Spaghetti Skyscrapers

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#MAETskyscrapers

Learning Objective
Students will learn about the design process and engineering principles (including trusses and cross braces) using spaghetti and marshmallows.

Essential Question:

- How can I create a tall and stable structure out of spaghetti and marshmallows? (remixed from Dorothy Hains Elementary Straw Tower Challenge)

Making Objective
Using the design process, participants will be able to build, evaluate and rebuild as often as they like to improve their structure. The focus will be on process, not on product.

Rationale
This activity focuses on problem solving, using engineering concepts and the design process to make a tower. The constraints are:

- Use only spaghetti and marshmallows.
- The base of the tower must fit on the template that is marked out on the table.
- The tower must be able to stand on its own.

According to the theory of constructivism, students construct new knowledge based on prior knowledge, either through direct instruction, or through inquiry-based learning ("Constructivism," 2016). In other words, when learners hear, see, or try something, they build new knowledge on prior knowledge.

Participants are encouraged to build independently (alone or with a partner). If they get stuck or appear to struggle, ask some guiding questions or provide a little guidance to help them along. According to Bransford, Brown, & Cocking (2000), after a period of active struggle, learners are ready for teaching by telling. Try to avoid telling too much, though.

Materials

- small marshmallows
- spaghetti
- tape measures - 1 per assistant
- 1 roll masking tape
- bins for supplies - 2 per table
- table placards - 2 per table
- 3 tables
- 1 computer

Example Table Placard

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The Challenge

Architecture firm Skidmore, Owings & Merrill (builder of the Burj Khalifa in Dubai), is looking for engineers for their newest skyscraper project. They've decided to hire three people, and will make their choice based on who creates the tallest of each model: the triangle tower, the rectangle tower, and the square tower. Using the supplies provided, build the tallest possible freestanding tower that you can. If you manage to hold first place by the end of the Faire, you might very well find yourself with a new job!

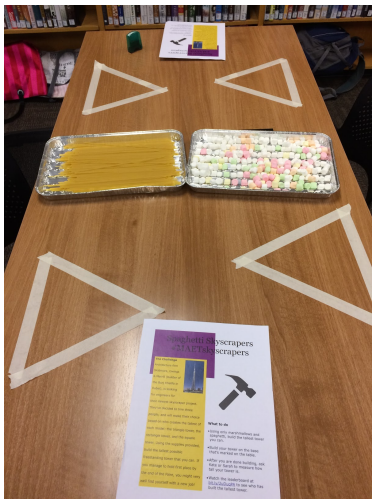
What to do

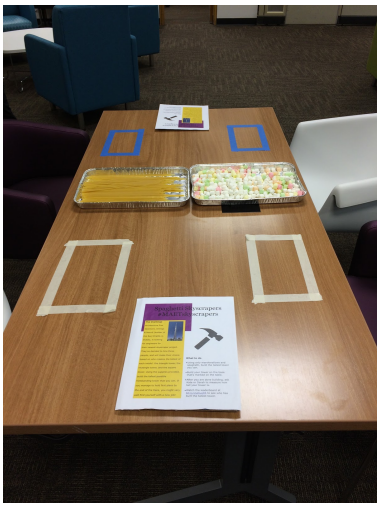
- Using only marshmallows and spaghetti, build the tallest tower you can.
- Build your tower on the base that's marked on the table.
- After you are done building, ask Kate or Sarah to measure how tall your tower is.
- Watch the leaderboard at bit.ly/2uDuqPA to see who has built the tallest tower.

Set Up

1. Find and/or buy all materials
2. Using masking tape, outline your shapes on the table(s) you are using. Feel free to mix and match your shapes across tables, or keep similar shapes on each table.
3. Place 1 container of marshmallows and 1 container of spaghetti on each table.
4. If cleanliness is a concern, cover floor below tables with dropcloth or cardboard.
5. Set up a leaderboard (if desired) using Google Sheets or similar.
6. Execute the lesson. (see 'Lesson Outline' below)
7. As students finish their towers, add their names (or initials) and heights to the appropriate spot on the leaderboard (if desired).

Photos of Setup





Lesson Outline

- As people arrive for the activity, say:
    - *Your challenge is to build a tower as tall as possible that can stand on its own, using the base shape provided. There is no time limit.*
- As people are working, if they are struggling and stuck (which often happens when there is not a cross brace, and the tower is tipping over), say:
    - *I see your tower is tipping. Is there anything you could do to make it stronger, more stable?* (At this point, you might guide them toward considering a cross brace.)
- When people first say they are finished, say something like:
    - *Okay, I'm happy to measure how tall that is. Are you sure you don't want to try to build it taller? If you like, I can measure it now, and you can keep trying to build it taller.*
- When people say they are finished, ask:
    - *How did you use the materials?*
    - *What did you do well?*
    - *If you built another tower, what would you do differently?*

Other Helpful Information

Resources for poster ideas, objectives, etc.

Destination Imagination, North Dakota
Dorothy Hains Elementary
TinkerLAB

References

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school: Expanded edition*. Washington, DC: National Academy Press.

Constructivism. (2016, September 08). Retrieved from https://www.learning-theories.com/constructivism.html