

Activity Building with Many Materials

Focus: Children explore building materials, designs, and techniques as they build three-dimensional structures from a variety of materials.

Materials: See each subactivity below.

Setting: Individuals or small groups in the Building Center. Rotate materials for various subactivities over the course of the study.

Throughout this study, children will use the Building Center for free exploration as well as other, more structured building activities. (For information about setting up a Building Center, see “Preparing for the Constructions Study” on page 89.) Initially, set out materials for one building subactivity at a time and leave each subactivity set up for several days. This encourages children to become adept at working with the materials and allows them to sustain work on their building projects during several sessions. Continuing a project over several days gives children time to think through and revise their plans and, ultimately, build better constructions.

After children have used the materials for the various subactivities separately, you might choose to provide materials from different activities simultaneously. If you decide to offer a mix of building materials, set up a system for organizing the materials (for example, designating boxes for each type of material) and show children how you expect them to clean up the work area and store the materials. If possible, have an adult or highly organized child assist until routines are well established. If you choose to provide just one set of materials at a time, choose materials that reflect children’s preferences and offer them again if interest is high.

Encourage children to think before they build: What would they like to build? How would they like to build it? Ask some pertinent questions to help them plan their work, such as, What kind of building will it be? Is it tall or short? Does it have a roof? Windows? This exchange of information is an opportunity to begin talking about architects and their job, if you haven’t already. Spend time in the Building Center and talk with children about what they are trying and discovering as they work. Encourage children to collaborate on building structures, just as they do on projects in the block area.

Questions such as the following may enhance the building process and help children reflect on their experiences:

- What kind of structure (e.g., short, tall, round, skinny) and design does each type of material work well for?
- What kind does it not work well for?
- What is the best way to make the materials hold together (e.g., tape, glue, nails)?
- Are the materials they are using the same as or similar to any materials that are used in real structures?
- How do the materials compare with others children have built with during the study?
- How do the structures they are making remind them of real ones they have seen? Are their structures modeled after real buildings?

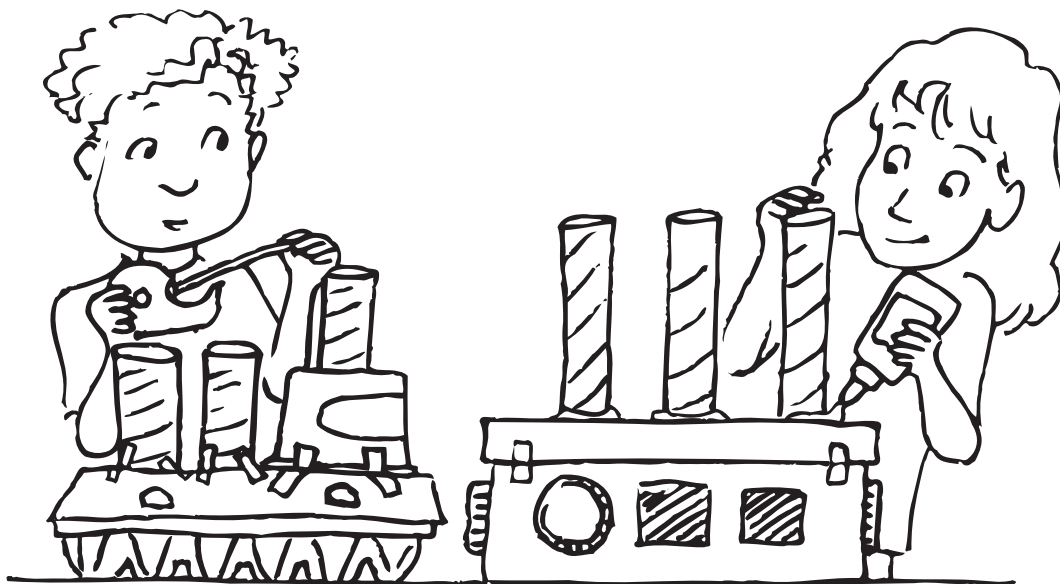
You can highlight some of these questions by giving children opportunities to share and talk about their constructions and the construction process. Encourage children to tell about any discoveries they make about building materials, designs, and techniques. Children can display their structures, along with an index card that tells the name of the “architect” and “builder” and any other informative facts they want to share.

TEACHER NOTE: Once children have had a chance to share their constructions, you will probably want to send these creations home to make space for new ones! Help children find fair ways to decide who should take home structures on which they have collaborated. Possibilities include: having each child take the structure home for a day or two; flipping a coin to decide who should keep the construction; collaborating on a replica; and taking a photograph for each child to keep, while dismantling the structure and reusing the materials. If asked, children are likely to come up with other workable solutions as well.

