

Unit 6 (Structures): Inside-Out Boxes

Concept

Boxes can be reversed and new structures can be made with them

Content Objective

Use reverse-box construction to make new structures

Language Objectives

Students will deepen their understanding of the meaning of the word "blueprint" that is used for engineering design

Students will use design engineering vocabulary (structure, design brief) as part of discussions

Students will access prior knowledge by discussing with a partner about different kinds of materials, their characteristics, and their uses.

Students will listen to the teacher orally explain the Design Brief task, and will orally share questions they have

Standards

- **NGSS:**

- **K-2-ETS1-1.** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
- **K-2-ETS1-2.** Make a drawing or physical model to illustrate how the shape of an object helps it to solve a problem.
- **K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.

- **TEKS:**

- **2A** ask questions about organisms, objects, and events observed in the natural world (ask)
- **2E** communicate observations with others about simple descriptive investigations (communicate observations)
- **3B** make predictions based on observable patterns in nature such as the shapes of leaves (predict from patterns)
- **4A** collect information using tools, including computers, hand lenses, primary balances, cups, bowls, magnets, collecting nets, and notebooks; timing devices, including clocks and timers; non-standard measuring items such as paper clips and clothespins; weather instruments such as demonstration thermometers and wind socks; and materials to support observations of habitats of organisms such as terrariums and aquariums (use tools)

- **ELPS:**
 - **Listening 2G:** Understand the general meaning, main points, and important details of spoken language ranging from situations in which topics, language, and contexts are familiar to unfamiliar [LC: Abstract & Concrete]
 - **Speaking 3G:** Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics; [Speech Production @ Grade Level]

Suggested Literature Connections:

“Not a Box” by Antoinette Portis

Materials:

tape dispensers; construction paper; design brief written on colored paper; cereal or other recycled boxes, assorted shapes; markers; paint and newspaper; cleanup supplies

Design Brief

Make a structure that 1) is an inside-out box, 2) holds its shape, 3) has six faces or sides, 4) is pleasing to look at, and 5) has one face that can open and shut

Suggested Activity Centers:

- **Everyday Objects:** Students turn objects like plastic bags, their socks and shirts inside-out. Do the articles look the same?
- **Name Reversal:** Students write their name with crayon on paper, then place a clean sheet over it and rub hard with a ruler. The print of their name is reversed.
- **Art:** Draw an inside-out Teddy bear, an inside-out apple, or an inside-out jacket.
- **Box Study:** Students look at several boxes and analyze the ways they open and shut.

Day 1: Engage/Explore

Teacher Says/Does	Student Says/Does	Language requirements
<p>1. Remind students about the previous lessons in which you opened flat a cereal box. Review the meaning of the word “BLUEPRINTS” with students, or what they drew to show what their structure (the cereal box) would look like flat. Chorally repeat “BLUEPRINTS” with students and ask them to use the accompanying gesture. Pose the question: <i>How many sides/faces did the boxes have?</i> Ask students to share in partners before sharing whole class.</p> <p>2. Explain that some boxes can be turned inside-out and the sides taped together to make a new box. Demonstrate this to the students, and have a student come up to help tape up the sides of the opened-up box. Remind them that this is where teamwork is especially helpful.</p> <p>3. Ask the students to describe the new box you have made. Create a Venn diagram (use handout (K.6.1) as a guide) to compare and contrast the new box with the old. Pose questions for students to share in partners such as: <i>How are the new and old boxes similar? How are they different? How many faces did the old box have? How many faces does the new box have?</i> Call on partners to share ideas aloud and add to the Venn diagram. Chorally count the number of faces. Ask them if the new box is more pleasing to look at than the old box was. The designs and lettering is gone, for example, and this may make the box easier to decorate and more pleasing to look at.</p> <p>4. Ask the children. Have students share in partners to analyze how the inside-out box works. Pose questions</p>	<p>Students share previous activity making a blueprint with cereal boxes</p> <p>Students compare old and new box structures</p> <p>Students share with partners how the inside-out box opens and shuts</p>	<p>Vocabulary: Blueprints</p>

