

Lesson Title: Building Structures

Lesson Overview:

Students choose from a variety of materials and shapes to discover which shapes will provide for the strongest structures. Teachers may wish to set certain criteria and constraints, such as structures must be at least 2 inches tall or students can only use 20 connecting pieces.

Topic(s): Engineering

Grade or Grade Band: 3rd – 4th grade

Lesson Objectives:

1. Evaluate which materials work best to support weight when building a structure
2. Design a structure to hold as much weight as possible

Next Generation Science Standards: 3-ET1-2 & 3: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem

North Dakota Standards: 4-ET1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Time Needed (estimate): 3 – 30 minute periods

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Preparation/Materials

Background knowledge students must have to be successful:

Students will continue to develop their engineering skills by brainstorming, testing materials, designing and redesigning. Students should be reassured that discovering both successes and failures is an important part of the engineering design process.

Differentiation and accommodation to support learning for all students:

Provide a partner for students who need assistance with recording data or building their **structures**

Essential terminology:

- **Structure**-a building with a roof and walls, such as a house, school, or store
- **Dimensions**-the measurement of length, width, or height of an object

Resources: <https://youtu.be/dWyJ1Dxrl68>

Materials needed:

- Toothpicks
- Straws
- Noodles
- Skewers
- Marshmallows
- dots candy
- gum drops
- licorice bites
- paper bowls
- pennies

Procedure/Activities

Engage:

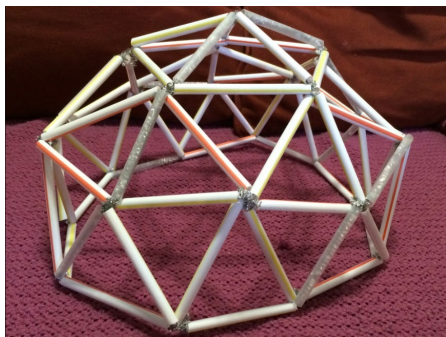
Scroll through the pictures on an architecture website such as: <https://www.yellowtrace.com.au/triangles-in-architecture/>. Ask students to name the different shapes they see in the buildings: squares, rectangles, triangles, rhombuses or diamonds. Ask the students “Do you think some shapes can be stronger than other shapes when constructing a building?” Allow students time to discuss with a partner or small group how a shape might affect the strength of a building. Tell students that they will be conducting tests to see how much weight structures can hold using different shapes.

Explore:

Allow students to select their building materials based on the items you have supplied. Each person or small group should have a material to use as support beams: toothpicks, straws, noodles or skewers and a material to use as a connector piece: marshmallows, dots candy, gum drops or licorice bites. Encourage groups to use any combination of the material types.

Encourage students to build structures using just the shape on the Building Structures Recording Sheet. Students should record the length of each side of their shape and then use shapes with the same dimensions throughout their structure. Once the structure is built, place a paper bowl on top of the structure and count how many pennies the structure can hold until it collapses. Repeat this process for each of the shapes listed on the recording sheet.

Example of a structure only using triangles.



(Bell)

Explain:

Once students have constructed and tested all their structures, engage the class in a discussion about the similarities and differences of their structures and any factors that may affect the strength of the structures. After the discussion, allow students to design and build a structure they believe will hold the greatest number of pennies.

Test the structures and again discuss what factors made them the strongest.

Extensions for learning more about this topic:

Teachers may wish to set certain criteria and constraints, such as structures must be at least 2 inches tall, or students can only use 20 connecting pieces.

Math- Angle measurements, faces, vertices, and edges of 3D shapes

Social Studies- Research the economic and geographic aspects that impact how structures are built in ND.

Evaluation of learning:

- Class discussions
- Structure building recording sheet





Additional Lesson Resources / Materials

References:

Bell, Danna. "Using Historic Drawings and Photos of Buildings to Engage Students in Engineering." *Using Historic Drawings and Photos of Buildings to Engage Students In Engineering | Teaching with the Library of Congress*, Library of Congress, 26 Jan. 2016, <https://blogs.loc.gov/teachers/2016/01/using-historic-drawings-and-photos-of-buildings-to-engage-students-in-engineering/>.

Building Structures Recording Sheet

Name: _____

Shape	Length of each side	Number of Pennies held
 Square		
 Triangle		
 Rhombus		
 Pentagon		

Which shape helped to produce the strongest structure? _____

Compare your results to others. List the similarities and differences of your structures in the table below.

Similarities	Differences

Everyone was allowed to choose their own building material. Did the building materials affect the strength of the structure? Support your answer with examples.

Are there any other factors that may have affected the strength of your structures?