Cleaning up the Plastic Beach

OVERVIEW

ESSENTIAL QUESTION

How is plastic made, how does it affect our marine environmentnd how can plastic waste be eliminated?


Photo: NOAA Marine Debris Program

OVERVIEW

After completing the chart-topping album Demon Days, Damon Albarn didn't know what to do next with Gorillaz, the animated band he created with illustrator with Jamie Hewlett. He came close to retiring Gorillaz altogether, and creating a new virtual cast of characters. But then, an ordinary observation unexpectedly set off a spark of inspiration.

In an interview with journalist Paul Morley, Albarn recalls he was watching the beach next to his house in Devon, England, and saw plastic debris washing up on the shore. "Just looking at all the plastic within the sand," Albarn said, "That's where it came from." Soon, Albarn and Hewlett relocated the Gorillaz to a fantastical studio built on an island of accumulated plastic trash, in the middle of the ocean. The ambitious *Plastic Beach* project was born, complete with an album, animated films, and books. Collaborators ranged from De La Soul, Lou Reed, Snoop Dogg, Bobby Womack, Mick Jones, and Paul Simonon.

This origin story of Plastic Beach is more a testament to Albarn's creative mind than serendipity. Seeing plastic on a beach today is not a rare occurrence: currently, there is approximately 6.9 billion tons of plastic waste on earth, 6.3 billion of which has never made it to a recycling plant. Discarded plastic bottles, shopping bags, and other disposable containers float in our rivers and oceans, and are washed upon our shores. Besides ruining the beauty of our waterways and beaches, this plastic waste may pose threats to the heath of our planet. Plastics in the ocean are broken down into very small pieces called microplastic, which are then eaten by marine life. The health effects of consuming such chemically-produced microplastics are still unknown, but what is known is that microplastics are now everywhere, from the insides of fish to sea salt to human excrement. On some beaches on Hawaii's Big Island, up to 15% of the sand is actually microplastic.

The plastic waste crises can only be said to have been caused by one thing: humanity's irresponsible use of great scientific and technological innovation. The invention of plastic in the late 1800s, and its mass production in the mid-1900s, has improved the world in multiple ways. It has revolutionized medicine, made transportation lighter and more energy efficient, made food easier to transport across the globe, and made space travel possible. Yet, the

remarkable qualities plastic offers, coupled with it's ease and affordability to produce, has also created a disposable culture. Today, roughly 40 percent of plastics produced every year is single-use: bags, straws, bottles, and other packaging that is used on average for less than an hour before being thrown away. If not recycled, scientists say these plastics will take 450 years or longer to fully decompose.

Thankfully, every day more people are becoming aware of the plastic waste problem, and are tackling the issue in many ways. National bodies such as Chile, China, Kenya, and the E.U. has enacted legislation to ban single-use plastics, while many multinational corporations are phasing out non-recyclable plastic products. Scientists are developing new plastics that dissolve on demand, and biodegradable plastics are increasingly available to consumers. Engineers are creating marine collection units to gather plastic waste before it breaks down into microplastic, and celebrity activists such as SZA are creating sustainable fashion lines that spread awareness about disposable synthetic clothing. There are also some signs that the disposable culture is changing from the ground up, as people are increasingly using social media to share the ways they are cutting down on waste.

In this lesson, the music and visuals of the Gorillaz album *Plastic Beach* is used to introduce students to the issue of plastic waste. Students are asked to calculate the percentage of plastic that goes unrecycled internationally, and illustrate a model of polyethylene to better understand why the molecular makeup of plastic creates both benefits and drawbacks. Finally, they evaluate various projects that are currently being undertaken to curb plastic waste, and develop their own similar program or project that they could employ on a local level.

Materials required for this lesson:

- Colored pencils
- Sketch paper

OBJECTIVES

Upon completion of this lesson, students will:

1. KNOW (KNOWLEDGE):

- About the creation, history, chemical makeup, and use of plastics
- About the impact plastic waste has on the environment and on health
- How to visually illustrate plastic molecules
- How various actions are being taken to curb plastic waste
- How students themselves might become involved in fighting plastic waste

2. MASTERY OBJECTIVE

- Students will be able to develop action plans to curtail plastic waste by learning about the environmental threats posed by plastics and by assessing existing projects that seek to eliminate plastic waste.

