

# Problem Solvers Activity SE 12: Shade Structures

## CHILDREN ARE LEARNING...<sup>1</sup>

### Science Content:

- The properties of objects are related to how they are used.
- Problems can be solved through the development of a new/improved object or tool.

## CHILDREN ARE DOING...

### Science Practices:

- Make observations
- Develop and use models
- Explore the structure and function of objects and materials

## MATERIALS NEEDED:

1 toy figurine per child

1 piece of paper per child

Pencils or crayons, enough for your group

1 flashlight

2-3 pairs child-safe scissors

1 pair adult scissors (teacher only)

1 roll of masking tape or painter's tape for every 2 children

*Assorted Open Ended Materials—Obtain enough of these materials for children to build a small structure:*

- Boxes of different sizes
- Blocks of different types
- Construction paper
- Coffee filters or tissue paper
- Blankets (small)
- Dish towels or washcloths, or other small pieces of scrap fabric or felt
- Other items from your classroom, for example: Craft sticks, empty water bottles, rulers, paper towel tubes, rolls of paper or foil, sheets of poster board or flip chart paper, etc.

**NOTE:** Like other engineering activities in this curriculum, you may want to implement this activity over 2-3 days, giving children time to explore materials, draw their design, build, and then test/refine their structure.

<sup>1</sup> Adapted from the Next Generation Science Standards (kindergarten): <https://www.nextgenscience.org/>

## PREPARATION:

Before implementing this activity, review the Engineering Design Process as discussed in Activity 21 (*Building Together*) and Activity 22 (*Waking Walter*).

- **For the EXPAND activity:**
  - Have the child-safe scissors, tape, and open-ended materials available to children in an accessible area with storage space for children's work, which is particularly important if you decide to implement this activity over a longer period of time.
  - Provide paper/crayons/pencils for children to plan and document their designs.
  - Have the figurines ready for the engineering task. Keep the teacher's scissors aside if needed.
- **For the EXPLORE activity:**
  - Have the flashlight close by for children to test how effective their structure is at blocking the "sun."

## Activity Instructions

### ENGAGE

Gather a small group of 4 children in a circle on the floor. (Note: Groups of 6 children work well if you are teaching 4-year-olds. Adjust materials as needed.)

**INTRODUCE:** Today let's start by talking about the sun. What do you know about the sun? (*Encourage children to share their knowledge. Common themes often include: the sun is warm/hot; the sun is in the sky; the sun is yellow; the sun goes away at night. If you wish, note children's experiences with/knowledge of the sun on a flip chart or white board where all can see.*)

**ASK:** Sometimes adults talk about protecting ourselves from the sun. In our classroom, we protect ourselves from the sun by wearing sunscreen in the summer. Would anyone like to talk about their ideas for why we need sun protection? (*Take children's ideas. Explore the different ways that children protect themselves from the sun: with a hat, sunscreen, sunglasses, sitting under an umbrella, sitting in the shade, etc.*)

### EXPLAIN:

- Too much sunlight can hurt our skin and make it red and painful. This is called a sunburn. (Have you ever had a sunburn?)
- The longer we stay in the sun and the stronger the sunlight is, the greater chance of getting a sunburn.
- You shared some ways that we can protect ourselves from the sun already (*repeat some of what children told you above*).
- Another way we can protect ourselves from the sun is to spend more time in the shade. What is the shade? Have you ever heard this word? (*Invite children's ideas about shade.*)
- Shade is the cool darkness that is formed when we have shelter, or protection, from sunlight.
- Shade can be formed in many ways: by leafy branches on a tree, or by the roof of a patio, or even by a sunhat or an umbrella at the beach.
- When have you seen a shady spot? Did you ever sit in the shade? Where was it? What made the shade you were sitting in? (*Explore children's experiences with shade. Encourage them to share what formed the shade they experienced—was it a roof, umbrella, curtain, or branch?*)
- It's nice to sit in the shade, isn't it? We feel cool and protected, even when it's really hot and sunny out.

## EXPAND

**GROUP:** Create groups of two children. Give each group a small toy figurine to work with for this activity.

**EXPLAIN:** Today we have a problem to solve—you and your partner are going to build something that will keep your little person (*hold up a figurine*) protected and safe from the sun. You are all great Problem Solvers in this class, and today we are going to work on solving this problem.

**EXPLAIN:** Engineers solve problems by using the engineering design process. This process has three steps. Our first step is to **explore** materials that we can use when building our solution.

