Shapes in History

GRADES:
3 - 8

DURATION:
Varies depending on the age group/grade, and the number of activities done.

LEARNING OBJECTIVES:
- Children will identify shapes and understand their architectural properties.
- Children will explore historical buildings locally and globally.
- Children will be introduced to the Engineering Design Process with a hands-on activity.
- Children will create charts.
- Children will develop their research, analysis and reporting skills.

MATERIALS:
For each child or group:
- Access to internet or other research sources
- Digital access to or printed copy of TeachEngineering's History and Testing Shapes of Strength for Buildings lesson plan
- 10 sheets of paper
- Masking tape
- 20 drinking straws
- 20 paper clips
- 2-3 hard cover books (or any other heavy objects with a flat surface)
- Ruler
- Scissors
- Worksheet
- Pen or pencil

For testing and demonstration:
- Small scale
- 7 popsicle sticks (optional for demonstration)
- 7 brads or brass fasteners (optional for demonstration)

BACKGROUND INFORMATION:
For Children
When looking at constructions both new and ancient, we can identify different shapes like circles, rectangles, triangles, ovals, cones, squares, hexagons, among others. Sometime the choices of shape are purely aesthetical or they are a reflection of cultural preferences. Other times, shapes are chosen for practical reasons. It is easier to build a square building than a hexagon building, for example. Another thing to consider is that a shape might be "stronger" or more stable than others.

This design challenge activity will give us the opportunity to test different shapes and figure out which ones are "stronger". To do so, you need to know what the Engineering Design Process is, which consists of a series of steps that guide engineering teams as they solve problems. There are many visual representations of the process like this one at NASA's website or this one from The Ohio State University. We have created a simplified one for you below. Basically, all challenges start with a problem. To solve that problem, teams brainstorm (ideation) to create solutions, then they create prototypes of their solution, test it, go back to their design and improve it. The steps of the process are repeated as many times as needed, making improvements along the way as engineers find failures and uncover new design possibilities.

ACTIVITY OUTLINE:

1. Talk to your child about shapes in architecture and the Engineering Design Process, or have them read the background information on their own (refer to Background Information above). Next, visit Ohio Memory and look for images of historical buildings (here's a sample search to help you along). As children look over the images, ask them to identify the shapes of the buildings from walls to roof, floor to ceiling, doors and windows, etc. Now let them search for other historical buildings, and have them look for the use of shapes in each one. Suggested buildings are listed below, but the possibilities are endless!

    - Parthenon (Greece)
    - Machu Picchu (Peru)
    - Kornak Sun Temple (India)
    - Great Mosque of Djenne (Mali)
    - Tikal (Guatemala)
    - Colosseum (Italy)
    - Notre Dame Cathedral (France)
    - Prague Castle (Czech Republic)
    - Dancing House (Czech Republic)
    - Buddhist Temple of Hōryū-ji (Japan)

2. Have your child look at TeachEngineering's History and Testing Shapes of Strength for Buildings lesson plan, and follow the steps in the lesson. Children will create their own structure to support the weight of three large books (or any other heavier objects with a flat surface). Here are some tips for running this activity:
    - Make sure your child follows the rules! Every engineering challenge has its constrictions (the amount of material you can use, the maximum size of the prototype, etc.). Overcoming these limitations is a great part of the challenge.
    - During the ideation step (brainstorming), make sure your child shares their ideas and solutions. If working with multiple children, each can build their own prototype, but the exchange of ideas can be done as a group. You can also act as the brainstorming partner, but be sure to let the child do most of the reasoning and make most of the decisions on how to approach their prototype. You can help them better understand the problem, but they should take the lead on the solution.
    - Each time your child finishes their prototype (or think they finish it), let them test how much weight it can hold, and complete a table (they can use the provided worksheet if desired).
    - You can make the activity more challenging by increasing the amount of weight for testing or decreasing the amount of supplies for prototype creation.
    - If working with multiple children, have them create more than one design and compare with them (as proposed by the lesson plan). If working with one child, have them create multiple designs and so they have enough data to make a chart that compare the prototypes' results.
    - Children in grades 3 - 5 may need extra help with construction, data recording and chart creation.

3. Using the collected data, help your child understand the table they created, and decide how they will represent the data in charts. They can use one of the templates in the worksheet or create their own.
    - Tip: If they already know how to work with Microsoft Excel or similar computer programs, they can transfer the data to them and create the graphs digitally. If they are not familiar with it, but you are, use this opportunity to teach them how. View this video for the basics of how to create graphs and charts, or let your child research how to do this on their own.

4. Now, children can report on their results. Which shape seems stronger? Why? What are the most common shapes in historical buildings? Is that an indication of how strong the shapes are? Let children express their conclusions with an essay, presentation or video. If using a visual format, children can take pictures of their prototypes or videotape the process of creation to add it to their final report.

ONE MORE THING:

Let us know how it went! Tag us on social media or email us at education@ohiohistory.org.

Shapes in History Worksheet

Your name: _____

Collect your data. If you are doing this activity with other kids and comparing your prototypes, use the first Table. If you are doing this activity by yourself, use the second Table.

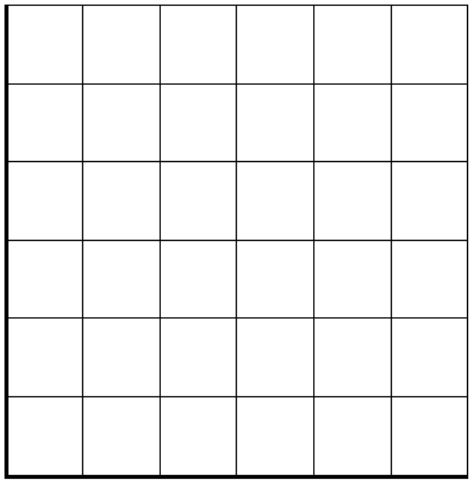
Name of creators of prototype	First test (measured in ounces, pounds, grams or kilograms)	Second test (measured in ounces, pounds, grams or kilograms)

Prototype	First test (measured in ounces, pounds, grams or kilograms)	Second test (measured in ounces, pounds, grams or kilograms)
1		
2		
3		

Can you represent some of these data in graphs or charts? Check out this video if you need to learn how to make them.

1. Choose the type of graph that best represents your type of data.
2. Create your own, or use one of the templates below.

Title: _____



Title: _____