

Early Learning STEM Lessons

Unit 2: Building Structures and Exploring Shapes

This unit was developed by the Bremerton School District in partnership with the Office of Superintendent of Public Instruction and funded through grants from the Boeing Company and EPA Region 10 to support Early Learning STEM Education. The Early Learning STEM units are designed for educators, teachers, and childcare providers to use with children between the ages of 3-5.



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Objectives

- Children will build structures using varying materials (e.g., different types of blocks, straws, newspapers, etc.).
- Children will make observations about materials and compare/contrast them.
- Children will make observations about structures and use words to compare/contrast.

Common Misconceptions

- *A shape can only look one way.* Young children can become stuck on the idea that a shape is only a shape if it looks the same. For example, they may believe that a triangle with the point down is not a triangle, or that a long skinny rectangle and a shorter fat rectangle cannot both be rectangles. You can avoid this misconception by having many different types of the same shapes and talking about how they are the same and different. When asking children to identify a shape, follow up with asking them to tell you how they know what the shape is.

Target Books

Nonfiction (Informational Text):

- Design it! Build it! by Susan Ring
 - Real-life illustrations are used to describe characteristics of different types of structures and the process of building. Questions about the design and necessary characteristics of various structures are included.

Fiction:

- The Shape of Things by Dayle Anne Dodds
 - Colorful cartoon images illustrate different shapes that can be seen in everyday life. Rhyming text names the key shape, and then adds additional information to turn that shape into an everyday life item such as a house or egg.
- Hot Rod Hamster
 - A hamster sets out to build a hot rod, selecting different characteristics that will meet his needs for speed, size, and color

Key Vocabulary

- **Length** – How long something is
- **Height** – how tall something is
- **Weight** – how heavy or light something is
- **Build** – to put things together and create something
- **Materials** – things being used to build
- **Shape** – the way something is formed, circles, squares, and triangles are all shapes
 - Beginning Shapes
 - Circle
 - Triangle
 - Square
 - Rectangle

- Oval
- Heart
- Star
- Rhombus (commonly referred to as a diamond)
- Advanced Shapes
 - Hexagon
 - Pentagon
 - Octagon
 - Cube
 - Cylinder
 - Sphere
 - Pyramid
 - Crescent
- **Design** – A plan of the shapes, sizes, colors and building materials needed to create something
- **Model** – A small copy of a structure
- **Structure** – A building or something built of parts arranged in a special way
- **Support** – To hold up or keep something from falling
- **Tower** – Tall structure or building
- **Bridge** – A long structure to go across and above something like a river or road

Pre/Post Assessment Ideas

- Using the provided worksheets or creating your own, have children look at a picture that is missing a shape. Ask, “What is the shape missing?” “What can be used to fill in that spot?” “Are there other shapes that they could use to fill in the hole?”
- Use pattern blocks to make pictures (or buy a commercial set) and see if children are able to match the shapes. You can make this easier or harder by changing the visual cues given. The very easiest would include the entire shape outlined and colored in with the matching color of the required block. Harder would be to have only a black outline of the entire picture without any clues to the shapes or colors of the blocks that are used.
- Ask children to build a tower using a set number of blocks. Vary the number you tell them to use based on the child’s age and ability. Younger children may only use a set number to ten, while kindergarten bound children may be able to count out and use 30 blocks. Observe how children count out the blocks. Are they able to count with rationality (one number word for each block)? Can they count in sequence? Do they stop when they get to the number you requested? Also observe the creation of their tower. Are they able to stack the blocks without them falling? How are they able to compensate for a lack of stability when they get to higher numbers of blocks?

Before Reading

- Introduce key vocabulary.

- Take a 'picture walk'-look through the pages and talk about what they see and think the story may be about; when appropriate, have children make predictions about what they think may be happening on a page.
- Record predictions that children make during their picture walk.
- Record what children already know about the topic, a circle map can be an excellent recording tool - examples are at the end of the unit.

During Reading

- Make comments about personal connections, either between you and the story or the children and the story.
- Ask questions that are:
 - "On the page"- basic level questions that have yes/no answers or can be answered by looking at the page.
 - "Between the lines" - a higher level of questioning that requires children to recall information they have already heard or information they are hearing right now in order to answer.
 - "Beyond the book" - an even higher level of questioning that requires children to take information they have previously heard and make reasonable predictions based on that known information.
- A single page of key vocabulary and a variety of types of questions specific to each book is included with the unit. It is recommended that you print this page and keep it with your book copy to serve as a reference guide when engaging with the book with young children.

