Edible Destruction

Activity Guide

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Science-Technology Activities & Resources For Libraries

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October 2017

This material is based upon work supported by the National Science Foundation under Grant No. DRL-1657593.
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Edible Destruction

Activity Time

This activity is flexible and open-ended; it can be done in 15 minutes but children can take up to 30 minutes, if desired.

Intended Audience

Families or other mixed-age groups, including children as young as 3 years old *with assistance from an older child, teen, or adult*
School-aged children
Tweens

Type of Program

- ☑ **Facilitated hands-on experience**
- ☑ **Station, presented in combination with related activities**
- ☐ Passive program (if instructions are provided at the start of the course)
- ☐ Demonstration by facilitator

Overview

Participants use snack foods in an engineering design challenge to create simple structures (6" or taller) and test – and refine – the structure's ability to withstand "earthquakes."

Recommendation: This activity incorporates food as a way to engage learners. Similar activities use straws and other inedible materials, but will likely end up in the landfill after the program. Inform participants about all of the ingredients that will be used.

Key Concepts

- When designing structures, certain shapes (e.g., triangles and "x"-shaped supports) withstand earthquake-type motions better than others.
- Children, like engineers, can improve their designs through the creative process of thinking, building, testing . . . and doing it again!

Materials

For a group of 20 children and their caregivers:

☐ Hand sanitzer (wipes or gel)

☐ 2-3 shake tables, each constructed from:
- ☐ 2 (8 ½" x 11" or larger) pieces of sturdy cardboard
- ☐ 2 thick rubber bands
- ☐ 4 tennis balls
- ☐ 1 ruler or paint stirrer
- ☐ Masking tape

☐ 1 additional ruler

See these activity guides for materials and instructions on how to make a variety of shake tables:

Seismic Shake-up
http://www.discovere.org/sites/default/files/DSG_SeismicShake.pdf

Build an Earthquake-Resistant Structure
http://www.discovere.org/our-activities/single-activity-detail/Build%20an%20Earthquake-Resistant%20Structure

Shaky Scraper
https://www.discovere.org/sites/default/files/Star%20Scraper_0.pdf

Dream Big Design Challenge Exhibit: Shake Table
http://discovere.org/sites/default/files/Shake%20Table%20%20DCE_022117.pdf

Shake tables may also be purchased on websites such as Amazon.com.

Technology:

☐ Optional: phone or tablet with accelerometer app installed

For example, the free Physics Toolbox Linear Accelerometer app, by Vieyra Software, can be used to measure the movement of the shake table. The app plots the movement of the device as acceleration over time: https://www.vieyrasoftware.net/physics-toolbox-accelerometer

Materials (continued)

Foundation and Walls:

- ☐ 20 paper plates
- ☐ 4 (14.4 oz. or larger) boxes of graham crackers

Optional: other fun options for foundation walls:

- ☐ 20 rice crispy bars
- ☐ 20 Kit Kat™ bars
- ☐ 20 (10-pack) boxes of Fruit Roll Up™ snacks

Adhesives / Connectors:

- ☐ 1 bag of mini marshmallows

Optional: other fun options for adhesives / connectors:

- ☐ 2 lbs. of cubed cheese (any firm variety)
- ☐ 2 lbs. apples, cut into small chunks
- ☐ 2 cans of liquid cheese
- ☐ 1 lb. cucumbers, cut into small chunks
- ☐ 1 bag of jumbo sized marshmallows
- ☐ 2 or more bags of soft candy, such as Tootsie Rolls, gum drops
- ☐ 5 (7 oz. or larger) icing pouches
- ☐ 1 (16 oz. or larger) jar of creamy peanut butter and plastic knives

Structural Supports:

- ☐ 2 (12 oz. or larger) bags of pretzel sticks and/or pretzel rods

Optional: other fun options for structural supports:

- ☐ 2 (12 count or larger) boxes of ice cream cups
- ☐ 1 lb. celery stalks, cut into 3" segments
- ☐ 1 (1 lb.) box of uncooked spaghetti
- ☐ 1 container of hard peppermint sticks
- ☐ 1 (100 count or larger) box of coffee stirrers (wooden and/or plastic)

Preparation

- Construct a shake table (~10 minutes).
  - Wrap rubber bands around two pieces of cardboard.
  - Insert four tennis balls in between the pieces of cardboard, placing one ball in each corner.
  - Using tape, attach a ruler or paint stirrer to the underside of the top piece of cardboard.
  - Build an example structure and test it on the shake table.
  - Set up separate areas for building and for testing structures on the shake tables.
- Optional: Place a phone or tablet with an accelerometer app on the shake table. Test that moving the shake table results in a reading of five meters/second or faster.

