

**Think
like an Engineer****First Grade**

Tower Build

**Objectives**

Identify visual-spatial and problem-solving strengths

Materials

toothpicks	tower pictures
gumdrops	flexible shapes
paper & pencil	birds
	measuring tape

Time

40 to 45 minutes

Whole Group Gathered (10 minutes)

Introduce the first 5 vocabulary words, using included craft stick shapes to illustrate the concepts. Show the various polygons, and explain that structural engineers use these to build things, from space stations to cars. Demonstrate compression and racking, and then ask the students how to prevent racking in the square, pentagon and hexagon. (Cross-braces break down the inside of a polygon into triangles, which is the strongest polygon, since it resists compression and racking.) Show the use of cross-braces.

Show pictures of towers with visible structural detail—radio tower, Eiffel Tower, etc. Ask the group to identify the shapes that make up the tower. Now, talk about the foundation of the tower, showing examples of the height and the size of the base, using the craft stick demo shapes. Next, explain the materials they will be using, and invite them to create towers that will support the weight of a bird on the very top. The goal is to make the tallest tower possible that will also support the bird.

Pairs (20 minutes)

Give each group a set of 48 toothpicks and 24 gumdrops, a piece of paper and a pencil. Circulate during building time, asking open ended questions about the design. Reminders about the goal are allowed, but remember not to give design tips. Students can be encouraged to tweak their designs. Pairs may test structures with birds as they work.

Circulate -- test each tower by measuring the height and then placing the bird on the top to see if the tower can hold the weight. The bird can be clipped or balanced.

Closure (5 minutes)

Look at the towers. Which were the most successful, and why? What are some ideas for future attempts? Explain that building design includes many such attempts, including drawing, building scale models and then prototypes, testing, and starting over using what you've learned. Things that don't work are more valuable in engineering because we learn more. Great start, Engineers!

Vocabulary~

Structural Engineering ~ a branch of civil engineering dealing primarily with the design and construction of structures (such as bridges and buildings.)

Polygon ~ n. a shape that has 3 or more sides

Compression ~ n. pressing together, forcing into less space

Racking ~ n. The distortion of a rectangular shape to a skewed parallelogram

Cross-brace ~ n. crosspiece that transmits, diverts, or resists weight or pressure

Rise ~ n. height of a structure, including high-rise, low-rise and medium rise

Foundation ~ n. basis on which something stands or is supported

Blueprint ~ n. a detailed plan of how to build something