

SCIENCE FAIR CENTRAL

Maker Corner Activity



DESIGNED DELIVERY

Grades 6-8

MAKE. CREATE. EXPLORE.

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Companies need to “think outside the box” when it comes to packaging design.

Overview

Do you know anyone (or maybe you do this!) that uses a meal delivery service?

Today with the busy lives people live and the easy access to companies and apps that allow us to shop, people are ordering more and more online and having it delivered. From already prepped meals, to clothes and household items, delivery companies do not have a problem staying busy. With new delivery options constantly becoming available, companies need to think “outside of the box” to ensure they are delivering products in excellent condition while also preventing food waste. If customers aren’t happy with the condition in which they receive the products, companies won’t be able to stay in business and the environment is negatively impacted.

This activity focuses on the “Defining the Problem,” “Designing Solutions,” and “Creating/Prototyping” stages of the engineering cycle. Student will take on the role of a packaging designer and be tasked with creating a package design for a box left outside after delivery that needs to remain cold and dry.

This activity focuses on the **Designing Solutions, Defining the Problem, and Creating or Prototyping** stages of the Engineering Design Cycle.

Engineering Design Cycle

- **Defining the Problem**
- **Designing Solutions**
- **Creating or Prototyping**
- Refining or Improving
- Communicating Results

Objectives

Students will be able to:

- **Apply** knowledge of the impact weather conditions have on the delivered packaging.
- **Create** a packaging design that will be resistant to these conditions while keeping food items cold and fresh.
- **Analyze** the effectiveness of their design in comparison to others created by classmates.



Delivery companies need to create the best packaging possible to stay competitive.

Materials

- Memo from Start Up Company (1 per group)
- Group Feedback Form (1 per group)
- Reflection (1 per group)
- Small Cardboard Box (1 per group)
- Radiant Barrier Insulation (teacher can show this/discuss with students but provide aluminum foil to groups to use at a much lower cost)
- Spray Bottle (1 per group or can have 1 available to students so they can test it with their design)
- Cardboard Paint Shield (cut up into 5 in X 5 in pieces available for groups to use)
- Ice Pack (1 per group or can have 1 available to students so they can test it with their design)
- Craft Scissors (1 per group)
- Foil Tape (1 roll cut into smaller pieces based on class size and number of groups)
- Shower Liner (1 cut into smaller pieces based on class size and number of groups)
- Trash Bags (1 per group)
- Markers
- Glue (1 per group)
- Rulers (1 per group)

Have you ever wondered . . .

What would life be like on a daily basis without the invention of the refrigerator and freezer?

We depend on these insulation systems to keep the food at our grocery stores cold, food in our homes fresh, and meals ready to be prepared in our school cafeterias. Even with modern refrigeration systems, Americans still waste 40% of their food each year. This is \$115 billion dollars lost as a result of wasted food.¹

What is involved in getting a package delivered to your house in good condition while minimizing their environmental impact?

Packages are shipped and delivered on a constant basis. The worldwide mailing industry employs over 7.5 million people, and generates over \$1.4 trillion dollars a year. Shipping and packaging services from the US Postal Service alone generated \$17.6 billion dollars in 2015! That amount doesn't even take into account other package delivery companies such as UPS and FedEx.²

Packages are typically delivered in a cardboard box. This seems great because cardboard can be recycled. However, many packages are left outside all day after being delivered. What happens to the contents of that box if it rains, snows, or is exceptionally hot and sunny that day?

Now it's your turn to "think outside the box" to create an efficient, eco-friendly design.



Make connections!

How does this connect to students?

If you haven't already, there will be a point in your personal or professional life when you receive a delivered package. When packages aren't delivered and received in excellent condition, it leads to additional waste. You can prevent the negative impact this unnecessary waste has on the environment.

How does this connect to careers?

Materials Engineer—Materials engineers develop the materials we use, that can be incorporated in the items we use in our day to day lives.³

Chemical Engineer—Chemical engineers apply their knowledge of science and math to produce products and develop equipment for manufacturing.⁴

Packaging Designer—Packaging Designers are hired by companies to create a product's packaging that be functional while also containing creative graphic work.⁵

Project Managers—Project Managers use their people skills and expertise in an area to lead a team toward achieving a common goal.⁶

How does this connect to our world?

By designing a package that will be able to keep delivered food cold, and protect the contents from damage, you will minimize additional food waste, decrease the amount of trash in landfills, and eliminate the extra burning of fossil fuels used to transport and deliver replacement packages.⁷

Blueprint for Discovery

Prior to the class arriving:

- Cut cardboard and shower curtain into small pieces so they are available to be used by students in their designs.
- Have all materials easily available in your classroom for students to access as needed
- Print out or digitally post the "Memo" from the startup company



- Print out or digitally post the “Feedback Form”
- Print out or digitally post the “Reflection” document

During Class:

1. Divide students into groups of 3 or 4.

2. Once the students are in groups, ask them to brainstorm together what comes to mind when they think of “home delivery”. Any of the following formats would work for groups to compile their ideas depending on the technology and resources available in your classroom:

- Create their own group Google Doc
- Post on a class “Padlet”
- Generate a word splash using an online word cloud generator
- List ideas on a whiteboard
- List ideas on a piece of newspaper print or construction paper using large makers

3. Based on what they have brainstormed, ask students to think about and discuss the following questions with their group members:

- What factors need to be taken into consideration when fresh foods are delivered to homes?
- What types of materials would best be able to prevent issues when packages (especially containing food) are delivered and left outside all day?
- What happens if packages are received with the contents damaged or destroyed?