ACTIVITIES

MOTIVATIONAL ACTIVITY

1. Tell students that for this lesson, they will be looking at how musical artists have addressed environmental issues.

2. Show **Image 1, Screenshot 1 from "On Melancholy Hill."** Ask students:

    - Do you recognize this image from anywhere? What do you see in this image?
    - What animal is featured in this image? What is this animal's natural habitat, and what might have happened to it?
    - Have you ever seen a similar type of image? (*Encourage students to think about other images they might have seen of ocean wildlife caught in plastic, or dead marine animals washed ashore.*)

3. Show **Image 2, Screenshot 2 from "On Melancholy Hill."** Ask students:

    - What do you see in this image?
    - What do you see under the ocean in this image?

4. Tell students that the screenshots come from the music video for "On Melancholy Hill," from the Gorillaz album *Plastic Beach*. Show **Image 3, Lyrics to "Plastic Beach."** Ask students:

    - What kind of place is being described in these lyrics?
    - What is a "Casio"? (*Casio is a company that creates keyboards that are generally considered by musicians to be cheap and, to a degree, disposable.*)
    - Based on the images and the lyrics, what might the song and album "Plastic Beach" be referencing?

PROCEDURE:

1. Display **Image 4, Plastic Ocean**, from the Ocean Conservancy. Ask students:

    - How many metric tons of plastic waste goes into the ocean?
    - Based on this image, can you calculate the percentage of solid waste that comes from plastics? (*If needed, walk through the problem with students by dividing the amount of plastic waste [275 million metric tons] by the total amount of solid waste [2.5 billion metric tons].*)
    - Based on this image, what percentage of plastic waste ends up in the ocean? (*If needed, walk through the problem with students by dividing the amount of plastic waste that goes into the ocean [8*

million metric tons] by the total amount of plastic waste [275 million metric tons].)

- According to the image, in one year 2 billion people along the coasts create 100 million metric tons of plastic waste. How much plastic waste does each person produce within a year? (*If needed, walk through the problem with students by dividing the amount of plastic waste created on the coasts [100 million metric tons] by the total amount of people living on the coast [2 billion].*)

- There are around 2204 pounds in a metric ton. Based on your answer to the previous question, how many pounds on average do people on the coasts produce in a year? (*If needed, walk through the problem with students by multiplying the amount of plastic waste created by individuals (.05 metric tons) by the amount of pounds in a metric ton [2204 pounds].*)

- What are some of the reasons why plastics in the oceans create problems? (*Encourage students to consider the ways marine animals might ingest or get tangled in plastic.*)

2. Tell students that chemically, plastics are **polymers**. **Polymers** are groups of special molecules called **monomers** that can be chained together to create a particular type of material. Plastic usually comes from petroleum, a naturally-occurring polymer based from carbon, but the molecules are engineered through heat to become a completely man-made, or synthetic, polymer.

3. Display **Image 5, Growth in Plastics.** Ask students:

   - Based on this chart, when did the production of plastics take off?

   - Why was plastic invented? What need did it serve?

   - Where are half the world's plastics made today?

4. Tell students that they will now be making a model of **polyethylene**, one of the most common plastics used for packaging.

5. Display **Image 6, Ethylene Monomer**. Display Image 6, Ethylene Monomer. Tell students that the image is a two-dimensional representation of a three-dimensional molecule. Using colored pencils and paper, have students draw an illustration of what they think an ethylene monomer might look like. (For tips on teaching students how to use shading to represent a three dimensional object, we suggest the document found at https://www.artistsnetwork.com/art-mediums/drawing/draw-a-sphere-in-6-easy-steps). Remind students that, while drawing the monomer, they need a way to visually differentiate the hydrogen (H) elements from the carbon (C) elements.

6. Display **Image 7, Polyethylene Polymer**. Using Image 7 as a guide, ask students to now illustrate a three-dimensional representation of what a chain of ethylene monomers, or a polyethylene polymer, might look like. Notice that when an ethylene monomer becomes a polymer, one of the carbon bonds is removed (in image 3, two lines connect the carbon molecules, while in image 4 only one line connects the carbon molecules). This difference should be represented in the drawing.

7. Ask students to share their illustrations of ethylene and polyethylene with the class.

8. Tell students that the flexibility and stability of plastics like polyethylene is what makes it valuable. But it works too well, and is very difficult to disintegrate, and ends up breaking into microscopic pieces, celled "microplastics" which can then be eaten by animals and humans.