Book Extension

- Build a house or building for a stuffed animal or doll using different materials such as blocks, boxes, containers, toilet/paper towel tubes, sticks, leaves, etc.
 - Have children select something that they will be constructing a house or other building for. Some examples might include building a house for a doll or toy animal or a garage for a toy car or airplane.
 - Have children study different buildings and see how different needs are met. Ask, "How are houses for people different from a dog house?" "How are those different from a garage or a shed?" "What things will their object need-a wide doorway to get in, or a chair to sit on?"
 - Using the gathered materials, let children build their structures. How will they make the pieces stick together? Does the round toilet paper tube make a good wall or would something else work better? How can they make sure that their structure is adequate for the object they chose? When they have finished their structure, have them test it out. Does it work or do they need to go back and redesign a part of their structure?
 - Children should then create a blueprint, or draw their design. Try to emphasize the shapes, colors, and the process of drawing, rather than the quality. Older children may be able to be more accurate in their drawings, representing the sizes, shapes, and differences in the materials than younger children, who may make more lines and scribbles. After children have drawn their blueprints, let them dictate to you about their drawings.

What type of structure is it? Who lives there? Is there anything special they would like to tell you about their structure? What shapes do they see, and what materials did they use?

- Bind these blueprints into a classroom book, allowing children to use them as a reference when building at other times.
- For an additional challenge, have children draw their blueprints prior to the construction phase, and then use their blueprints as a reference when building. Allow changes to their plans, as that is what all good engineers do!

Discussion Points

- Encourage children to talk about why they are doing something a certain way. Ask, “Why are they using the heavy blocks on the bottom?” “What might happen if they put them on the top?” “Why did they choose to build using the twigs?”
- Talk about the changes they are making as they build their structure. Why did they stop making it so tall and instead build longer walls? If they tried making a roof from the cardboard tubes and changed to strips of paper, why did they decide to try that instead?
- Guide problem solving steps between the children. Call attention to specific elements that one child has succeeded at and another is having difficulty with. For example, “Sam, I noticed that Jada was able to stack the blocks so her building doesn’t fall. Maybe you could ask her to show you how she did it?” This will encourage cooperative play and using peers as resources rather than the adult being the sole keeper of information.

Small/Large Group Activities

- Have a ‘take apart’ bin. Use old appliances or ones that no longer work and let children take them apart to see what is inside.
- In a sensory table or large bucket, have chunks of wood and sandpaper so children can practice sanding.
- Use popsicle sticks to build pictures and letters. Talk about what letters and designs can be built using popsicle sticks. Ask, “Can you make letters or designs with curves? If not, what can you do to fix that problem?”
- Create an “I can build” book. Take pictures and/or have children draw different structures using various materials. Store in the block area to assist in giving children ideas of what to build or how to make a particular structure.
- Make a giant geoboard using pegboard, screws, and bolts. Children can use rubber bands, hair ties, string or yarn tied in loops, or other material to make pictures and shapes. This can be used inside as large cooperative play, or brought outside.

Block Area

- Have multiple types of building materials available.
- When engaging with children in the block area or when building and constructing with children, make comments and ask questions that allow them to: describe the materials they are using and what their structure looks like; compare and contrast

the different materials and structures created; create hypotheses on why a structure did or did not fall down and follow up to see if their hypotheses was correct. Examples include:

- “What do the blocks feel like? Look like?”
 - “How are the wooden blocks different from the foam blocks?”
 - “Which block would you prefer to make a house with, newspaper or blocks?”
 - “Why do you think the house fell down? What would happen if you used the big flat one instead of the tiny square?”
- Have whiteboards or laminated papers and wipe off markers so children can draw their design prior to or post construction.
 - Have materials such as cove molding, PVC pipe (cut in half or left whole), or tubing for children to create ramps, tunnels, and other more complex structures.

Art Activities and Writing Area

- Color on pieces of sandpaper. Compare to coloring on regular paper.
- Use toothpicks to build structures. Problem solve how to make the toothpicks stick together. Explore the use of materials such as cotton balls, marshmallows, packing peanuts, and gauze netting.
- Use different tools to paint with-make prints from hammers, screws, socket wrenches dipped in paint.
- Draw blueprints of structures children have seen and/or want to create.
- Glue magnets onto colored craft sticks and foam or felt shapes, allow children to build pictures using these on a cookie sheet, refrigerator, or other magnetic surface. Using magnetic paint, you can turn almost any surface magnetic.
- Create partner art – children can work in pairs to create matching art projects. Either fold a large piece of paper in half or give each child their own piece. One child goes first, adding something to their paper. The other child then copies that same addition. For example, the first child makes a blue circle in the middle of their paper. The second child does the same, and then adds a yellow swirl at the top of the page. The first child copies the swirl, and it continues until both children decide they are finished. A variation would be that each child created their own, and then switches papers and attempts to replicate their partner’s work.
- Use shapes cut from heavy paper such as cardstock. Let children use these stencils to create rubbings using the side or a crayon, and then trace the stencil over the rubbing design. Talk about how the rubbings look different than the tracings.
- Using scrap papers, let children cut, glue, staple, and tape the papers onto a chunk of cardboard or other heavy weight base. Encourage children to explore with making the paper scraps into cylinders, rolls, or other three-dimensional designs
- Paint, color, or glue fabric/paper scraps to cardboard boxes of various sizes. Use these in the block area to serve as stores, houses, or anything else children decide.
- Have rulers, stencils, measuring tape, etc. available for children to use when making designs.

