SCIENCE FAIR CENTRAL

Maker Corner Activity

PATROLLING FOR PLASTIC

Grade Level: High School

MAKE. CREATE. EXPLORE.

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THE HOME DEPOT

Discovery EDUCATION

Did you know that up to 90% of the trash in our oceans is plastic waste?

Overview

Students are introduced to the increasing problem of plastic that is littering our oceans and harming marine wildlife and ecosystems. Students will look at the successes and failures of some of the most recent projects in the news and will design an improved or new way of collecting plastic and garbage in the ocean. They will create a prototype model of an ocean waste collecting device and will test their model by dragging it through a child's swimming pool filled with various pieces of plastic waste and garbage that might be commonly found in the ocean. The class will discuss the strengths and weaknesses of the devices and come up with ideas to refine them.

Have you ever wondered...

What impact does plastic waste have on our oceans?

While the invention of plastic has had a multitude of benefits for people, plastic is also causing a multitude of problems in our oceans and waterways for the living things that call these places home. While you may think of climate change and overfishing as major threats to marine ecosystems, you should certainly include plastic waste to that list as well. Up to 90% of the trash in our ocean is plastic waste. Getting tangled in and ingesting this waste is harming countless species of marine life and upsetting the delicate balance that our oceans ecosystems require.

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

Engineering Design Cycle

- Defining the Problem
- **Designing Solutions**
- **Creating or Prototyping**
- Refine or Improve
- Communicating Results

Objectives

Students will be able to:

Identify that the increasing amount of plastic waste in the oceans is creating major problems for marine wildlife and damaging aquatic ecosystems.

Design a mechanism of removing floating or sunken trash from the ocean.

Construct a prototype model that will demonstrate how plastic waste could be collected in a model "ocean."

Materials

- vinyl tubing
- rubber tubing
- garbage bags
- screen
- funnel set
- rubber bands
- duct tape
- utility knife
- hot glue gun and glue
- foam sheets
- string trimmer line
- paracord
- child's swimming pool
- various pieces of plastic waste (that can be recycled)
- cardboard or foam core sheets

Make connections!

How does this connect to students?

In 2016, a photo of a turtle with a plastic straw lodged in its nostril went viral and sparked a global push to reduce the use of plastic straws in restaurants, schools, and in people's homes. Yet, straws are hardly the only type of plastic waste ending up in our oceans. It is estimated that each year, 8 million metric tons of plastics enter our ocean on top of the estimated 150 million metric tons that currently circulate our marine environments. We need to come up with solutions to remove plastic from our oceans to protect all marine species from harm and the degradation of the places they call home.

How does this connect to careers?

Marine Engineers
Marine engineers design and oversee the construction of ocean vessels and structures. They may design the electrical, environmental, and propulsion systems aboard seagoing vessels ranging from oil platforms to cruise ships.

Marine Biologists
Marine biologists study life in the oceans, including the behavior and health of marine species. They investigate diseases and environmental conditions that affect marine species and study the impact that human activities have on marine species and ecosystems.

Environmental Scientists
Environmental scientists and specialists use their knowledge of the natural sciences to protect the environment and human health. They may clean up polluted areas, advise policymakers, or work with industry to reduce waste.

How does this connect to our world?

Our oceans are in trouble, and unfortunately one of the major threats to marine wildlife is plastic waste that has infiltrated every level of marine ecosystems, from the large mammals, fish, and birds, all the way down to the tiny phytoplankton at the bottom of the food chain. Humans need to make changes to ensure that all this plastic waste stops making its way into waterways, and it is only through the choices we make about what we buy and use that can clean up and ultimately maintain the health of our oceans.

Blueprint for Discovery

Prior to the Activity:

- Set up the child's pool (filled with water) in an outdoor space or place a tarp underneath the pool in a classroom space
- Put clean, **recyclable** plastic waste in the child's pool (small containers, plastic silverware, etc.), ensuring that some waste will float, and some will sink.

Whole Group Activity

Introduce the problem and challenges with possible solutions

1. Begin by asking students to think about when and how they use plastic in their lives. On their devices, ask students to go to the following link: https://www.earthday.org/plastic-calculator/ where they will be able to calculate (on average) the amount of plastic waste they consume in a year.
2. Ask students to share their thoughts about the amount of plastic they personally discard in a year. Were they surprised? If time allows, add the numbers of the class together to see how much waste the class discards. Is this shocking to students?
3. Explain to students that while plastic waste can be recycled or may end up in landfills, much of our plastic waste ends up in oceans. Display the fact sheet (https://www.earthday.org/2018/04/05/fact-sheet-plastics-in-the-ocean/) for the class and quickly share the 10 facts with students. Ask students to share their initial reactions to these statistics.
4. Ask students if they have ever heard of the famous "great pacific garbage patch." Show students the following video that introduce them to this swirling gyre of trash and some of the shocking facts and misconceptions about it. https://www.youtube.com/watch?v=vrPBYS5zzF8
5. Explain to students that while we can all agree that we need to stop adding more plastic waste to our waterways, one major problem we have yet to successfully solve is how to get the existing plastic waste out of the oceans.
6. Show students the following video clips that highlight various ways that people are trying to clean up ocean waste:

   1—https://www.youtube.com/watch?v=PFwHcr_FMW8
   2—https://www.youtube.com/watch?v=UgZ_3zmcw-Q
   3—https://www.youtube.com/watch?v=cmpA60473Lw
7. After watching the clips, ask students to reflect and share if they see any potential design flaws in any of these solutions or which one(s) they think will have the most success and why.