9. Have students return to their groups, and pass out to each group one of the following articles:

    - **Your Guide to Navigating the Anti-Plastic Straw Movement**
    - **Here's Why Sza's Plastic-Free Line Could Change the Sustainable Fashion Game**
    - **2,000-Foot-Long Plastic Catcher Released to Aid Cleanup of Great Pacific Garbage Patch**
    - **Designing the Death of a Plastic**
    - **Zero-Waste Bloggers: The Millennials Who Can Fit a Year's Worth of Trash in a Jar**
    - **Ocean Plastic is a Huge Problem. Blockchain Could Be Part of the Solution**

10. Display **Image 8, Article Instructions**. Have students read the article, answer the questions in Image 8, and report to the rest of the class their answers.

SUMMARY ACTIVITY

1. Display **Image 9, Engagement Plan**. Tell students to work with their group to come up with their own engagement plan to tackle plastic waste. Encourage students to draw from the solutions presented in the previous activity for their own engagement plans, and to consider SZA's plans for her fashion sustainability line and the way their engagement plan could similarly excite people about environmental issues.

EXTENSION ACTIVITY

1. Make the engagement plan a reality. Have the class decide which engagement plan they would like to pursue. Organize student roles, next steps, and an engagement calendar to pursue the project as a class.

2. Share updates on your pursuit of the engagement plan with us! Email info@teachrock.org.

COMMON CORE STATE STANDARDS

Math Standards

6.RP: Understand ratio concepts and use ratio reasoning to solve problems.

6.NS: Compute fluently with multi-digit numbers and find common factors and multiples.

College and Career Readiness Anchor Standards for Reading (K-12)

Reading 1: Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

Reading 2: Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

Integration of Knowledge and Ideas 7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Integration of Knowledge and Ideas 8: Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

Integration of Knowledge and Ideas 9: Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity 10: Read and comprehend complex literary and informational texts independently and proficiently.

College and Career Readiness Anchor Standards for Language(K-12)

Language 1: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

Vocabulary Acquisition and Use 6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

College and Career Readiness Anchor Standards for Speaking and Listening (K-12)

Comprehension & Collaboration 1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and

expressing their own clearly and persuasively.

Comprehension & Collaboration 2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. and orally.

Presentation of Knowledge 4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

NEXT GENERATION SCIENCE STANDARDS (NGSS)

MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS-LS1-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

HS-PS2-6: Communicate scientific or technical information about why the molecular-level structure is important in the functioning of designed materials.

HS-ESS3-3: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

NATIONAL CURRICULUM STANDARDS FOR SOCIAL STUDIES – NATIONAL COUNCIL FOR THE SOCIAL STUDIES (NCSS)

Theme 1: Culture

Theme 2: Time, Continuity, and Change

Theme 3: People, Place, and Environments

Theme 5: Individuals, Groups, and Institutions

Theme 7: Production, Distributions, and Consumption

Theme 8: Science, Technology, and Society

Theme 10: Civic Ideals and Practices

COLLEGE, CAREER & CIVIC LIFE (C3)

Dimension

D4.1.6-8: Construct arguments using claims and evidence from multiple sources, while acknowledging the strengths and limitations of the arguments.

D4.6.6-8: Draw on multiple disciplinary lenses to analyze how a specific problem can manifest itself at local, regional, and global levels over time, identifying its characteristics and causes, and the challenges and opportunities faced by those trying to address the problem.

D4.6.9-12: Use disciplinary and interdisciplinary lenses to understand the characteristics and causes of local, regional, and global problems; instances of such problems in multiple contexts; and challenges and opportunities faced by those trying to address these problems overtime and place.

D4.7.6-8: Assess their individual and collective capacities to take action to address local, regional, and global problems, taking into account a range of possible levers of power, strategies, and potential outcomes.

D4 .7.9-12: Assess options for individual and collective action to address local, regional, and global problems by engaging in self-reflection, strategy identification, and complex causal reasoning.

NATIONAL STANDARDS FOR MUSIC EDUCATION – NATIONAL ASSOCIATION FOR MUSIC EDUCATION (NAFME)

Core Music Standard: Responding

Interpret: Support interpretations of musical works that reflect creators' and/or performers' expressive intent.

Core Music Standard: Connecting

Connecting 11: Relate musical ideas and works to varied contexts and daily life to deepen understanding.