**REVIEW:** When we explore these materials, we can OBSERVE them, we can TOUCH them, and we can SEE WHAT THEY DO. Think about what you can do with these materials to make shade for your little person and keep them out of the sun.

**DISPLAY:** Show children the collected materials. Let them know they can use other materials that they find in the classroom as well. Remind them of the task: building a shade structure for their little person. (*Give children about 5 minutes to explore. Then continue the conversation using questions like the ones below to reflect on/consider the potential uses of these materials.*)

**ASK:** Help children share their research and observations through a group discussion using the questions like the ones below:

- What did you discover about the materials here?
- Which of these materials might be good to give your person some shade?
- What could you do with these materials to make some shade for your little person?
- Which of these materials were not helpful to you?
- Which of these materials do you think you would like to build with? What makes you think that?

**REVIEW:** Summarize children's discoveries and observations about the different materials.

**TRANSITION:** Are you ready to be an engineer? Let's use our observations to build a shade structure!

## EXPLORE

**EXPLAIN:**

- The next step of the engineering design process is to create, or build, your shade structure.
- You already learned a lot about how these different materials feel and what they can do.
- You used that knowledge to come up with ideas about which materials might be good for a shade structure.
- Now you can draw a picture of what your plan is. (*Distribute paper and pencils/crayons.*)

**ASK:** As children draw their plans (5 minutes or so), you can use questions like the ones below (if needed) to help them think about their design:

- What do you want your shade structure to look like?
- What will make the shade?
- What materials will you need?

### THE ENGINEERING DESIGN PROCESS

1. **Explore:** What materials do you have?
2. **Create:** What will you do with the materials?
3. **Improve:** Can you make your creation better?

Adapted from: Davis, Cunningham, & Lachapell, 2017.

- What goes on the bottom? What goes on top? What will you do to hold the pieces in place?
- How can you be sure the structure will be big enough for your person?
- Do you see any materials on the table or in our classroom that would help you solve that problem?

**TRY IT:** Give children time to select their materials and build their shade structure.

**OBSERVE:** The teacher's role during the **Create** step of the engineering design process is to observe the children as they build in order to support their learning.

- Younger children may have difficulty knowing how to start—see the questions above and below for guidance on supporting them.
- Given typical fine motor skills from 2 ½ to 3, younger children may need assistance with cutting, ripping tape, holding objects in place while building, etc.
- All preschoolers may need help in organizing themselves to act on their plan. You can help by (1) reminding them of the goal of the activity, (2) directing them to the plan they drew, (3) observing what they have already done—"I see you have chosen a piece of cardboard" and (4) prompting them to consider the next step—"Where should the cardboard go?"

**SUPPORT:** Support children's attempts to build their structure. Assist with cutting and/or ripping/placing tape if needed. Some children may need help getting started or organizing themselves; you can assist by asking guiding questions like the ones below, if needed:

- Can you tell me about your design plan? What materials will you start with?
- What made you choose those materials? What will you do with them next?
- What material will make shade for your little person?
- What makes those materials good for shade?
- Can you bend/fold/cut/adjust that material in order to cover your person/make the material easier to work with/etc.?
- I wonder if you are feeling frustrated with that material. Do you want to try using a different material and adjust your plan?

## EXPAND

**EXPLAIN:** Now we're going to test our shade structures. We are going to pretend this flashlight is the sun. You will have a chance to hold the flashlight over your structure and see if your little person is protected from the sunlight. *(Alternatively, you can invite children to take their structures outside—or even build outside—to see if their design is successful.)*

**EXPLORE:** Give each child a chance to hold the flashlight over their structure with the figurine inside. Remind children of the problem: "Today, we were working to build a structure to protect this little person from the sun." Ask children if their design lets any sun inside or whether it shades the figurine completely. Encourage them to tell their peers about their design. Focus on the steps they took in building their structure.

**ASK:** The last step of our engineering design process is to see if we can **improve**, or make our design better. Look at your shade structure. Look at your friends' shade structures. *(Encourage children to walk around and look at the other structures. Ask children to share elements they notice or like about each structure—these kinds of observations may help with Step 3: Improve.)*

**ASK:** Engineers try a design and test it to improve it over and over again, until they get one that really works well. What about your design? Does your design give your little person some shade? Or do you have

ideas about anything you would like to change? Did any of your friends have good ideas that you would like to try? *(Take children's ideas, encourage them to make this change and test the shade structure again.)*

### TRY IT:

- Prompt children to try something new in their design to “make it better” or improve it, if they wish. Normalize this activity as an important part of being an engineer—it’s okay to try something new and change your design. It’s also okay to try something new and go back to your original design.
- Allow children to test their changes using the flashlight to see if there are improvements.
- Help children make a connection between the materials they used and the shade they were able to create for their figurine.
- Invite children to explain how they used the materials to solve the problem, and then how (if at all) they changed their design to improve the structure (the focus of Step 3).

