FAMILY ACTIVITY: Paper Column Challenge

In this activity, youth will learn about the ancient engineering innovation of using columns to support buildings. Youth will experiment with engineering by building prototypes of columns out of paper, and then testing the strength of their structures by placing something weight on top. In this activity, youth will be facilitated to think creatively and to engage with an abbreviated engineering design process.

Columns are something we take for granted, but a long time ago, they were an exciting technological innovation that helped humans build bigger, sturdier buildings. In Greece and other ancient civilizations in the Mediterranean region, using columns meant that people could build bigger spaces to worship their gods, bring people together, and demonstrate their political power. In more modern times, architects and engineers have built buildings with columns inspired by Ancient Greece, both because Greek-style columns are functional and because they are used as symbols of what some people have seen as an inspirational ancient culture.

MATERIALS AND INSTRUCTIONS

Materials

- Computer paper - 3 sheets minimum
- Tape
- Several hardback books or other flat weights to test the strength of columns

Instructions

1. ASK Do you know what a column is, on a building?
   - Columns can also be called pillars.
2. ASK Where do we see columns?
   - On buildings, outside and inside.
3. ASK What do columns do?
   - Columns work to hold up heavy buildings by helping transmit the weight of a load (like a roof) to the structural elements below.
   - Varying the shape, density, amount, and arrangement of columns will influence their strength.
   - This principle can be explained by telling or showing that if you stand on your own, you can only hold so much weight, but the more people who help you carry something, the more weight you can carry.
4. EXPLAIN that humans started to use columns thousands of years ago, and it helped them build much bigger buildings than they could before! Ancient Greece is one place that became famous for its columns, and they’re still copied on buildings today.
5. DEMONSTRATE acting out three of the most most famous styles of columns: doric, ionic, and corinthian.
   a. DORIC is the simplest style. Stand up straight with your feet together and hands to your sides.
   b. IONIC gets a little fancier. It looks like there are scrolls of paper at the top. Pull your
hands up your sides to your armpits, so that it looks like your arms are making circles.

c. CORINTHIAN looks the fanciest, with plants and other designs coming out of the top. Stretch your arms high above your head and stick your hands outwards.

6. INSTRUCT youth to act out the three types of columns, mixing or speeding up your prompts.

7. EXPLAIN that they're going to make prototypes, or tests, of columns and see how much weight they can hold. Columns will be made out of paper in three different shapes: CIRCLE, TRIANGLE, and RECTANGLE.

8. SHOW an example of a paper column or demonstrate how to make one.
   a. Roll or fold the paper, lengthwise, to create tubes of different shapes.
   b. Tape the columns to secure them.

9. ASK Which shape do you think will be the strongest?

10. ASK Do you think paper columns will be able to support a heavy weight?

11. CREATE a paper column in each different shape.

12. TEST the strength of the paper columns by stacking a book on one column at a time. Stack as many books/magazines as the columns can hold.

13. ASK Remember, we predicted that ___-shaped columns would be the strongest - do we think that was true? Why do you think?
   
   • Overall, circle columns (cylinders) should support the most weight, because weight is distributed evenly around the edges. Rectangular and triangular columns tend to buckle because the weight is more concentrated on the corners and edges.

14. TEST more variations of column shape, width, and amount!

QUESTIONS TO EXPLORE

1. What is something you learned during this activity?

2. What were some challenges you faced while doing this activity?

3. What are you proud of in your design?

IDEAS TO INCLUDE YOUNGER SIBLINGS! (ADAPTATIONS FOR 0-5 YEAR OLDS)

- Engage preschoolers by adding familiar buildings to your opening discussion. Consider where they may have seen columns before (such as Chicago’s Field Museum). Connecting this experience to their real lives will help them engage. Demonstrate the acting out part by describing how your movements are different for each column in order to include them - or ask them to watch carefully to see how your movements are different before they begin to try and imitate you.
- Hands on support in making the columns of different shapes will likely be needed in order to make each one truly distinct.
- Little ones will enjoy predicting which type of column is strongest.
- Infants and toddlers love building towers and knocking them down (try counting to 3 first). Invite them to play alongside with blocks made of different materials if you have them - empty boxes, paper towel and toilet paper rolls will do nicely, too - and make less noise when they fall down. Make sure as you share attention with them that you talk about the different shapes and other characteristics of the blocks (or other materials) they use as they build.
REFERENCES, MODIFICATIONS, & EXTENSIONS

Modifications

- The target ages for this activity are 7+, but it can be done with younger youth with adult or older youth support.
- COLLABORATE - Youth can do this activity with siblings or adults.

Extensions

- Point out columns on buildings that can be seen safely from home (virtually or in person).
- Learn more about architecture and engineering principles.
- Learn more about histories of architecture and buildings.
- Learn more about the structures of buildings they know.
- Watch a quick video about classical Greek columns by #MetKids.