SMALL GROUP ACTIVITY

Students get into groups and work together to create a prototype model of their waste collection system and end by testing them in the pool

8. Now explain to students that they will be getting into small groups to create and test their own ocean trash-collecting device. Introduce the supplies that are available for them to use to build their device and allow them to see the "ocean garbage patch" you have created for them in the child's pool.
9. Allow students to use the 3 ocean trash collectors in the video as inspiration for their design, but they should try to come up with ways to improve or modify the design to be their own.
10. Finally, before they begin construction of their ocean cleaning machine, students may want to create a simple sketch of how they will build their machine using the provided materials.
11. Once the group has completed the building of their model machine, they should head to the child's pool ocean and test their design! This could be made into a competition between groups to see who can grab the most trash, or groups could give each other feedback on the strengths and weaknesses of the various machines as the watch each other in action.

Take action!

Along with cleaning up existing plastic in the oceans, students can use these links to discover ways that they can reduce the amount of their own plastic waste, and the plastic waste by their friends and family, or to find a beach or shoreline trash cleanup where they live using this interactive map!

- Ocean Conservancy Volunteer—Interactive Map
  https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/volunteer/
- Cut Plastic and Other Trash Out of Your Kitchen
  https://foodprint.org/blog/keeping-kitchen-waste-minimum/?gclid=Cj0KCQjww47nBRDlARIsAEJ34bme8e-8CbBEWXoo3pYCwgdcdxMByDbBrGfQyMJ7-BGEnp_I1OtlLcMaAknzEALw_wcB

Reduce plastic waste in your community! Students can create a campaign to reduce plastic waste in their school cafeteria, by encouraging recycling of plastic and stopping the use of unnecessary plastic waste such as straws and plastic disposable water bottles.

National Standards

Science

Next Generation Science Standards

HS-LS4-6 Biological Evolution: Unity and Diversity
Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

HS-ETS1-1 Engineering Design
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Technology Education

Next Generation Science Standards and International Technology and Engineering Educators Association

Students will develop an understanding of Technology and Society. This includes learning about:

- The cultural, social, economic, and political effects of technology.
- The effects of technology on the environment.
- The role of society in the development and use of technology.
- The influence of technology on history.

Mathematical Practice

Common Core

English Language Arts

Common Core

Links

- https://www.nps.gov/subjects/oceans/ocean-plastics.htm
- https://ocean.si.edu/conservation/pollution/marine-plastics
- https://www.earthday.org/2018/04/18/fact-sheet-how-much-disposable-plastic-we-use/
- https://news.nationalgeographic.com/2017/02/mr-trash-wheels-professor-trash-wheels-baltimore-harbor-ocean-trash-pickup/
- https://www.5gyres.org/science
- https://www.plasticpollutioncoalition.org/ocean
- https://oceanconservancy.org/trash-free-seas/plastics-in-the-ocean/
- https://www.npr.org/2019/01/05/682532583/an-engineering-wunderkinds-ocean-plastics-cleanup-device-hits-a-setback
- https://www.youtube.com/watch?v=nYC4Q-0wcAc
- https://www.youtube.com/watch?v=O1EAeNdTFHU
- https://oceanconservancy.org/blog/2014/07/17/the-five-myths-and-truths-about-plastic-pollution-in-our-ocean/?ea.tracking.id=18HPXWJBXX&gclid=CjwKCAjw_YPnBRBREiwAIP6TJ3zKhzU-M-OGOJAoNXfXuJ2Bf9WwXwjpoJsgOrEY_EwReCHwbhAlahoCmSsQAvD_BwE

Community Planning Handout

Step 1: Familiarize
Use Google.com/Maps to view your community. Zoom in and out and take a few minutes to find some areas/locations that you recognize!

Step 2: Assess
As a City/Town Planner, it is your job to not only develop new communities, but improve existing communities too! With your co-planner, read through the common community problems below.

Then decide: Do you think one of these problems affects your own community? If so, place a checkmark next to it. If not, describe another design problem your community faces that may affect the health of residents and/or the environment.

_____ **Problem:** Not enough green space! Green space includes parks, public gardens, play areas, and even walking trails! Parks and public green areas are important for the environment, the health of local citizens, and creating a sense of community.

_____ **Problem:** Too much traffic! If a more walkable and/or bikeable community center could be constructed, residents could walk to complete their errands and activities. This would cut down on air pollution and help residents get more exercise.

_____ **Problem:** _____
_____
_____

Step 3: Prepare
Now decide on an area in your community that you would like to improve based on the problem you identified. Zoom in and out on Google Maps until this area is in view. Then grab a piece of poster board and work with your co-planner to sketch a blown-up version of the map you see on your device screen.

> *Tip:* Try to make your map **to scale**. This means that everything on your poster board will be bigger than the map on your device by about the same amount.
>
> To make your map to scale, estimate about how much larger the poster is than your device screen, and then make sure all parts of your sketch are this many times larger. For instance: If your poster is about 4 times larger than the map on your device screen, then everything on your poster should be about 4 times larger than it appears on your screen. Use a ruler to help you!

Community Planning Handout

Step 4: Plan
Once you have a map of your community lightly sketched, it's time to make improvements! How could you solve the problem you identified above? Pretend you are meeting with your local architect (drawing designs and creating models is their specialty!) as you brainstorm and discuss possible changes with your co-planner. Then make these changes on your own map.

Step 5: Create
Bring your design to life! Use the map as your base and construct a 3D version of your design by using the model materials to build upward. Keep your model **to scale** as much as possible!