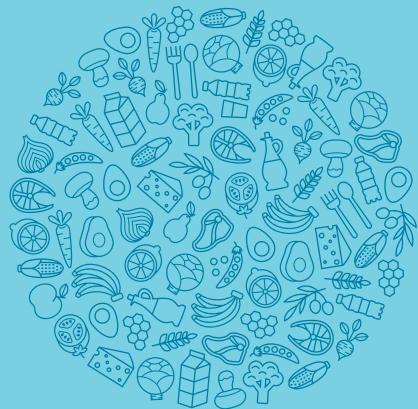


STEMconnector

2018 NATIONAL
DD
DAY OF DESIGN
FOOD RESCUERS



Food Rescuers: STEM Innovations to Reduce Food Waste

TEACHERS' GUIDE – MIDDLE SCHOOL



Overview

Food Rescuers Design Mission encourages students to create like an innovator by employing creative problem-solving skills and an entrepreneurial mindset while innovating a solution to the problem.

In the Food Rescuers Design Mission, students design a new invention that will reduce food waste for their school's cafeteria. Teams can tackle this challenge using a wide-range of materials and technology, from everyday materials available in the classroom to design software to 3D printed components. The focus is on the ideas and approaches, not the products.

THROUGH THIS CHALLENGE, STUDENTS WILL:

- Acquire deep understanding of the challenges posed by food waste.
- Build and apply foundational and advanced STEM knowledge and skills, cutting across many disciplines, from biology to math to computer science and engineering.
- Build employability skills such as communication, critical thinking, and teamwork.
- Build important career skills, such as problem-solving, design-thinking, teamwork, entrepreneurship, and communication, and develop a supportive network of peers, educators, and career mentors / advocates.
- Grow in confidence, think creatively and engage deeply with their community and possible careers.
- Translate their new-found strengths into innovation, local impacts and jobs

Alignment to Standards

The activities that follow can be used for almost any grade from 5th through 8th grade. Skills listed are general and can be focused for specific grade levels as needed for differentiation and grade appropriateness.

READING STANDARDS

INFORMATIONAL TEXT STANDARD 1

Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

INFORMATIONAL TEXT STANDARD 7

Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem

WRITING STANDARDS

WRITING STANDARD 1

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

WRITING STANDARD 6

Use technology, including the Internet, to produce, publish and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

WRITING STANDARD 7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem: narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation

SPEAKING AND LISTENING STANDARDS

STANDARD 1

- B. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- C. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- D. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

COMMON CORE STANDARDS OF MATHEMATICAL PRACTICE

MP.1 Make sense of problems and persevere in solving them.

NEXT GENERATION SCIENCE STANDARDS (NGSS)

MS.ET.S1-1: 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.ET.S1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS.ET.S1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS.ET.S1-4: 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.

Middle School Food Rescuers Lesson Plan

Time: 1 instructional period (50 min - 1 hour). Pre and post design mission extension activities are included to extend scope of project if additional time is available.

Materials: Paper, pencils, crayons, markers, pipe cleaners, string, aluminum foil, cardboard boxes, paper towel tubes, construction paper, tape, glue, etc

Preparation: Space should be configured to allow participants to easily work in teams. Each team should consist of no more than 5 students for the most conducive learning environment. Feel free to play upbeat music during all steps while students work, and turn it down to give instruction. Display a widely-visible timer that lets students know how much time they have left during each step.

OPTIONAL PRE-MISSION ACTIVITIES

These activities can be completed in the day(s) prior to launching the design mission. It can help build students' knowledge about food waste within their school community.

CONDUCT RESEARCH

1. Students can investigate and research the problems of food waste within their own school communities prior to the Day of Design Mission by interviewing a school cafeteria employee. Options could include inviting them to speak to the class with students asking prepared questions. Alternatively, you could send questions to the employee to respond to and then share with your class.

Sample questions for a school cafeteria employee:

- Where does the food come from? How does it arrive to the schools?
- How is the food stored?
- How much food lost in the preparation process?
- Do you separate organics and inorganics into bins?
- Is composting available?
- What do you know about what happens to the uneaten food or food that expires?
- In your opinion, what would make it easier for you to reduce food waste?

2. Provide students time to complete research on the problem of reducing food waste. Direct students to use online research databases, library books, etc available at your school. After researching the topic, have students return to their teams to discuss the following questions below.

Team Discussion Questions:

- What is currently being used to reduce food waste? Why or why doesn't it work?
- How are scientists and engineers using technology to reduce food waste?
- What were some other key findings from your research?

Step 1. UNDERSTAND THE PROBLEM (7 min.)

1. **Read Introduction** Students read Introduction to Food Waste. Options can include: read aloud as a whole class, in pairs, or independently.

2. **Small Group Brainstorm**

Ask students to brainstorm as many ideas as possible that will reduce food waste. No idea is too wild! Students can sketch or write ideas on their student handout.

INTRODUCTION TO FOOD WASTE

Food is fuel for your body and mind. In the United States, we currently have access to more food choices than ever before. This applies to our school lunch programs which have overall made improvements in providing more nutritious and healthy food choices for students. Food provides the nourishment students need to succeed in school. Simply put, food is too important to waste.

Yet food is still the single largest component of our everyday trash at homes and in schools. According to the Natural Resources Defense Council, 40 percent of food that is produced is never eaten. Growing food that ends up as garbage isn't just wasteful. It is a massive environmental drain using precious water in food preparation, fuel to transport the food and many other environmental resources. It also adds to already overflowing landfills. In landfills, the rotting food waste produces a harmful emission called methane which is the main cause of global climate change. Many factors are thought to be at the root of food waste, but most researchers agree that we need to find new, innovative ways to reduce food waste.

We can apply ideas from science, technology, engineering, and math (STEM) to create innovative ways to reduce food waste. Scientists and engineers can develop new ways to store food that reduces oxygen levels so that fresh produce and meat can last longer. Engineers are designing ways to transform food waste into green energy. We can also use technology to develop apps that help redistribute food surplus to feed people in need as well as tracking systems that allow cafeterias and restaurants track what food is being thrown away, monitor trends, and make informed decisions to reduce the amount of food that goes wasted.

Scientists and engineers are always working to design better solutions to reduce food waste. These are complex problems, and they require complex thinking. Design thinking is a powerful way to develop solutions to complex problems. It starts with defining the problem and understanding how that problem affects people. Then it requires brainstorming many, many ideas and designing and testing prototypes of those ideas. In this type of design, failure is just part of the process. There is room for improvement in every design.

There is much we can do already to help reduce food waste. But there is also much more we could do. And that is where you come in. By applying your understanding of STEM skills and knowledge and by using design thinking, you can come up with new and innovative solutions to help YOUR community reduce food waste.

Your Day of Design Food Rescuers Mission is to design a new invention that will reduce food waste for your school cafeteria.

Step 2. DIG INTO THE MISSION (7 min)

1. Video (Optional): If students have not researched the issue prior to the mission day, build student's knowledge of the problem by showing and discussing this video from Food Rescue (4:37): <https://www.youtube.com/watch?v=7xBzAqnXZJc> Direct students to capture notes in their handout.
2. Real-World Examples: Share with students 1-2 examples of some inventions that have been created. Refer to links below. Decide ahead of time what you would like to share with the class.
 - Copia: App that connects businesses with excess food to nonprofits who need it.
 - FoodKeeper: App that alerts users when their food will likely go bad.
 - Bluapple: Product that absorbs ethylene gas in refrigerators, allowing consumers to store fresh produce up to three-times longer.
 - Landfill Gas to Energy: Illustration of the development of biogas- a renewable energy composed primarily of methane resulting from the natural decomposition of organic waste by anaerobic bacteria.
 - Home Biogas and The Horse Video that shows 2 inventions that transform food waste into energy.
 - Kitchen tech to reduce food waste
3. Provide time for students to capture their thinking in their handout.

Step 3. BRAINSTORM AND DESIGN (10 min)

1. Say to students, "Based on all the insights you have gained, what do you NOW think is a workable solution to reduce food waste in the school cafeteria? (Remind students to think like engineers and be willing to use their knowledge in science, math and technology to help them think of ideas.)"

If necessary guide students to consider the following questions:

- What makes food spoil? What could prevent food from spoiling?
 - What is the system we use to select our food in the cafeteria?
 - What happens to leftover food? Could leftover food be turned into something useful? How?
2. After allowing students to discuss their ideas for about 5 minutes, ask teams to decide on one idea that they would like to try to draw and build today. As a team, they should help one another sketch out their idea in their student handout or on a large piece of poster paper.
 3. While the students are drawing, gather the prototype materials and place in an accessible location.

Step 4. BUILD A PROTOTYPE (25 min)

1. Explain to students that they can now use the resources you have set out to create a prototype of their invention. Let them know that it might not match their ideas completely, but it should help bring their ideas to life.
2. If time permits, have teams share their prototypes to one another. This could be done with a gallery walk. One team member stays by their team's prototype and explains it as other teams walk around and visit each prototype.

Extension Activities

Test Your Prototype

1. Discuss with your students how they can test their prototype in the school cafeteria, given the available materials used in the prototype. Have them record their ideas in the extension activities handout.
2. If possible, have students test their prototype and capture what they learned in the extension activities handout. Depending on the readiness of the prototypes, you may only have one team test their prototype or you may have all teams test.

Refine Your Prototype

1. Ask students to describe what they would change on their prototypes.
2. Teams can rebuild prototypes or complete another sketch.
3. If you have the time and resources, students can test the new prototype and continue to improve their invention. You can do this once, twice, or as many times as possible.

Share Your Solution

1. Ask students, “How can you bring your prototype / solution to your community? What do you need to make this happen? Who could you work with? Are there other opportunities to help your community reduce food waste? Be creative, get involved! Then create and share a video to tell the story of your adventure as a Food Rescuer.