Unit 5 (Structures): Flat Space

Concept

The space in a structure can be flattened out.

Content Objective

Predict shapes of boxes when flat by using cut paper rectangles.

Language Objectives

Students will learn the meaning of the word "blueprint" that is used for engineering design Students will orally share predictions structures that are flattened out Students will use high-frequency Math words necessary for describing structures that are flattened out: *shapes, rectangles, squares.*

Standards

NGSS:

- o **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-PS2-1. Conduct investigation comparing strengths and directions of pushes and pulls on motion of object.

TEKS:

- o **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)
- o **6C** observe and describe the location of an object in relation to another such as above, below, behind, in front of, and beside (relative location of objects)

• ELPS:

- 1A Use prior knowledge and experiences to understand meanings in English. [Prior knowledge]
- 1D Speak using learning strategies such as requesting assistance, employing nonverbal cues, using synonyms & circumlocution (conveying ideas by defining or describing when exact English words are not known) [Making Meaning]

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- 3A: Practice producing sounds of newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters to pronounce English words in a manner that is increasingly comprehensible. [Phonemic Production]
- o **3E** Share information in cooperative learning interactions [Communicative Competence]

Suggested Literature Connections:

"The Birthday Box" by Leslie Patricelli

Materials:

Cardboard container boxes (cereal, etc.); cut construction paper shapes; paste; markers; newsprint paper; paper

Teacher Preparation

Arrange for a guest to come talk to the class about the importance of blueprints as planning tools. Also, take a cereal or other recycled box and peel it apart at the seam. Flatten it out, smoothing all of the faces. Then, lightly tape the sides so that it looks like a whole box again.

Suggested Activity Centers

- Map-Making: Let students work with maps as plans for how to get somewhere.
- **Teddy Bear House**: Students draw a picture plan of a house they would like to make for their teddy bear.
- Make a Box: Students try folding a piece of paper into a box, and number the faces.
- **Multimedia**: Students audio-record a plan for making a peanut butter sandwich and then try to follow someone else's sandwich

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Day 1: Engage/Explore

Day 1	Day 1: Engage/Explore		
	Teacher Says/Does	Student Says/Does	Language requirements
1.	Connect to the prior lesson on bendable toys. Review	Students describe	Vocabulary:
	the importance of having a plan. Ask the students to	experiences making	Rectangles/squares
	share with a partner how making a plan first helped	bendable toys	Bendable toys
	them when they made a bendable toy. A plan is like a		
	map that tells them where to go. Ask them to share in		
	partners what would happen if they hadn't made a plan		
	when they made the bendable toy. Share an invented		
	plan of your first toy where you drew a bendable toy		
	but forgot to include the materials and the tools, and		
	your second plan that was complete and guided you		
	effectively. Is it better to have a plan or not when		
	creating a product? Ask students to show thumbs up		
	for "yes" and thumbs down for "no."		
2.	Introduce that it can be difficult to draw things we		
	haven't yet made, so we use our imagination, and		
2	sometimes we have to guess when making our plan. Review basic shapes, including rectangles and		
٥.	squares, by having students chorally sing a shapes		
	song or follow along with a video online.		
4	Hold up the empty cereal box. Point to the front face of		
1	the cereal box and ask students to share in partners		
	the name of the shape (either rectangle or square; use	Students review basic	
	handout (K.5.1) as a guide if needed). Ask them to	shapes by identifying them	
	share in partners their predictions for what the back of	on the sides of a cereal box	
	the box is shaped like. Do the same with the sides and		
	the bottom—have the students predict the shapes. Ask		
	them to explain their answers. How many faces or		
	sides does the box have? Chorally count them with the		
	children.		
5.	Describe and analyze the box. Ask students: Is the top		
	just like the bottom? How are they different? (The top		

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Teacher Says/Does	Student Says/Does	Language requirements
may have a tab and a slit to connect the sides closed.) Ask the students to share in partners how the box top works, e.g. it connects and disconnects when you want it to. Analyze the opening and closing end of the box. Ask students to share in partners and pose the question: What makes it work? Ask the children to describe its features. Remind the children to observe closely. 6. Ask the students to close their eyes and imagine what the box will look like if the box lies flat on the floor. 7. Tell the students that you will open the box out flat because you have removed the glue from the sides, and display the opened-flat cereal box as seen in the figure in the handout. Ask student to raise their hands if the box matched what they imagined.	Students describe the features and analyze the workings of a cereal box	

