



Classroom Teacher Preparation

Engineering 4: Engineering Redesign (with Legos!)

Please use the following to prepare for the next SfS lesson.

Description:

This lesson focuses on the redesign step of the engineering and design process. Students will begin with a flawed prototype bookshelf made of Legos that must be redesigned based on certain constraints. Students will critique the bookcase, design and build a new prototype, and then present it to the class by testing it in a model hallway.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

3rd-8th

- Evaluate a prototype with design flaws
- Redesign, test, and present a prototype to the class for critique

Disciplinary Core Idea (DCI)

ETS1 Engineering Design - ETS1.C Optimizing the Design Solution

- (3rd-5th) Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
- (6th-8th) Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design.

Science & Engineering Practice (SEP)

Constructing Explanations and Designing Solutions

- (3rd-5th) Use evidence (e.g., measurements, observations, patterns) to ... design a solution to a problem.
- (6th-8th) Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

Crosscutting Concept (CCC)

Structure and Function

- (3rd-5th) Different materials have different substructures, which can sometimes be observed. Substructures have shapes and parts that serve functions.
- (6th-8th) Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

Preparation:

Students should be familiar with the following vocabulary:

- **Constraint** – a limiting factor to consider when designing a solution
- **Prototype** – the first model of something from which other forms are developed or copied



Room Set Up for Activities:

Students will work in groups of 3-4; with a maximum of 8 groups.

Desktops, tables, and/or floor space will be required for this lesson.

Safety:

There are no safety concerns for this lesson.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Engineering**. Modules include:

Engineering 2: Rover Restraint - This module gives students a hands-on, team-oriented introduction to engineering within the context of space exploration. They learn about NASA's Mars rovers as examples of the challenges engineers face in balancing competing goals, while creating a lander for a mock rover to be tested in an egg drop.

E03: (Re)-Building a Bridge – Students design, build, and test prototype bridges that can transport a defined number of people, modeled by weights. During testing, they identify the failure points of their models and use these data to improve their designs, rebuild, and retest.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state:

www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by asking students to create a table made out of paper.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

WGBH Videos and Activities: The PBS educational site is a great, **free** resource for educators but you must create an account to use the materials. The first time you log in to the PBS Learning Media website you will be asked to create an account and provide an email and password. Once you have logged in, select “keep me logged in” to avoid having to repeat the process.

- Find out how to build a slider that climbs along strings. Experiment with the design process and friction in this activity from Design Squad Nation.

<https://mass.pbslearningmedia.org/resource/arct14.sci.dstgrab/treasure-grab/#.WhDv5rbMyXQ>