Activity

1. Opening Discussion: Share ideas and knowledge.

- Introduce yourself. Help the participants learn each other's names (if they don't already know each other).
- Frame the activity with the main message: Makers and engineers — like the participants — can improve their designs through the creative process of thinking, building, testing . . . and doing it again!
- Set the stage for the activity by exploring video clips and online animations that demonstrate how earthquakes damage structures and how engineers are working to create safer structures.
- Brainstorm ideas for designing safer structures.

As much as possible, encourage the participants to share their own thoughts and experiences, and to respond to each other's questions throughout this activity. Responses could include:

- That's a great question! Does anyone have an answer?
- Interesting what do the rest of you think about what _____ said?
- What do you think would happen if we tried that?

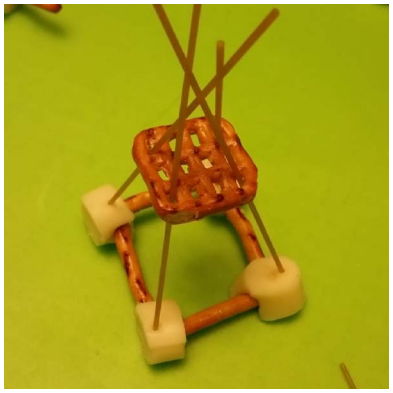
This discussion will help participants focus on the elements they must ensure are included in the design of their structures. Let them lead as much as possible.

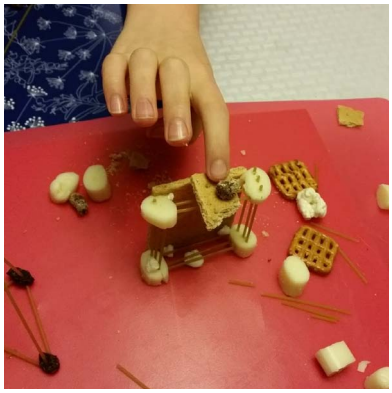
Try holding this discussion in a circle and using a "yes, and…" style of facilitation. Begin with one person sharing an idea. The next person says, "yes, and…" and adds their own idea to the first. The process continues until everyone in the circle has contributed an idea toward designed a solution.

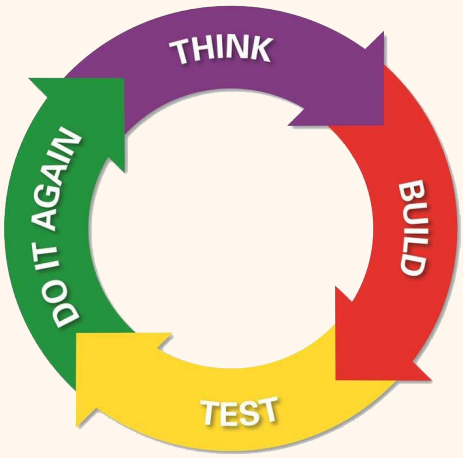
Activity (continued)

2. Design Challenge: Invite the participants to design, build, and iteratively test a model of a structure – 6" or more in height – and test it on the shake table.

- Describe the types of snack foods that are available for them to use. Encourage groups to use the engineering design process, where they methodically improve one aspect of their component at a time.
- Demonstrate how easily square-shaped structures collapse compared with triangles and "x"-shaped supports.
- Optional: During testing on the shake table, use the app to measure the movement of the "earthquake." Challenge the participants to shake their structures at least 5 meters/second or faster.







Guide the participants through the engineering design process as they work. Adjusting and retesting their ideas is the best way to experience the ongoing work of an engineer! As time allows, emphasize this stage of the engineering design process as much as possible. They will be rewarded by seeing improvement.

Reassure the participants that there isn't a "right" answer that they must arrive at on the first try. Furthermore, failure is an essential part of figuring out what works and what doesn't. It is OK to fail — and try again . . . and again . . . and again!

3. Conclude.

Optional: Have each participant describe their structure — as well as their challenges and successes in the engineering design process — to the audience. Eat and enjoy!

Next Generation of Science Standards

Assessment Standard

Engineering Design

Students who demonstrate understanding can:

- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Structure and Properties of Matter

Students who demonstrate understanding can:

- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.

ESS3.A Natural Resources

- Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

ESS3.B Natural Hazards

- A variety of hazards result from natural processes; humans cannot eliminate hazards but can reduce their impacts.

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B: Developing Possible Solutions

- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Next Generation of Science Standards (continued)

Science and Engineering Practices

Asking Questions and Defining Problems

- Define a simple problem that can be solved through the development of a new or improved object or tool.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Developing and Using Models

- Develop a simple model based on evidence to represent a proposed object or tool.

Using Mathematics and Computational Thinking

- Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

References

This activity builds on ideas and materials from Seismic Shake-up (http://www.discovere.org/sites/default/files/DSG_SeismicShake.pdf) and adapts the "Pass the Buck" discussion strategy from Build It Better! (https://www.teachengineering.org/activities/view/cub_natdis_lesson08_activity4).

NGSS Lead States (2013). Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.