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Day 2: Explore/Explain

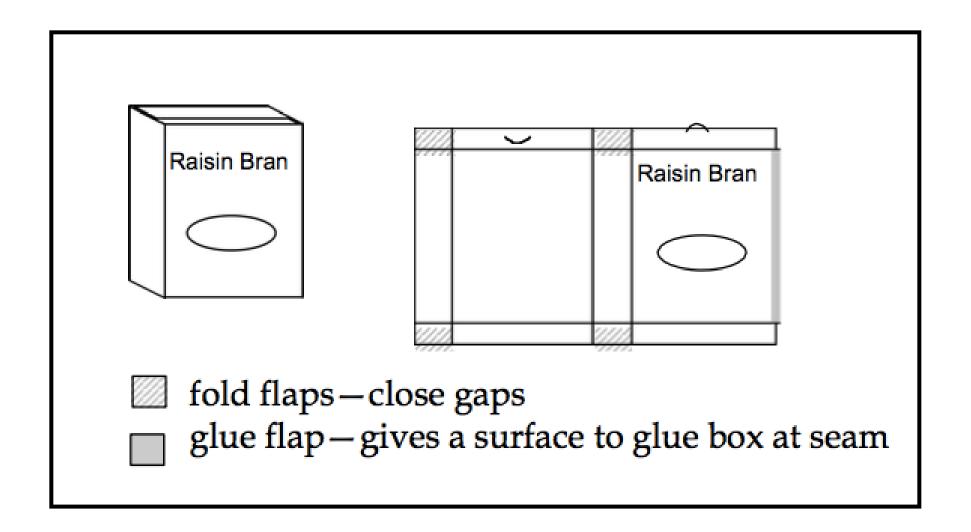
_	Teacher Says/Does	Student Says/Does	Language requirements
1.	Blueprints. Tell the students that they can predict the		Vocabulary:
	shape of objects like this box with sketches using cut		blueprint/sketch
	paper pieces. These pictures that help predict or plan		
	are what engineers call "blueprints". Chorally say the		
	word together a few times with students. Guide		
	students in creating a gesture for "blueprints" such as		
	one hand symbolizing paper and another hand drawing		
	on it. Inform students that they will get to create their		
	own blueprints of the cereal box to imagine what that		
	cereal box, or structure, will look like when it is flat.		
2.	Briefly display the opened-flat cereal box and then		
	remove it from view as students begin to work to		
	encourage students' predicting rather than copying.		
	Remind students to use their imaginations and creativity		
	in making their blueprints of the cereal box.		
3.	Hand out cut paper shapes to engineering teams of two		
	students. Each team should receive narrow rectangles		
	and wide rectangles to work with. (Alternatively, you		
	can ask students to trace their cereal box faces, then		
1	cut out the shapes, using those for their blueprint.)		
4.	Have the student teams use the cut paper shapes and make pictures (blueprints) of what they think the box will		
	look like when it's laid flat. They can simply place the		
	cut shapes onto the floor, moving them around until		
	they are arranged as they wish. Then they can push the		
	arrangement into the area in which the other groups		
	can see what they have done. As teams are working,		
	check in with them and model using the word		
	"blueprints" when posing questions to them.		

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Day 3: Evaluate/Elaborate

Day	3: Evaluate/Elaborate Teacher Says/Does	Student Says/Does	Language requirements
1	Gallery walk. Once all engineering pairs have finished	•	
''	their blueprints, tape them up on the walls around the		
	room. Have students walk around the room to observe		
	and analyze each blueprint. Ask them to think about		
	which ones are the same and which are different. After		
	the gallery walk, have students find a partner different		
	from their engineering partner and share their		
	observations/analysis. Students may interchange the		
	words "pictures" and "blueprints" as they are analyzing		
	the blueprints.		
2.	Come back together. Ask engineering pairs to bring		
	their blueprints with them. Share out some observations		
	and analysis of the blueprints. You may decide to		
	encourage students to avoid saying students' names		
	when sharing observations and analysis whole group. Then lay the cut cereal box flat and compare the		
	blueprints to the flattened box. Have the students, in		
	their pairs, check their blueprints and see if they can		
	find where the plans differ from the actual flat box.		
3.	Self-evaluate. Ask students to self-evaluate the		
	teamwork in making the blueprints to find out how well		
	they worked with their partner. Pose questions such as:		
	Did both members contribute ideas? Did both members		
	help trace or draw? Have students show fingers to		
	kinesthetically respond: 3 fingers=Definitely, 2		
	fingers=Sometimes, 1 finger=No, we probably need to		
	work on that. If any teams need to be re-configured,		
	now is a good time to do it.		
4.	Using handout (K.5.2), have student pairs work on		
	writing, drawing, giving a synonym and describing the		
	meaning of the word "blueprint"		

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DTEEL K.5.1 Flat Space (Engage/Explore)

Name: _	Date:		
	(Write the word)	(Give an example)	
	(Describe it in your own words)	(Another word with same meaning)	

DTEEL K.5.2 Flat Space (Evaluate/Elaborate)