4. Pass out the “Memo” from the company to each group. Provide student groups with an opportunity to review the project they have been “hired” for as well as the requirements and limitations they must adhere to.

5. Review with students the location and amounts of available materials for each group to use. In an effort to conserve materials, you may want to remind or encourage them to:

- Sketch or design their package prior to actually building it
- Use the small cardboard and plastic pieces or portions of the trash bags with the spray bottle to test how water will impact the package

6. Set a timer for students to design and build their package. Periodically remind students how much time is left.



7. When the time is up, have students arrange their packages around the room in a way they can be easily displayed for other groups to see. The teacher should explain that the first attempt at designing and building something new, is typically not the only attempt. Any time a new product is being created, the process consists of several rounds of testing, evaluating and improving the product.

8. Students will stay in their groups and will do a gallery walk together around the room to view each of the packages produced. Students will analyze and evaluate the packages designed by each of the other groups. While at each display station, they leave positive feedback and suggestions for improvement on the "*Group Feedback Form*".

9. After viewing all of the other package designs on display, groups will review the feedback left about their design by their classmates. Together they will reflect on the information that was communicated about their design and determine what changes they would implement if given time to adjust or modify their package. Groups will complete the "*Reflection*" document together.

Take Action

Want to learn more about steps you can take to prevent food waste:

<http://www.sustainabletable.org/5664/food-waste>

Want to learn more about sustainable packaging, how the US Postal Service is working with the Environmental Protection Agency to increase sustainability, and how you can reduce your carbon footprint when you need to send a package:

<http://about.usps.com/what-we-are-doing/green/eco.htm>



National Standards

Science

Next Generation Science Standards

MS-PS3-3 Energy

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*

Technology Education

Next Generation Science Standards and International Technology and Engineering Educators Association

Students will develop an understanding of Design. This includes knowing about:

- Attributes of design.
- Engineering design.
- The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Students will develop abilities for a technological world. This includes becoming able to:

- Apply the design process.
 - Use and maintain technological products and systems.
 - Assess the impact of products and systems.
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Mathematical Practice

Common Core

CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CCSS.Math.Practice.MP4 Model with mathematics.

CCSS.Math.Practice.MP5 Use appropriate tools strategically.



Works Cited

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<https://www.bls.gov/ooh/architecture-and-engineering/materials-engineers.htm>
4. U.S. Bureau of Labor Statistics. Occupational Outlook Handbook: Chemical Engineers. December 17, 2015.
<https://www.bls.gov/ooh/architecture-and-engineering/chemical-engineers.htm>
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<https://design.tutsplus.com/articles/so-you-want-to-be-a-packaging-designer--cms-25535>
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<https://www.pmi.org/about/learn-about-pmi/who-are-project-managers>
7. 7 Lawrence County Solid Waste Where Does Our Trash Go? "The Lifecycle of Garbage" May 31, 2017.
<http://www.lawrencecountysolidwaste.org/index.php/kids-corner/where-does-our-trash-go>



Date:

To:

From: New Food Delivery Company

Subject: Well Designed Delivery Packaging

We are a new food delivery service that has been working for years to start offering our services to customers. The foundation of our company is delivering fresh, healthy meals, with minimal waste and in perfect condition to our customers. Before we can officially launch our APP and go public, we have 1 final challenging, yet important element of this adventure to accomplish.

It's time to determine our company name and create the necessary packaging for our deliveries. We have done a lot of research, and have heard wonderful things about your ability to create effective, efficient, and eco-friendly products with a creative edge to them.

We're certain you are the right team to accomplish this for us and would like to inform you of the requirements as well as limitations. Your project manager will be able to provide you with more information throughout the design process.

Creative company name indicated on the package

Food inside of the package must be able to stay cold when left outside all day after delivery (your package design must be able to accommodate at least one of the cold packs provided)

Materials inside of the package must stay dry even in wet weather conditions

Packaging must incorporate cost effective materials (that are available for you to test and use in the production lab)

Should you have any questions during the design process, or need additional information, please direct any questions to your project manager.

We look forward to seeing your completed packages. Congratulations and welcome to one of the most innovative companies of our time!



Group Feedback Form

Reviewing Group Member Names:

Great Ideas:

Ideas to consider for improvement:

Reviewing Group Member Names:

Great Ideas:

Ideas to consider for improvement:

Reviewing Group Member Names:

Great Ideas:

Ideas to consider for improvement:



Package Design Reflection

What were the characteristics of your design that you feel need to be kept because they will be effective?

What improvements or changes would you make to your design?

As you viewed the packages designed by other groups, what were some factors you think you should have taken into consideration but didn't?

What were some of the struggles your group encountered as you designed your package?

Do you feel your package design would have been different if you weren't trying to be eco-friendly? If so, in what ways?

