MacGillivray Freeman Films
VIRTUAL FIELD TRIPS

GRADE LEVEL: Elementary through High School

Daylight in a Bottle Activity

WATCH THE FILM

Dream Big: Engineering Our World transforms how we think about engineering. From the Great Wall of China and the world's tallest buildings to underwater robots, solar cars, and smart, sustainable cities, *Dream Big* celebrates the human ingenuity behind engineering marvels big and small, and shows how engineers push the limits of innovation in unexpected and amazing ways. Students will follow the inspiring stories of aspiration among a diverse group of engineers.

DREAM BIG EDUCATIONAL ACTIVITY

Daylight in a Bottle (45 minutes)

Introduction and Overview

In the film *Dream Big*, we see ways that engineers are bringing light to the interior of buildings without the need for electricity. Now students can experiment with ways to make similar devices to light the homes of those in need. The challenge: how to bring sunlight inside by using water-filled plastic bottles. Good for all ages and grades 3–12.

Components of the educational activity:

1. Hands-on activity (35 minutes)
2. 3 educational videos (10–15 minutes)
3. Fun facts quiz (5 minutes)

Prepare this in advance:

1. Set up how the film will be viewed in classroom: Do you need a projector and screen? Or can you view the film in an auditorium? Technical details for the film itself are provided separately. It will be delivered by internet or DVD.
2. Set-up viewing for the videos: Will it be the same as the film? The videos can be viewed by internet.
3. List of materials you will need for the hands-on activity.

Virtual Field Trip features two components:

1. **The Film, *Dream Big: Engineering Our World*** (45 minutes)
2. **Educational Hands-on Activity** (45 minutes)

MATERIALS

- Cardboard box–the bigger the better
- 2 pieces of extra cardboard–something large enough to cover the hole made for the water bottle
- 3-4 clear water bottles (0.5 L or 17 oz)
- Food coloring
- Scissors or box cutter
- Duct tape or paper–used for covering small gaps or holes

INTRODUCE THIS:

More than a billion people around the world don't have electricity. Many live in houses without windows. This means that even during the day they must burn candles or use kerosene lanterns which cost money. Sunlight is free, renewable, and doesn't cause pollution. It is also known to improve how people feel. There is a growing movement to bring sunlight inside by using water-filled plastic bottles.

WATCH THIS:

Video #1: *Philippines: Plastic Bottles go Solar* (6 minutes)
See the difference daylighting can make in a Philippine settlement.
Video on YouTube: **https://youtu.be/hPXjzsXJ1Y0**

WATCH THIS:

Watch Video #2: *Dream Big - Lean and Green: Engineering Alternative Energy* (5 minutes)
Engineers are always looking for ways to use renewable energy sources such as the sun and wind. Learn more on this video on YouTube.
Video on YouTube: **https://youtu.be/wB4B23MUMko**

DOWNLOAD THIS:

Download this pdf with full instructions for the activity. It also includes questions, topics and adaptations for younger and older grades. **https://www.dreambigfilm.com/education**

DO THIS:

Have your students participate in this hands-on activity in the classroom. **The Challenge: how to bring sunlight inside by using water-filled plastic bottles** (35 minutes)

Instructions To Do Activity

Part one: Prep the Box

1. Look inside the box. If it has holes or gaps cover them with opaque tape or paper.
2. Place the box on its side, so that the flaps of the box are open either to the right or left. Place a water bottle on the top side of the box. Trace a circle around the water bottle and then cut a hole just big enough for the water bottle.
3. Take another piece of cardboard, trace a circle as above and draw lines across the circle as though you were dividing a pie into 6-8 pieces. Extend the lines about 1 inch beyond the circle. Use scissors or box cutter on the lines. This is called the collar.
4. Cut out a small rectangle near the bottom of one of the sides of the box (do not cut the side that was originally the bottom of the box). This will be a view hole.
5. Tape a colorful picture on the inside of the box opposite the view hole.
6. Close the box by either holding the flaps closed or taping them together.

Part Two: Testing

1. Insert an empty water bottle in the collar, then place the water bottle/collar into the hole on top of the box. Move to a place where the sunlight or flashlight hits the bottle, and look through the view hole. Can you see the picture? Is it dim?
2. Now try it with a completely filled water bottle.
3. Is it any better?
4. Does it matter if the water bottle is only half full?
5. Would it work better if the water was colored?
6. Can you think of something that would work better than a water bottle?
7. Engineers use the Engineering Design Process to find ways to solve problems. First, they identify the problem. Then they research possible solutions, test them out, and try again

TALK ABOUT THIS:

What were the results of the first test?

- Light (such as sunlight) travels in a straight line. As light travels through the water it spreads out so it can reach into all the corners of the box.
- How do you think people used to light their houses before electricity was invented? If you didn't have electricity to light up your home what would you do?
- Structural engineers and architects who design buildings often look for ways to bring natural light into a building. This saves electricity, reduces costs, and often improves the mood of the building's users.

WANT MORE CHALLENGE?:

- Try the same activity with a different clear liquid such as soap, vegetable oil, or rubbing alcohol.

WANT TO GO FURTHER?

Discover **Fun Facts** and explore more resources to expand the learning experience, like those below.

DOWNLOAD THIS:

Take the Fun Facts Quiz! Now that students have seen the film and completed the hands-on activity, it's time for a little reflection with fun facts! Download this easy fun facts quiz, designed as a hand-out.

https://dreambigfilm.com/quiz/

FIND OUT MORE

Explore other resources to expand the learning experience around *Dream Big* and engineering.

- Full Lesson Plans for grades K–12 tied to Next Generation Science Standards and 50 other hands-on activities are available to explore. http://www.discovere.org/dreambig/activities
- Other educational materials: http://www.discovere.org/dreambig
- Other educational videos: https://dreambigfilm.com/videos/

DreamBigFilm.com

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ASCE American Society of Civil Engineers

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