Meal/Snack Conversations

- Using crackers and peanut butter or frosting, build structures. Talk about the shapes, how they are sticking together, what types of structures they built.

Outdoor Component/Active Movement

- **Go on a shape hunt outdoors.** Take observation notebooks and a writing utensil and have children find and record the shapes they see in nature. For example, a tree trunk or a swing seat may look like a rectangle, they may see circles and ovals in a flower, or triangle shaped rocks and leaf tips.
- **Go on a building hunt outdoors.** Take observation notebooks and a writing utensil and have children find and record the buildings that they see. Another option is to use different building materials and have them create buildings and draw what they have created.
- **Set up a woodworking area.** Let children saw, hammer, and sand! If you don't have a wood bench, just hammering nails into a stump will do. Set up some simple machines like ramps, pulleys, and levers.
- **Take buckets of water and different sized paint brushes and rollers outside to paint the ground and building.** See how the different materials leave different types of marks.
- **Make a giant geoboard using a pegboard and nuts and bolts.** Rubber bands, hair ties, or other stretchy fabrics tied in loops can be brought outside as an activity for children to do.

Assistive Technology

Assistive Technology is the use of strategies, adaptations, and/or materials which are created or commercially available products to enable participation in activities that otherwise would not be accessible. While these strategies are designed to assist those with disabilities and/or other barriers to learning, they can be implemented with all children, including those who are not native English speakers, and provide additional visual and technological support.

For this Unit:

- Add visual/picture supports for each of the block types you are using.
 - Clip art available as sticky notes for some children to choose rather than drawing or writing their observations.
 - Clip art or objects for each shape you are searching for, the shapes can be matched to photos of the actual objects that are observed.
 - Clip art or other symbols or objects for each building type to answers to questions about which sense was being used.
- A communication device programmed with key words, vocabulary as well as words that could answer questions about the senses or observations. This could be used to participate in discussions, answer questions, and request items.
- Create a non-skid surface as a base for building with some blocks.
- Put the sandpaper on a piece of wood to make sanding easier and anchor the piece to be sanded to make it stationary.

- For painting, it may be easier if some children use adapted brushes, or brushes you have added tape or foam to for an easier to grip handle.
- Knobbed crayons or crayons that are melted and poured into cookie cutters to create easier to grasp shapes.
- Building up the handles of tools with tape or foam for easier grasp in the “take apart center”.
- Create a spinner attached to a switch so a child can participate in selecting living and non-living items for others to categorize. This same spinner can be changed for the math games that are provided.
- Create an electronic interactive word wall: This is created using PowerPoint. Each letter in the first slide is a hyperlink to the corresponding alphabet page. At the bottom of each alphabet page are links to return to the main screen or go forward to backward a page. Children can assist with the creation by choosing pictures and suggesting words to be added.



e	eye		I see with my eye.
e	ear		I can hear with my ear.
e			

Other Resources

- **Teacher Resources**

- Discovery Education – www.discoveryed.com is an online resource that offers a wide variety of digital media content into classrooms. This allows for increased engagement of children and gives them the opportunity to

explore and experience fascinating people, places, and events. All content is aligned to state standards, can be aligned to custom curriculum, and supports classroom instruction.

- Video clips about shapes: Preschool Fun for Kids: Shapes; Number Crew: Shape Sorting and Shape Escape; Animals, Colors, Shapes; 2 songs, game with 3 levels to “plug a dam” with the correct shapes.
- Put classroom books developed into a PowerPoint or Digital story so all students can access it on the computer and view it multiple times Discovery Ed website www.discoveried.com. Under the Teacher Resources there are tutorials on creating stories using Photo Story which comes with Microsoft. There are multiple tutorials plus completed projects.
- Videos on creating a plan, using levers, planes and wheels to solve problems. Sid the Science Kid: Climb is divided into 11 segments that describe their problem, drawing it, and using simple tools (technology) to solve it.
- Teacher Resource on how to turn photos into shapes
- BookFlix – <http://bkflix.grolier.com> is an online literacy resource that can be purchased through Scholastic and is geared for children up to approximately third grade. Over 100 pairs of fiction and nonfiction books are included, with the fiction book being animated and the nonfiction in a read-a-long format. BookFlix includes games or puzzlers, a meet the author section, web resources, and teacher lesson plans.
 - Book Flix Teacher Resource: Engineering lesson plans and activities
 - Book Flix Whiteboard lessons : Engineer a Spider Web, Engineer a Bridge (Home page/Learn More/Teacher/ prek-k)

Sample Circle Map

