



DESIGNING FOR THE DROP

Overview

Book: *Quarantine* by Lex Thomas

Grades 8-12

Students will use the Engineering Design cycle to plan, build, and test a device that will help them collect supplies they need for a high quality of life while existing in quarantine. In the book, characters' survival depended on their success of gathering supplies at the Food Drop. The Food Drop was a vicious event. Teams needed to work together with strategy and strength.

In this PBL, students will work in teams to determine their strategy for gathering supplies, as well as design and build a device that will help them gather the most valuable supplies that they can.

Suggested time frame is 45-60 minutes. You can divide the activity by engineering the device one session and holding the Drop another session.

Standards

| | |
|-------------|--|
| MS-ETS1-1 | Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. |
| MS-ETS1.4 | Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. |
| SEL – 1B.5a | Implement a plan to build on a strength, meet a need, or address a challenge. |

Objectives

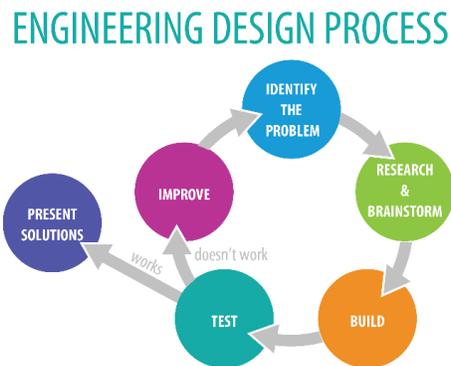
Students will determine a team strategy for the drop.

Students will brainstorm ideas for a device or tool to help them gather the supplies.

Students will create the device.

Students will test the device during a simulated food drop.

Students will improve the device, as needed, using the engineering model.



Materials Required

Newspapers

Duct tape

Food Drop:

Prepare a wide variety of boxes, containers, plastic jugs, etc. These should be all different sizes and weights. Be sure that each box is clearly labelled as to what is contains. There should be items for food, health (vitamins, OTC meds, soaps, detergent, etc.), safety (first aid kits, flashlights, batteries, etc.), clothing, and entertainment (books, video games, iPods). Each item should have a specific point value. Some of the higher point values should be very heavy or hard to handle.

Here is a suggested list.

- High nutrition foods- 1500 pts.
- Junk food – 500 pts.
- Government rations/basic food supplies – 1,000 pts.
- Medical supplies – 1500 pts.

- Vitamins and supplements – 1,000 pts.
- Clothing basics – 500 pts.
- Batteries – 500 pts.
- Tools – 500 pts.
- Detergent, soap, shampoo, etc. 300 pts.
- Candy- 200 pts.

The number of items in each category is up to you. Be sure to have enough items for the teams to make two supply runs. Optional: use plastic wrap to encircle the entire set of supplies.

Prior Knowledge and Vocabulary

In the book, the groups at McKinley developed an economic system through the bartering of various goods and services. The students will need to have the following prior knowledge.

Students will need to understand the meaning of scarcity and value.

Students need a grasp of basic economic concepts, such as supply and demand, goods and services, and barter vs. monetary economic systems.

Students should understand the difference between surviving (just barely enough food, water, shelter, and clothes) and thriving (plenty of food, water, shelter, clothes, comfort, and entertainment).

Procedure

1. Divide the class into teams.
2. First teams should identify the problem- gather and transport supplies from the Drop.
3. Teams must also determine a strategy: What type of items will they gather? What is the logic behind the selections?
4. Brainstorm ideas and designs for the type of device or tool that will help solve the problem.
5. Give teams about 20 minutes to construct the design using only newspaper and duct tape.

6. Students should then think of a strategy or plan for the obtaining the type of supplies they want to gather.
7. The Drop – place the supplies in the center of a large area such as the gym or outdoors. Each team should select two members to represent them at the Drop. These two representatives are to use the device to gather and transport supplies. Each team should have a marked off area or table that is the designated drop off zone. This is the area where the other team members should remain throughout the Drop. Be sure that all teams are started at equal distances from the supplies. Use an air horn or whistle to signal the beginning of the time. The students have only TWO minutes to collect and transport items. Encourage students to remember the strategy the team has devised. The two representatives may make as many trips between the supply stack and their drop off zone as needed. Only the two representatives from each team may handle any supplies. Once an item is in the drop off zone it cannot be stolen by another team. However, items remain in play until they reach the drop off zone. At the end of the two minutes sound the horn. Any item NOT in the drop off zone must be returned to the central pile.
8. Give students exactly 5 minutes to make any changes to their devices in order to improve them.
9. The teams may pick two new representatives or keep the ones from the first round.
10. Signal a second start. Representatives only have ONE minute to gather supplies. The same rules apply.
11. At the end of the second run, teams will tally up the point values of the supplies that they have selected. The team with the highest point total wins the Drop and rules the school.
12. Ask students how well their strategy or devices worked. How did the representatives feel during the drop? What were the other team members thinking during the drop? How could they improve their strategy?

Extensions

1. Have students retain the supplies that they gathered and follow up with the *Quarantine Market* activity.

2. Students brainstorm a list of ideas that would adapt this device for future Drops.
3. Writing: Ask students to write a report about the event. What was the team's strategy for gathering supplies? Why did they decide on this? How well did the device aid this strategy? What changes were made for the second run? How did it work?
4. Robotics and other devices are now used to help perform all types of tasks. Have students research how some of these devices work. (manufacturing robots, programmable prosthetics, bomb diffusing robots, cochlear implants, talking computers, etc.)
5. Record a play by play commentary, similar to a sporting event, about one of the food drops that occurred in the book.

Rubric

| RUBRIC | | | | |
|---------------|--|---|--|--|
| | Exceeds (3) | Meets (2) | Partially Meets (1) | Does Not Meet (0) |
| Strategy | Group developed a logical strategy and stayed exclusively with it throughout the event | Group developed a logical strategy and for the most part used it during the event | Group developed a logical strategy, but did not use it during the event. | Students did not develop a logical strategy. |
| Device | Group created a device that aligned to their strategy and used it for the event. | Group created a device that somewhat aligned to their strategy and used it for the event. | Group created a device that was not aligned to their strategy and used it for the event. | Group did not create a device. |

| | | | | |
|------------|---|--|--|------------------------------------|
| Success | Group gathered the supplies that aligned to their strategy. | Group gathered mostly supplies that aligned to their strategy. | Group gathered very few supplies that aligned to their strategy. | Group did not gather any supplies. |
| Total N/19 | | | | |

STEM Read and SmartSpace@NIU are part of Northern Illinois University's STEAM Works Initiative.