Scrap Materials (Scrounge Art)

Materials: “Recycled” (but clean) garbage, such as toilet paper or paper towel tubes, PVC tubing, craft foam, cardboard from boxes, shoe boxes, corks, string, scrap paper, egg cartons, plastic bottles and lids; glue; staples; brad fasteners; various kinds of tape (e.g., masking, wrapping, packing); and paint (optional).

Provide inviting scrap materials for building structures. Ask for donations if you don’t have a collection in the classroom already. (The family letter on page 93 includes a request for scrap materials.) The more varied shapes and sizes of materials you offer, the more unique the children’s structural designs will be. In addition, children will need to experiment with ways to fasten different materials together. Discuss the various techniques children use. Children will often invent a variety of creations with these materials, so you may need to focus their work on buildings for the purposes of this study. You might also allow children to paint their completed structures if you have the time and resources.

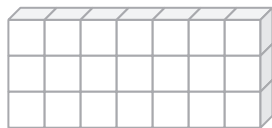


Sugar Cube Bricks

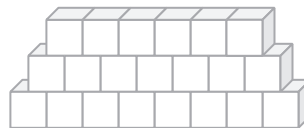
Materials: Sugar cubes, glue, and paper or cardboard (optional).

Invite children to build structures from sugar cubes held together with glue. As they build, encourage children to discuss different problems they encounter, such as how to make windows and doors. A great deal of shared problem solving can take place as they construct their buildings. Encourage children to compare the sugar cube “bricks” to real bricks. Mention that real brick buildings are held together by something called mortar, which works like the glue they are using. As children try to build different kinds of structures with the sugar cubes, help them make connections to the types of real structures that are (and are not) typically built of bricks. For example, bricks are not used for skyscrapers, since the lower walls would have to be extremely thick to support the weight of the building. However, bricks are frequently used for low, “boxy” structures, such as houses.

Children may want to experiment with using other materials, such as paper or cardboard, to make roofs for their sugar cube structures. Again, make comparisons between the models children are building and the roofs on real buildings. Focus the discussion on shapes as well as materials, such as a flat versus a slanted roof shape, and what materials would work best for each kind of shape. As an extension, suggest an experiment with how stability is enhanced if the edges of the “bricks” are staggered, rather than lined up on top of one another. Challenge children to find this pattern in real brick buildings as well.



edges aligned



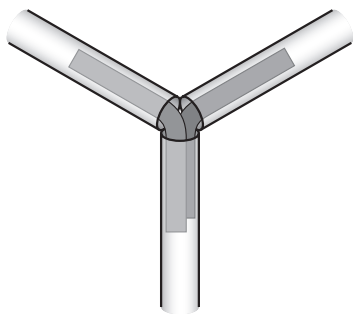
edges staggered

TEACHER NOTE: Consider sending home sugar cube structures soon after construction to avoid attracting insects and other unwanted creatures. If children agree, you might also dismantle them and recycle the “bricks.”

Clay

Materials: Clay, water, and pictures of adobe houses (optional).

Provide clay for building clay structures. Some children might make clay bricks to build with. Others might try to shape larger pieces of clay into walls and roofs. They may discover that clay is an especially good medium for making curved structures. Talk about the different building techniques and results. Mention or show pictures of adobe houses, which are fashioned from a mixture of mud and straw; this material has properties that are similar to clay. (If you did “Building with Mud: Nests and Bricks” in the Dirt, Sand, and Water Study, refer back to that activity.) If you cannot bake the clay structures, let children know that dried clay is fragile and they will need to be careful when they take them home.



joining straws
with pipe cleaners

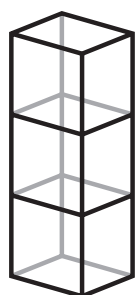
Paper, Sticks, and Straws

Materials: Small diameter straws*, cut in half; chenille craft wires* (pipe cleaners), cut in thirds; craft sticks or sticks from outdoors (optional); paper or cardboard; cellophane (optional); and tape and glue.

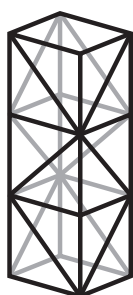
*Indicates items that are included with the curriculum

Put out paper, sticks, straws, and pipe cleaners. (Cut the straws in half and the pipe cleaners in thirds before setting them out.) Show children how to connect straws by inserting the ends of the pipe cleaners into the ends of the straws and bending the pipe cleaners to position the straws as desired.

As children work, you will probably see many come up with some sort of stick or straw “frame” onto which they add paper “walls” and “roofs” and cellophane “windows,” if those materials are available. Explain that this is how skyscrapers or other tall buildings are constructed—with a steel frame on which lightweight wall panels (often made of glass) are hung. Discuss how skyscrapers can’t be built like many shorter buildings, in which the walls hold up the structures, because the skyscraper’s walls would have to be too thick. You might want to encourage some children to try building frames with and without diagonal cross braces to compare their stability. (See “Marshmallow and Toothpick Constructions” for more information about the strength of triangles versus rectangles.)



less strong



more strong

Woodworking

+ SAFETY NOTE: Review safety procedures and rules prior to allowing children to do any woodworking. Also be sure that children are working under the close supervision of an adult at all times.

