea of work, effort, and moving items. This lesson will lead them to ask, "How can we do this work faster/easier?"

Vocabulary used in this activity:

work, effort, challenge, lift, move, force, frame, box

Standards

ECERS-R **Language-Reasoning:** Books and pictures, Encouraging children to communicate Using language to develop reasoning skills | **Activities:** Fine Motor, Art, Math/Numbers | **Program Structure:** Group time

NGSS **K-2nd Engineering Design:** K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-1 Ask questions, make observations, gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

CCSS-Math K.CC.C.6, K.MD.A2, K.G.A.1, K.G.B.4, 1. MD.A.1, 1.MD.A.2, 1.G.A.1, 1.G.B.5

CCSS-ELA SL.K.1, SL.K.1.A, SL.K.1.B, SL.K.5, W.K.3, CCRA.L.6, SL.1.1, SL.1.1.A, SL.1.1.B, SL.1.5, L.1.5.C

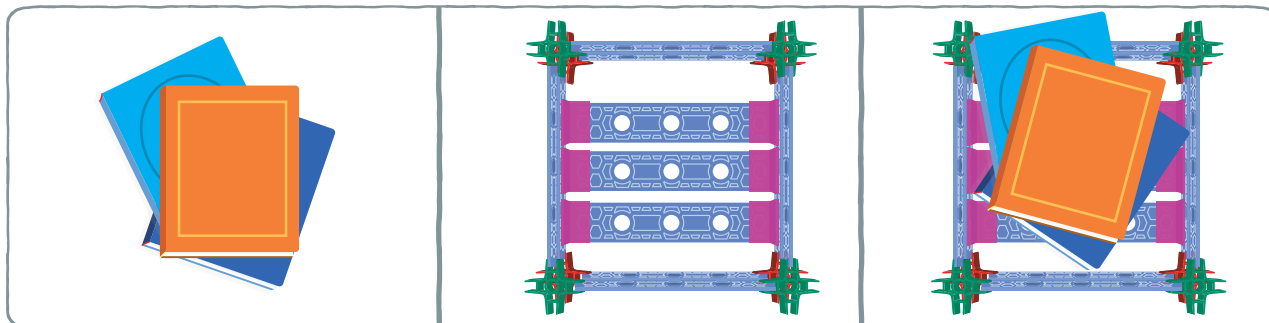
Time needed: 35-40 minutes

Materials and Supplies: Gingerbread character, paper, pencils/crayons, Brackitz planks and 4-way connectors, gingerbread cookie-sized "people" cut-outs (these should be not much bigger than a child's hand). Optional: Cookie or playdough to make more tactile figures, tracing paper.

Resources/Optional Reading: Move it! Motion, Forces, and You, by Adrienne Mason or Motion: Push, Pull, Fast, and Slow by Darlene Stille.

Set-up and Preparation: Prepare trays of Brackitz building materials so that they are ready to be handed out; 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 Gingerbread friend from Unit 1 can help them keep a user in mind who will use their designs.



★ Lesson 1: LETS MOVE IT! ★

35-40 minutes

Whole Class

10 minutes



"I'm going to hand you one book and we'll pass it around our circle/group." Pause while book is passed and comes back to you. "Was that hard to lift and move? (No!) But what if it were 5 books?" Now, pass 5 books and wait for them to come back to you. "Did that feel heavier? Where did you feel it? (Hands/fingers, arm muscles) That's one way to understand the idea that moving something from one place to another is WORK. Today we're going to think about how much work we have to do to move things."

Instructor Notes and Tips

You may read the suggested books, **Move it!** and/or **Motion** before or after this lesson to help students prime the idea of motion requiring work. Help students consider feeling their muscles tense or their hands hurt as an indication of work. Encourage students to push the books AND lift/hold them so they have different experiences sensing force.

Group Exploration

10 minutes



Feel the work! "When we lift or move something, we are applying FORCE to get work done. The force comes from us: from our muscles. We're going to practice different ways to move these heavy books. Let's try it two ways:

- 1. In your group carry these items 3 'laps' around the classroom.**
- 2. Tie a string around these items and try to pull them across the classroom."**

"Now, did you feel the work in your body? Did you feel it during both ways of moving the items? Did you feel it in different places?"

Create start and stop spots for each group, so that they can line up for this exercise, or have "laps" clearly marked. Have string ready, and you may also want plastic shopping bags to wrap around the items to bundle them together. Help student tie the string around their "lift" items to ensure the knot isn't impeding them from doing this exercise.

If your books are too heavy or wide for student-made Brackitz frames, consider using blocks or other toys.

Each student's turn moving the items should take 30 seconds to 1 minute; "feeling the work" should take 6-7 minutes.



Lesson 1: LETS MOVE IT!



Group Challenge

15 minutes



(Show the picture of a cart) "In this picture, someone is using a cart to move more items with less work. Look at your Brackitz pieces - do we have what we need to make a cart? (No.) What's missing? (Wheels!) You're right, **no wheels on the cart today**. But let's build a frame that could contain the things we want to move using Brackitz."

Pass out trays of planks, connectors (but no wheels and axles) that are already prepared for groups. This is a chance for students to begin building. Watch to make sure groups are able to share tasks and ideas functionally.

Reflection

5 minutes



"Let's each take 30 seconds to use our frame to push or pull these items through the course. What's happening when we try to get over and around these challenges and obstacles? (frames falling apart, items falling out and tipping over, frames/boxes of items getting stuck) I wonder if we can make this less frustrating in the next lesson?"

Prepare some obstacles in the "course" before students are ready to test their designs. This could be speed bumps under the rug, non-smooth "hills" of items, or classroom "boulders" made of toys, blocks, and other items.

CHALLENGE ADVANCED STUDENTS

In the group exploration, you may have students push/pull a small piece of furniture (child desk or table) rather than moving books, to feel the work.

In the group challenge, scale up by suggesting that groups build frames of different shapes - squares, triangles, irregular polygons - and then move them through the course. Which shape does best? Why? This gives advanced students a chance to consider how distributing weight and balance can factor into cart design and use.

SIMPLIFY FOR YOUNGER GROUPS

In discussion, ask: "Have you ever had to hold or lift something that was too heavy for you? What was it? How did it feel?" This is a way of helping students identify that they did work.

In the group challenge, have students focus only on building an "open box" or a rectangle. Explicitly talk about it as, "a box with no top" and "a box that has only 5 sides but is open on top so we can put books in." You may limit teams to the 4-way hub so that they can only build a cart with 90 degree angles.

Name _____

★ Lesson 1: LETS MOVE IT! ★

Student Worksheet



Today we carried books to move them. Is there an easier way?
Draw it or write a sentence about it:

Count how many Brackitz pieces you used today: _____

Name

★ Lesson 1: LETS MOVE IT! ★

Trace the frame you built here: