STEM in the lab

Inspiring Idaho's future STEM workforce

INDEX CARD TOWER

GRADE LEVELS

This activity is appropriate for grades 2-4.

MISSION

Build a tower out of index cards strong enough to hold a cup of Skittles.

VOCABULARY

ENGINEER: A person who designs, builds or maintains engines, machines or public works.

ENGINEERING DESIGN PROCESS: A series of steps that guides engineering teams to solve problems. The design process is iterative, meaning that we repeat the steps as many times as needed, making improvements along the way as we learn from failure and uncover new design possibilities to arrive at solutions.

ENGINEERING DESIGN PROCESS STEPS: Ask, imagine, plan, create and improve.

MATERIALS

To complete one tower:

- Pack of 4 x 6 index cards
- Roll of masking tape
- 9 oz plastic cup
- Bag of Skittles
- Yard stick

ABOUT THIS ACTIVITY

Engineers at Idaho National Laboratory work every day to change the world's energy future and secure our nation's critical infrastructure. Nuclear, electrical, mechanical, chemical and environmental engineering are just a few of the engineering careers found at INL. Even though these jobs have very different focuses, all engineers use the engineering design process.

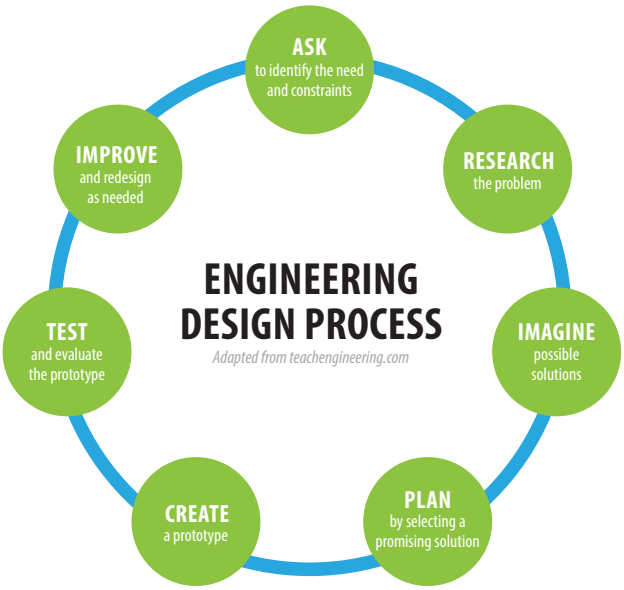
It's never too early to start thinking like an engineer. Using the engineering design process, students will build an index card tower that will be able to hold a cup full of Skittles.

INSTRUCTIONS

Divide students into small groups. Explain to students that they will be using the engineering design process to build an index card tower designed to hold the weight of a cup of Skittles.

1 ASK:

Give each group an index card and 1 Skittle. Have students make a prediction of how many Skittles (in a cup) the index card could hold.



2 IMAGINE:

Have the students think about ways they could change the card to make it stronger. If students are stuck, have them try folding their card into different columns (circular, triangular, square etc.) or make an accordion shape with the card. How do the different shapes change how much weight the card can hold?

3 PLAN:

On a piece of paper, have every student sketch an idea about what their index tower will look like. The goal is to not only have the tallest tower, but the strongest tower. When every team member has a sketch or written plan, each team member will show the drawing or plan to other team member and talk about his or her idea. After looking at all the designs, the team will decide what to do. This procedure ensures that every student has a voice in the design. A student may not have his or her idea used, but they have at least had a chance to be part of this process.

4 CREATE:

Each group will receive 100 index cards and 2 feet of masking tape. Using the supplies provided, students work together to build their tower. The index cards may be cut into pieces and reassembled as desired. Tape is to be used to fasten parts of the tower together. It may not be used to attach the tower to the floor or any other object. Tape may not be used to extend the height of the tower. After the tower is built, the cup holding the skittles must be placed at the top. Each group will receive one full cup of Skittles to practice with. Remind students that the Skittles are tools, not food to eat. No other materials can be added. The tower must be freestanding. A tower shall be declared free-standing if it remains self-supporting for more than 10 seconds. Students have 30 minutes to build their tower.

5 IMPROVE:

After the time limit, have students use a yard stick to measure how tall their tower is. Height is determined by measuring the distance from the base of the tower to the highest point of the tower/cup. Have each team record the height of their tower on a piece of paper. Starting with one cup of Skittles, either subtract or add more cups of Skittles as needed to determine how much weight each tower will hold. The average weight of a Skittle is 1.1 gram, so have students count the number of Skittles in each cup to determine how much weight their tower will hold. Have students write down the number of Skittles that their tower was able to support. Show all groups which tower was the strongest. Have groups compare their tower to the "strongest" tower, then brainstorm how they could improve their tower.

EXTENSIONS

» Instead of Skittles, try heavier objects, like marbles.

» Try different sizes paper to see which paper will hold the heaviest weight.

» Using paper build a stool strong enough for a person to sit on.

RESOURCES

» Engineering Design Process
https://www.teachengineering.org/populartopics/designprocess

» Index Card Structure Challenge
https://www.crscience.org/pdf/IndexCardStructures.pdf

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For information on grants, training and student opportunities, curriculum ideas and other resources, please visit ***stem.inl.gov.***