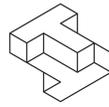


# Seed Dispersal

Design Challenge Learning



**The Tech**  
Museum of Innovation

201 S. Market St.  
San Jose, CA 95113  
1-408-294-8324  
thetech.org

Students will design, create, and test a structure for a wind dispersed seed. As they iterate through this design challenge, they gain firsthand experience in the design process.

## Grades 3-8

**Estimated time: 45 minutes**

### **Student Outcomes:**

1. Students will be able to design and build a structure for a wind dispersed seed.
2. Students will be able to discuss design considerations based on their knowledge of the complementary nature of structure and function.
3. Students will be able to utilize the three step design process to meet an engineering challenge.

#### **Next Generation Science Standards**

**Grade 3-5:** *Engineering Design* 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3

**Grade 3:** *Life Science* 3-LS1-1

**Grade 4:** *Life Science* 4-LS1-1

**Grade 6-8:** *Engineering Design* MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4

**Grade 6:** *Life Science* MS-LS1-4

#### **Common Core Language Arts-Speaking and Listening**

**Grade 3:** SL.3.1b-d, SL.3.3, SL.3.4a

**Grade 4:** SL.4.1b-d, SL.4.4a

**Grade 5:** SL.5.1b-d, SL.5.4

**Grade 6:** SL.6.1b-d

**Grade 7:** SL.7.1b-d

**Grade 8:** SL.8.1b-d

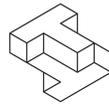
### **Vocabulary:**

*Familiarity with these terms and concepts will enhance students' experience in the activity*

- **Cotyledon:** Main part of the embryo within a seed of a plant. Upon germination, it becomes the embryonic first leaves of a seedling. The number is used by botanists to classify flowering plants.
- **Dispersal:** The action or process of distributing things or people over a wide area.
- **Dormant:** A period in an organism's life cycle when growth, development, and activity are temporarily stopped. A seed is dormant when it fails to germinate under favorable conditions. Seeds are dormant prior to water and oxygen activating the embryo.
- **Embryo:** The part of a seed that develops into a plant.
- **Fruit:** A part of the flowering plant that is responsible for the dissemination of seeds.
- **Germination:** The process by which a plant grows from a seed to a plant. Factors influencing germination include temperature, water, oxygen, and light/darkness.
- **Nutrients:** A substance that provides nourishment essential for growth and the maintenance of life.
- **Organisms:** All living things (plants & animals).
- **Property:** A characteristic of an object that you can observe.
- **Roots:** One of the first structures to grow; it is the part of the plant that attaches it to the ground or to a support, typically underground, conveying water and nourishment to the rest of the plant via numerous branches and fibers.
- **Seed:** A flowering plant's unit of reproduction, capable of developing into another such plant. It is comprised of the embryonic plant enclosed in a protective outer covering called the seed coat.
- **Seed coat:** The protective outer coat of a seed.
- **Seedlings:** A young plant, especially one raised from seed and not from a cutting.

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## **Resources:**

- Seed Dispersal: A website that breaks down the five different ways seeds can be dispersed. Each dispersal method is described and analyzed through text and pictures. <http://theseedsite.co.uk/dispersal.html>
- *The Seedy Side of Plants*: An episode of the PBS produced Nature that explores how flora reproduce. The website contains six short films that capture the dispersion of seeds up close and in slow motion. [www.pbs.org/wnet/nature/the-seedy-side-of-plants-introduction/1268](http://www.pbs.org/wnet/nature/the-seedy-side-of-plants-introduction/1268)

## **Design Challenge Process:**

*The Design Challenge Process is designed so students reinforce their science, mathematics, social studies, and language arts content knowledge, through an open-ended process that results in an original, team-driven solution. Students are expected to take responsibility for assessing their own progress and incorporate peer feedback as they conceptualize and redesign their projects.*

*The process consists of three interconnected steps:*

### **Conceptualize**

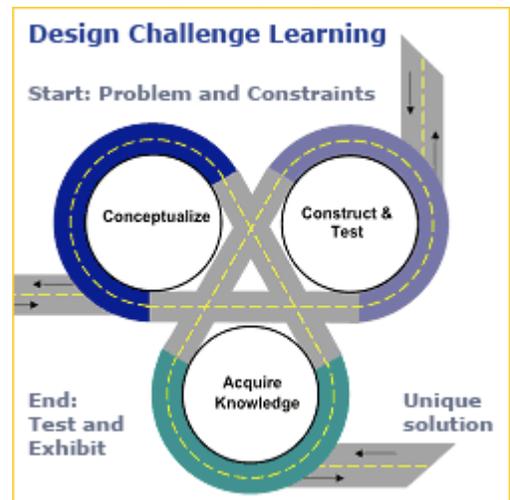
- Identify problem, materials, and constraints
- Brainstorm ideas and possible solutions

### **Construct and Test**

- Select a solution
- Design and construct
- Prototype
- Redesign or modify
- Retest

### **Acquire Knowledge**

- Research
- Share solutions
- Reflect and discuss



*Through the try, fail, learn approach, students develop the skills and habits of mind of Silicon Valley innovators: creativity, problem solving, design, collaboration, leadership, risk-taking, perseverance, and learning from failure.*

## **Materials:**

### **Team Materials (2-3 Engineers):**

- One 8 ½ x 11 inch Paper
- 6 inches of Masking Tape
- Scissors
- One dried Lima Bean
- Student Handout

### **Testing Supplies:**

- Box or Window Fan
- Meter stick (measuring distance)

## **Lesson Plan:**

### **Introduction** (5 minutes)

The expansion of ecosystems rely on the effective dispersal of plant seeds. When bare land is created by forest clearances or fires, the only way for plants to repopulate is by dropping seeds. However, if forest expansion could only happen at its boundaries where seeds first fall, expansion and growth would be slow. Therefore, some plants have structures that allow their seeds to become airborne and soar on the wind long distances. What do you think these structures look like?

### **The Challenge** (15 minutes)

1. Introduce the Challenge: Working with a partner, design a wind dispersed seed structure that will carry a single seed (dried lima bean) the farthest distance possible.
2. Introduce the Constraints:
  - You may not use more than one sheet of paper.
  - Your seed must be fixed to your created seed structure and may not fall out.
  - When testing in front of the fan, you must complete 3 trials and all results must be recorded.
  - Your final score will be the average of your three trials.
  - You may test on your own (not in front of the fan) as many times as you'd like.
3. Build: Give students about 10 minutes to build and test. The instructor should ask open-ended questions to help guide students through the design process, but should also allow students space to tinker.

### **Testing, Demonstration, and Reflection** (20 minutes)

4. Testing: Completed seed designs will be dropped in front of a fan, and the distance it travels will be recorded. Each seed/seed structure will be dropped 3 times, and the average distance traveled for the three trials will be calculated. Record the average distances for the class on chart paper. Refer to the chart during the class reflection questions.
5. Demonstration: Have students demonstrate their devices one team at a time. At the end of each demonstration the teams should reflect and answer questions that are guided by the questions and teaching points listed below.
6. Reflection: Have each group of students explain their design strategy. The instructor should ask leading questions to get at the science behind the designs.
  - Questions:
    - Did you mimic any seeds you've seen before?
    - What could you change that might make your seed travel farther?
    - If you had more time what would you change, add, or remove from your design?
    - How many iterations did your seed structure go through?
  - Teaching Points:
    - There is a complementary relationship between structure and function.
    - Plants have structures that serve different functions in growth, survival, and reproduction.
7. Discussion: Introduce pictures or examples of seeds that use wind to help in their dispersal. Have students compare and contrast the similarities and differences between the student-designed and nature-designed seeds. Discuss other ways that seeds also travel and reflect further on the structure and function of these amazing designs.

- Questions:
  - Which seeds from the class trials traveled the farthest?
  - Why would a seed benefit from traveling away from the parent plant?
  - What were the features of the seeds that traveled farthest?
  - Did the structures of the seeds that traveled the farthest appear similar to structures found in nature?
  - What seeds did the class structures mimic?

## Extensions

- Repeat the experiment but place the fan outdoors and in the grass. How do the results compare? Did changing the surface that the seeds fall on change the overall results? How might you redesign your seed to travel farther under these new environmental conditions? Try the experiment on both carpeted and tile floors.
- Make a collection of seeds found outdoors. Make a poster display. Research how the seeds are dispersed.
- Collect a wind dispersed seed found locally. Design an experiment to study the effect of manipulating the seed structure that captures the wind.
- Collect wind dispersed seeds from a variety of different local plants. Design an experiment to determine which seeds travel farthest. Analyze your results.