Teacher Says/Does	Student Says/Does	Language requirements
such as: <i>How does the inside-out box open? Shut? How might you change the box so it opens? Shuts?</i>		

Day 2: Explain/Elaborate

Teacher Says/Does	Student Says/Does	Language requirements
<p>1. <i>Show</i> the students the Design Brief. Form the students into engineering teams of two. Display your visual of the Design Brief (see below).</p> <p>2. <i>Display</i> the Design Brief</p> <div data-bbox="254 659 1016 881" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Design Brief-Make a structure that:</p> <ol style="list-style-type: none"> 1. Is an inside-out box 2. Holds its shape 3. Has six faces or sides 4. Is pleasing to look at, and 5. Has one face that can open and shut </div> <p>3. <i>Remind students</i> of the steps in solving the problem in the Design Brief and display your visual of the steps with accompanying pictures with handout (K.6.2):</p> <p style="padding-left: 40px;">Step 1. Ask questions to be sure you understand the Design Brief!</p> <p style="padding-left: 40px;">Step 2. Make a plan before you work.</p> <p style="padding-left: 40px;">Step 3. Remember safety rules.</p> <p style="padding-left: 40px;">Step 4. Check what you make.</p> <p>4. <i>Ask questions.</i> Go over each specification or rule of the Design Brief, using “wait time” between questions and having students share in partners before asking questions to the whole group so that each item is covered in depth. Ask students what “pleasing to look at” means and what kinds of materials they might use to</p>	<p style="text-align: center; vertical-align: middle;">Students ask questions and share ideas about the Design Brief</p>	<p>structure design brief blueprint</p>

Teacher Says/Does	Student Says/Does	Language requirements
<p>accomplish this. Display available supplies such as paint, pencils, markers, construction paper, tape and/or glue that they will have access to.</p> <p>5. <i>Make a plan.</i> Tell the students that when they plan with their partner they should make a blueprint with cut paper shapes (that teacher supplies), or draw how their structure will look and how it will open and shut. Ask them to think about which materials they would use to accomplish the Design Brief task. Create a checklist for the engineering pairs to reference as they make their blueprint, including each rule of the Design Brief with a visual or sketch next to each rule.</p> <p>6. <i>Come together</i> to share completed blueprints. Ask each engineering pair to share their blueprints with another pair, and give positive feedback. Teachers could select one or two blueprints that they feel are especially creative or unique and ask students if they can share them with the class.</p>	<p>Students share and discuss their blueprints</p>	