### REFLECT

To close the activity, use a reflective question/s - like those below - to prompt children’s thinking about engineering and design plans.

- The first thing we did today was explore our materials. What did you discover about our building materials?
- What materials did you decide to use? Why?
- What materials did you decide *not* to use? Why?
- Tell me about how you created your shade structure.
- What happened when you shined the flashlight on your structure? Did your structure create shade for your little person?
- Tell me about how you made your design better.
- What did you enjoy about building a shade structure?
- What was tricky about building a shade structure?

**SUMMARIZE:** Today, we used the engineering design process to build a shade structure to keep our little person safe from the sun. You explored and chose materials, built your design, and then tested it to see if you could improve the design. Sometimes engineers have to try the same design many different ways before they find a design that works. We try again and again because we are Problem Solvers!

## Individualizing the Activity

### Make it more challenging:

- Once children have made a shade structure for a small figurine, give children a stuffed animal and ask them to create a different structure that would work for this larger animal. Can they use the same design or will have to adapt it?
- In the Create step, pause and give each child a chance to talk about their design plan. Let other children ask questions or share ideas.
- As children walk about and observe their peers’ work, prompt/encourage them to say one thing they notice or like about each structure.

**Make it less challenging:**

- Reduce the choices of materials so that children are not overwhelmed by options.
- Do the activity as a group so that you can scaffold (support) children's problem-solving along the way. Narrate your and the children's work to emphasize the steps involved in building the structure: *Now I'm going to test this cardboard and hold it up to see if it covers the little person. Now how can I get this cardboard to stay in place right over my figurine? I wonder if I can use the blocks.*

**MAKING CONNECTIONS ACROSS THE DAY:**

- Create a "Shade Structure Exploration Box" by placing open-ended materials, figurines and flashlight into a bin and offering this as a free play activity.
- Talk about the steps of the engineering design process when children are playing in the block area—What materials are they using to build? What are they building? What could they do to make their building better or more stable?
- Notice when it's sunny outside. Involve children in coming up with solutions to creating shade on the playground for, for example, an outdoor read-aloud. Can you work together as a group to build a large shade structure for the group? Invite children to draw a plan. Test out several possible solutions (with permission from program leadership).
- Explain that protecting our skin from the sun is an important way children can keep their bodies safe and healthy. Sunscreen is like a shield to cover and protect their skin. Playing in shady areas can also help protect them from the sun.
- Use the idea of "planning before doing" in all classroom activities. For example, as you are gathering art supplies, you might say: "I need a plan. Let me make a list. I need 6 paintbrushes and a pad of paper. Let's be sure I have everything on my plan."

## Song: *Explore, Create, Improve*

### Chorus (2x)

Design a plan, work your plan.

(Model step, clap, step, clap)

Build a shade structure, yes you can!

Stepping side to side on the beats)

First explore; find out more!

Lay the materials on the floor.

(Point to "materials" on the floor)

Then compare the things you can use

(Continue step-clap movements)

It's so much fun, deciding what to choose!

Ooooo Explore!

(Free dance, waving arms up high side to side)

Ooooo Create!

Ooooo Improve!

Now let's create; building structures is great!

Think it through, try it out; see what you can make.

(Shrug shoulders-asking a question)

Check it out; compare, use your imagination.

(Point to the materials)

Building that structure from your mind's creation.

(Point to your head)

Ooooo Explore!

(Free dance, waving arms up high side to side)

Ooooo Create!

Ooooo Improve!

How can we improve...while we bust a move?

(Shrug shoulders-asking a question)

Let's problem solve to think it through.

(Point to head)

We can try our ideas in many combinations;

(Pretend to pound nails with hammers)

We are engineers of the next generation.

Design a plan, work your plan.

(Model step, clap, step, clap)

Build a shade structure, yes you can!

Stepping side to side on the beats)

## Making Literacy Connections

Share the following book with children as an opportunity to deepen their understanding of engineering and design.