Materials: A variety of pre-cut wood, wooden dowel rods, medium-length nails (or glue), child-sized hammers (if using nails), screws, screwdrivers, safety goggles, and paint (optional).

If you have access to child-sized woodworking equipment and an adult to help children use it, invite children to design and build with wood. Most kindergarteners can hammer nails into pre-drilled holes. If nails and hammers are not possible, let children do some wood constructions using glue to hold parts together. (Many home improvement stores will donate unused pre-cut wood for classroom use.)

If you are unable to have open-ended woodworking projects, you might consider purchasing simple kits for building a birdhouse or dollhouse. If possible, divide the class into groups and have each group build their own house with the assistance of an adult. If you use one kit for the whole class, make sure there are enough steps involved to allow each child to do at least one assembly task. Conduct this project in your Building Center and rotate children through so that you or another adult can closely supervise the construction. Children may also enjoy painting the completed structures.

Connections

This activity connects with “Architecture Walk” and “Build Your Home.” Materials from “Marshmallow and Toothpick Constructions” can also be made available in the Building Center once that activity has been introduced.

Activity Strong Structures

Focus: Children discuss what features make a building strong and then test their theories.

Materials: A variety of building materials, chart paper, and a marker.

Setting: Class meeting. Later, children revisit and test their ideas in the block area or Building Center. Hold the meeting after children have had experience building with a variety of materials.

On a piece of chart paper, write the question “What makes a building strong?” and post it where everyone can see it. Read the question to the children. Ask them to consider what strong means in this context. Since there is no single correct answer, you will get many responses, such as how easy or hard a building is to wreck, how tall or big a building is, or how much weight a building can hold. Next, tell them to think about what kinds of things make their block buildings and other structures, including real buildings, strong.

TEACHER NOTE: You might want to give the class a minute or two of silence to think about this question before beginning the discussion. This type of waiting period encourages children to think before speaking. It also allows children who might need more time to process the question a chance to gather their thoughts.

As children share their ideas, explore with them what kinds of things they do to keep their buildings from falling and what makes their structures sturdy. If children seem “stuck” at any point, you could pose a few open-ended questions to spark discussion. (Does it matter what shape the building is? Are certain materials stronger than others? Does it matter how you put the blocks on?) During the discussion, record children’s theories about what makes buildings strong on the chart paper. Use a combination of sketches and words to capture their ideas. You might want to keep a separate list of features that make a structure weak.

Encourage children to listen carefully to each other and build on one another’s ideas. If children disagree, remind them to be respectful of each other’s ideas. Invite others to voice opinions and experiences that might shed more light or offer another perspective. Make it clear that the goal for this discussion is to think of and share ideas, not necessarily to come up with correct answers. Continue the discussion only as long as children seem engaged. The question of what makes a building strong could be discussed again with an expert if you make contact with an architect or other expert in the field as part of the “Visits and Visitors” activity.

To conclude the meeting, acknowledge children’s scientific thinking and interesting theories and tell them that later they can use blocks or other materials to test their ideas some more. Emphasize that proposing and testing ideas is one of the main things that scientists do, and that scientists often change their first ideas after they’ve had a chance to experiment further.

After the meeting, post the list of ideas in the block area or the Building Center. Help children explore and test these ideas as they build. Have them share their discoveries with the class, possibly through examples or demonstrations. Later, you might have a follow-up meeting to discuss what children have learned. Or, you might elect to have more informal revisiting of the topic through children’s periodic sharing and demonstrations.

Science Extension

Encourage children to look for examples of the features they think make buildings strong in pictures of real buildings and on the “Architecture Walk.”

Language Arts Extension

Retell or have the children act out the story of the Three Little Pigs. Discuss the different structures’ ability to withstand the wolf’s attempts to “blow the house down.” You might wish to pass around some straw, some sticks and a brick for the children to examine and consider. Do the children think the story is likely to be accurate as it relates to strong structures?

Connections

This activity connects with “Visits and Visitors,” “Architecture Walk,” “Marshmallow and Toothpick Constructions,” and “Building with Many Materials.”

Activity **Marshmallow and Toothpick Constructions**

Focus: Children learn about the relative strength of triangular and rectangular designs as they build structures with marshmallows and toothpicks.

Materials: Miniature marshmallows, toothpicks, small resealable plastic bags containing a starting allotment of materials for each child, and pieces of stiff cardboard to hold finished structures.

