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LESSONS

FREE OUR FRIEND!

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

Lesson 3: FREE OUR FRIEND!

Students continue with the creature as their building and engineering inspiration. Given an immediate problem to help solve, students have a play-based introduction to solving problems by designing and building devices.

Objectives:

"I can create a 2-D design as a guide for a 3-D design." and "I can create a 3-D design to help solve a problem." Students will demonstrate they can create a Brackitz design to try and solve a problem, practice beginning design process (testing a design) and continue getting familiar with the Brackitz system.

Standards

ECERS-R	**Language-Reasoning:** Books and pictures, Encouraging children to communicate, Using language to develop reasoning skills | **Activities:** Fine Motor, Art, Math/Numbers
NGSS	3-5 ETS1, ETS1.A, ETS1.B
CCSS-Math	Practice.MP2, Practice.MP5, Practice.MP7, Content.4.MD.A, Content.4.MD.A.1, Content.5.MD.A, Content.5.MD.A.1, Content.4.OA.A.2
CCSS-ELA	Literacy RI.5.5, Literacy RL 5.4, Literacy SL.4.1

Time needed: 35-40 minutes

Materials and Supplies:

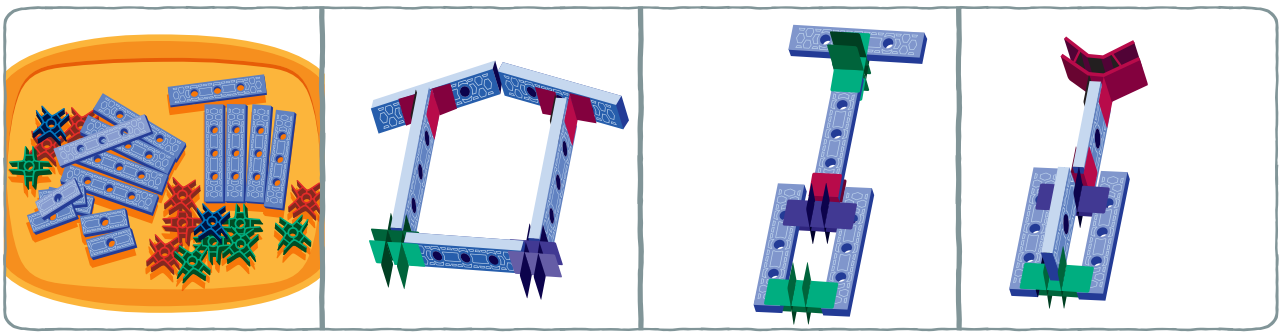
3-D figure(s) with some depth made out of dough or cardboard from Lesson 2, box, paper, pencils/crayons, Brackitz planks and 4-way connectors

Setup and preparation:

Have trays, boxes, or plates ready with the same number of planks and connectors for each group of 2-3; help students cooperatively form groups of 2-3 to work together. Find a box or boxes smaller than a shoe box.

Background knowledge:

Prior to this lesson, the only background knowledge students need is to be able to pick things up and grasp them. A reminder of the agreed upon dimensions of the creature will help students build with the creature in mind.



brackitz
connecting imaginations

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40-45 minutes

Whole Class 5-10 minutes

Instructor asks, (Remind class; especially check/reinforce the agreed upon DIMENSIONS) "You built beautiful homes to keep creature we have in mind safe. What did we learn about the creature's size from making those?" Discuss, have students recall dimensions and lengths (in Brackitz and in cm/inches) "Today our goal is to help create ways for the creature to leave their containers without touching them. We don't want to crowd small creatures or leave our scent on their homes - many animals are sensitive to that. If we can't touch the box to open it, but we want to be in charge of opening it, what are our options?"

Instructor Notes and Tips

Students may immediately talk about specific KINDS of tools - tongs, jaws of life, etc. Help students understand that these all fall into the category of tools. Objects we use to help us complete a task in a better, faster, easier, or more repeatable way. Then ask them to think of tools we use to keep our distance from things. This may differ from tools like hammers or can openers and you can help students consider why.