**Suggested Book:** *The Contest Between the Sun and the Wind: An Aesop's Fable* by Heather Forest

### AS YOU READ:

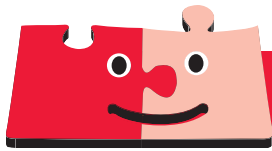
- On the cover, we see the main characters of our story: the sun and wind. Can children find each character? What do the expressions on the faces of these characters tell us? Does the wind look friendly (he is frowning)? Does the sun look friendly (she is smiling)?
- Ask children about the title of the story: Do they know what a contest is? A contest is when two or more people try the same activity to see who does it best. In this story, the sun and wind will have a contest. What do children predict their contest will be about?
- When the sun and wind watch the man walk by, ask children again to point to each character. (Again, point to their expressions: What do their faces tell us about their feelings?)
- The sun and wind decide to have a contest about which of them can make the man take off his coat. Ask the children to predict who they think will win the contest: the sun or wind? What makes them think so?
- What happened when the wind huffed and puffed and blew? Was the wind successful in making the man take off his coat? What happened instead? (The man got cold and buttoned his coat tighter!)
- The wind is *discouraged* when the man doesn't take off his coat. What do children think it means to be *discouraged*? (Discouraged means we feel disappointed that we weren't successful at something.)
- What did the sun do when it was her turn? (The sun got brighter and brighter.) As the sun got brighter, what happened to the man? (He got hot!)
- What did the man do when he got too hot? (He took off his coat!) What did the man do to get out of the sun? (He sat down in a shady spot.) Can children show you the shade in the picture? What is making the shade?
- On the page with the larger illustration of the man is sitting under the tree, ask children to show you the shade on the grass. How do they think the man feels sitting in the shade?
- Who won the contest—the sun or the wind?

### BUILD ON THE BOOK: CLASSROOM THEATER

Materials: Photocopy an image of the sun and wind from the book. Glue each image to a piece of sturdy paper.

Re-tell the story of the Sun and Wind's Contest with the children in your classroom. Ask for two volunteers to be the sun and wind—give each child their character image to hold. Ask for another child to be the person in the story and give this child a jacket or scarf to wear from the dress-up area. Read the story again, pausing for the three characters to act out the contest. (If desired, simplify the language so children can easily "repeat" their lines.) Prompt children to act angry, discouraged, kind, or proud, based on what's happening in the story (this can be a great opportunity to explore emotions too!) Leave these props and the book in the classroom library so children can act out the story during free play time.





### Build a House for Teddy

This week, children designed and built a shade structure for a doll. They used the engineering design process to help them build. There are three steps to this process:

1. Explore, 2. Create, and 3. Improve. You can help children practice these engineering skills at home by trying the activity below.

- Let your child choose a stuffed animal or other small toy in your home.
- Collect materials—like boxes, dish towels, tape, popsicle sticks, foil, paper towel/toilet paper tubes, or other items that might help children build.
- Ask your child what materials they want to use to build a house for their stuffed animal. What is their plan?
- Give children time to build. Let them know you can help with ripping tape, cutting, or other challenges.
- Suggest that your child test their structure at the end to make sure the stuffed animal fits inside. Does the design work? Does your child want to make any changes?





## Solo para familias

### Construir una casa para Teddy

Esta semana, los niños han diseñado y construido una estructura de protección para una muñeca. Para ello, han utilizado el proceso de diseño técnico. El proceso de diseño de ingeniería consta de tres pasos: 1. Explorar; 2. Crear y 3. Mejorar. Puede ayudar a los niños a practicar estas habilidades de ingeniería en casa con la siguiente actividad. Deje que su niño elija un peluche u otro juguete pequeño de su casa.

- Reúna los materiales como cajas, toallas de cocina, cinta adhesiva, palitos de helado, papel de aluminio, tubos vacíos de papel higiénico o de toallas de papel, u otros artículos que puedan ayudar a los niños a construir.
- Pregúntele a su niño qué materiales quiere utilizar para construir una casa para su peluche. ¿Cuál es su plan?
- Déjeles tiempo a los niños para que construyan. Dígales que usted puede ayudarlos a rasgar la cinta adhesiva, a cortar o con cualquier otra tarea difícil.



Propóngale al niño que al terminar la estructura la pruebe para asegurarse de que el peluche cabe adentro. ¿Funciona el diseño? ¿Quiere hacer algún cambio?