Setting: Class meeting to introduce activity. Then individuals, pairs, small groups, or the entire class construct structures. Later, have a follow-up discussion.

At a class meeting, show children some toothpicks and miniature marshmallows and explain that the class is going to design and make buildings with marshmallows and toothpicks. Tell them that they can use these materials to conduct experiments about what makes a structure strong. Ask for children's ideas about what they may be able to learn about building for strength.

Ask if anyone can show how to use the materials to make a triangle. Encourage children to try to use the materials to make a triangle, then a rectangle. If needed, demonstrate how to construct triangles and rectangles. Ask whether they think one shape is "stronger" and maintains its shape better than the other.

Take a few minutes to share some ideas, then invite the class to build structures and test their theories. Hand out an initial allotment of marshmallows and toothpicks to each child, and make additional marshmallows available as needed. Give children ample time to experiment with the materials independently or in small groups. As scientists, they will be trying to answer a question: Which shape makes stronger structures? Have a follow-up discussion to share results.

TEACHER NOTE: Children may be inclined to use the materials to make bugs, letters, or various flat shapes and structures. Circulate and help them focus on building upward to test the strength of various shapes for three-dimensional constructions.

Place the completed structures on pieces of stiff cardboard and let them dry for several days. (The structures get firmer and stronger as they dry.) After displaying the structures in the classroom for a while, send them home with the children. The buildings will have a better chance of making it home intact if they are loosely wrapped; better still, an adult can help transport them.

TEACHER NOTE: Marshmallows are tempting. You may wish to acknowledge this, yet set limits, by telling children they can eat five marshmallows (or some other predetermined number) while they are building.

Math Extension

This activity provides children with hands-on knowledge of the characteristics of several geometric shapes. To extend learning, encourage children to build other geometric shapes and solids.

During the activity, children can practice one to one counting when they count out a certain number to eat and when they take a specified amount of additional toothpicks and marshmallows each time they need to obtain more for their buildings.

Connections

This activity connects with "Building with Many Materials," "Architecture Walk," and "Strong Structures."

Activity Architecture Walk

Focus: Children take a walk outdoors to look for shapes, patterns, and other interesting features in neighborhood architecture. They consider the relationship between form and function in architecture.

Materials: Clipboards and pencils, pictures of buildings, and camera and film (optional). (If clipboards aren't available, use several half sheets of paper stapled to a piece of cardboard.)

Setting: Class meeting. Afterward, children, preferably in small groups, take a walk in the neighborhood around the school

Before starting out on your walk, talk with the class about the purpose of the architecture walk. You might want to introduce the term *architecture*. A simple definition of architecture is that it refers to the way buildings are designed and built. Tell the children that you want them to look very carefully at the architecture of some of the buildings that are right around the school. Encourage them to look for details about how the buildings are built that they may not have noticed before, even if they've seen the buildings many times. Point out that careful observation is an important part of science. Mention that the way a building looks and is built (its *form*) is often related to its *function* (what the building is used for).

Ask children if they have ever noticed that buildings contain many shapes and patterns. Show them a picture of a building and ask if anyone notices any shapes or patterns in its design or structure. Try to let everyone share at least one observation. Point out examples of two- and three-dimensional shapes if children do not offer them. You might want to repeat this exercise in front of the school at the beginning of the walk by asking children what shapes or patterns they notice on the school building. Model how to sketch and label some of these observations on your clipboard. Explain that you want to make a record to help you remember. Take photographs of what the class has observed if possible.

As you walk, stop frequently in front of a variety of buildings to allow children to make observations, share information, and make sketches. Engage the group in conversation about what they notice. Take advantage of opportunities to highlight shapes and patterns that are ornamental and those that have a structural function, such as pitched roofs with triangular shapes that let water roll off and rectangular bricks that stack easily. Invite children to share details about the buildings that interest them and to think about possible reasons for the features they notice. Talk with children about the relationship between form and function in the buildings or parts of buildings they observe.

Afterward, in the classroom, put out pictures of a variety of buildings and encourage children to study them for shapes, patterns and other interesting architectural features.

Variation

Some teachers have had the children conduct a scavenger hunt during the walk to look for particular architectural features or materials—such as a triangular roof and a flat roof, columns, arches, brick structures, wood structures, and stone structures. The *Eyewitness: Building* book is an excellent source of information for a scavenger hunt. See page 94 of the Science Library section for bibliographic information about this book.

Language Arts Extension

Compile children's sketches (with accompanying labels), as well as any photographs you have taken, into a book or photo album about neighborhood architecture.

Math Extension

As you walk around school, encourage children to look for rectangles, circles, triangles, and other geometric shapes that they see. Which shape appears most frequently? You might make a list and count to compare. Why might this be?

Connections

This activity connects with "Strong Structures" and "Marshmallow and Toothpick Constructions."