Day 3: Explain/Elaborate

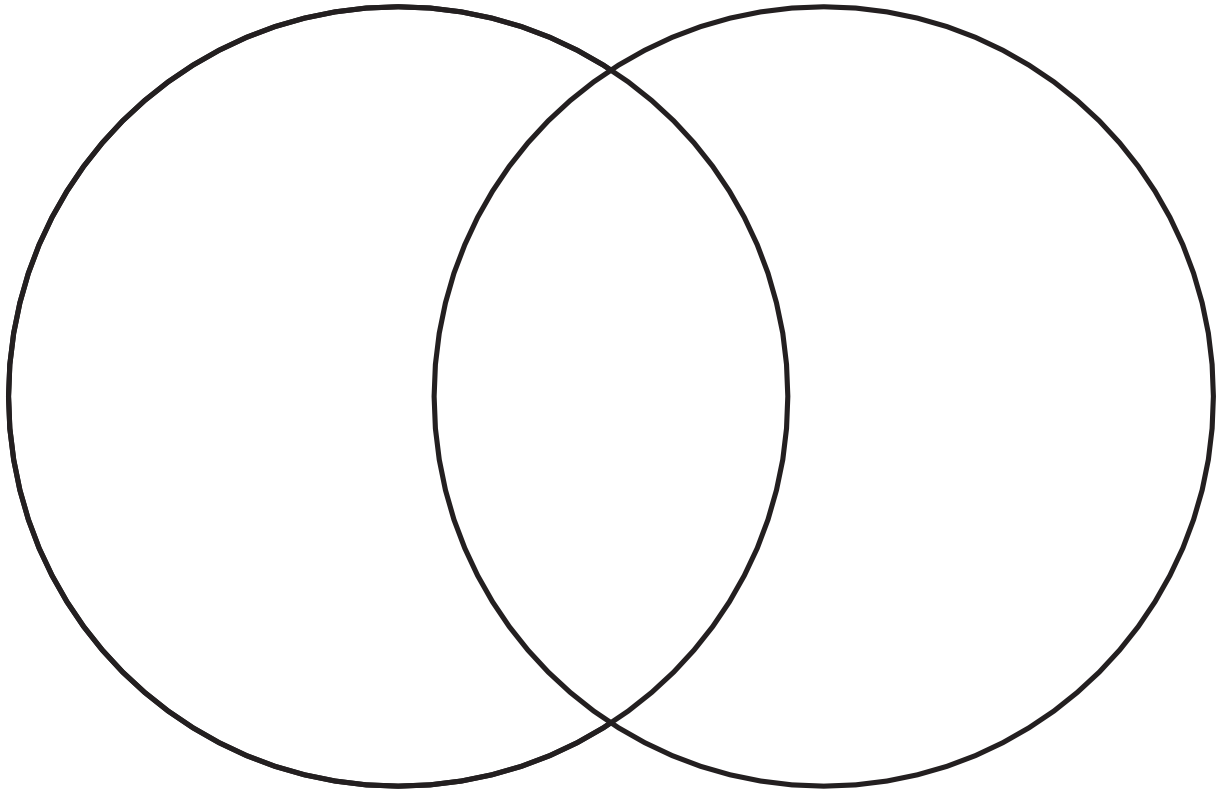
Teacher Says/Does	Student Says/Does	Language requirements
<ol style="list-style-type: none"> 1. <i>Practice</i> the word “BLUEPRINT” through choral repeat and the gesture. Ask students to share in partners what they accomplished last lesson. Inform them that, today, they will put their plans into action to create a new structure from an old structure. 2. <i>Display</i> the Design Brief as well as the steps. Go over steps 3 and 4 with students. Ask them to share in partners what it would look like to be safe while creating their inside-out boxes, and how they could check what they make. Share out ideas whole class. 3. <i>Teamwork</i>. Have engineering pairs get their blueprints and their checklists, and then select a box and bring it to you if they need help peeling the seams apart. If you have different-sized or –shaped boxes, you may want to let students select a box beforehand so that they can look at it during the planning stage. As teams are working, observe, pose questions, and take anecdotal notes of students’ understanding of the Design Brief. 		blueprint design brief

Day 4: Evaluate

Teacher Says/Does	Student Says/Does	Language requirements
<ul style="list-style-type: none"> • <i>Add to your own class log what the teams did during the last activity & the methods they used.</i> • <i>Bring teams together to evaluate once teams have completed their structure with an inside-out box, and guide them in presenting their blueprints and structures by asking questions such as those below:</i> <ul style="list-style-type: none"> • <i>Was it difficult to turn the box inside out?</i> • <i>How did partners help each other?</i> • <i>How did you test the structure to find out if it holds its shape?</i> • <i>Tell about how the door opens and closes.</i> • <i>What was the most fun about making your inside-out box?</i> • <i>Show your blueprint and how it looks like your inside-out box.</i> • <i>Sharing writing.</i> Take dictation from teams as they describe their product. Display the structures in Design Gallery w/student dictations. 	<p>Team share the process they used to design their blueprints and structures</p>	

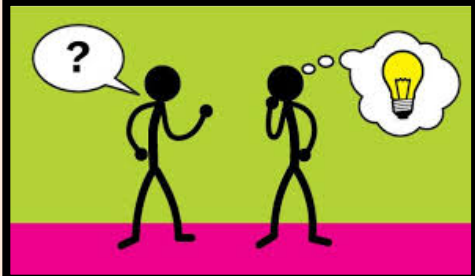


OLD BOX

NEW BOX



Names: _____ Date: _____

Bendable Toy Design Brief

<p>1. Ask questions to be sure you understand the Design Brief!</p>	
<p>2. Make a plan before you work.</p>	
<p>3. Remember safety rules.</p>	
<p>4. Check what you make.</p>	