Some students in this grade range may be very excited by other options like robots, drones, etc. Praise them for thinking so broadly but help them understand that we do still use items like tongs when we cook, or do lab work in part because we want distance for safety, but enough closeness to monitor the task.

Group Exploration 15 minutes

Part 1: "I'm setting up our pretend houses here (boxes), and we will need to stand over here." (marks floor) Can you each think up a tool we could use to open the box without getting close to it? What would it DO? How would it WORK? What would it look like? What dimensions will it need to have? Draw it so you have a beginning plan. Make your drawing almost as a guide for someone else to use it to build your tool."

Part 2: "In your groups, pass your drawing to your neighbor. Let them see what your plan was. Now you're looking at a new drawing too. It takes many engineers to make good solutions. What idea on someone else's design seem like good idea? How can you compromise and make one group drawing as a design idea?"

Part 1: Visit groups asking for ideas that will meet the goal (engineering criteria) is building something they can safely use from a distance. Keep making sure students are paying attention to the distance/length, and other dimensions their tool will need to have.

Part 2: Help students pass drawings in a circle. Ask them to consider what good ideas another student may have had. Ask: could these ideas be good? Could both work together? Help students with language like, "Let's try ___ first and then we could try ___ next" as they work towards compromise. Praise collaborations that use ideas from more than one group member; step in if someone is insisting on their own design with no changes or additions from other group members. "Engineers work together and compromise - let's try to see how the ideas could work together so that you can practice engineering."

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Group Challenge 15 minutes

Once your group has agreed on a compromise design, you can start building. I used the pieces from your homes so you could build tools today. But this box could be the home so test your tool on this box as many times as you need to. Does your tool work right away or do you need to keep changing it to make it work better?

Having pre-arranged trays, boxes, or plates with the same amounts of Brackitz planks and connectors can save time on organizing tools. You may also wish to have multiple boxes so groups can test without taking turns.

As groups test their tool, keep reminding them to ask, "How will we know if our design worked?" **(Goal: If it can open the box and allow you to be far away without breaking or being unsafe.)**

Reflection 5 minutes

Did you get your tool working? It's okay if you didn't. When something doesn't work the first time, or the second, or the twentieth time, it is a chance to learn what parts of your design might be working, and what parts might need to be changed.

How do you know if it works or doesn't work? **(Testing it on the box, does it open it, can you be far away, is it sturdy, is it safe).** How many times did you have to rebuild your tool or try to make it a different way?

Make sure that before this lesson closes out students understand that testing a design and finding out what is working and what needs improvement is the best way to make good designs and "be engineers." Most designs fail on the first attempt and need to be improved on many times before others can use them. Encourage students to see this as a way of making their creations better and better. Create a culture of, "what you did today was take the first steps to making better designs" rather than insisting on "finished products."

CHALLENGE ADVANCED STUDENTS

In discussion, ask: "What's the ideal distance for us to be from the homes/boxes to open it?" Involve students in defining the design criteria!

Then, "Estimate that distance - about how many Brackitz planks long will our tool need to be?"

In the challenge/build, scale up by: Introduce systematic testing of the tool. With each test, ask the group to pick one thing to change on their design. This is a more structured and mature approach to design-test-redesign but some students may be able to handle it.

SIMPLIFY FOR YOUNGER GROUPS

In discussion, ask: "Why do we use tools instead of using our hands for everything?" this may help students think about ways we use tools. You may also show them some of the tools we use in class every day - scissors, pencils, etc.

In the group exploration and challenge build: Assign students or groups a design partner to share ideas with, get feedback from, and to do their testing for them. Facilitate the exchanges between them to help keep it positive and helpful.

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Student Worksheet

How will we know if the tool worked to help free our friend?
List two or three things that count as success.

1. _____

2. _____

3. _____

How many times did you have to rebuild or redesign your tool? (Circle)

1 2 3 4 5 6 7 8 9+

How did you test your tool? What did you find out when you tested your tool?

_____

_____

_____

_____

_____

_____

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Student Worksheet

Draw the tool you made here!

What is the length of your tool?

_____