



## Creative Lessons To Open Classrooms & Minds To The World.

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# Tenth Grade Lesson Plans

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#### LESSON PLAN TITLE

### Fighting the Garbage Monster - A Lesson in Two Parts

#### DESIGNERS

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#### SUMMARY AND RATIONALE

This lesson is composed of two parts. In the first part, students learn how their actions at the local level (trash) can impact other areas of the world. In the second part, students concretely measure that impact and try to create and implement a solution. Depending on the goals of the teacher, more time might be spent on Part I with students tracking trash from the local watershed to the ocean and look at the action project as an extension. Alternatively, if the teacher wishes to focus more on the action-oriented aspect, they might briefly introduce Part I and spend more time with Part II where students create a plan, carry it out, gather data and reflect on the results.

#### GRADE

7th-12ed

#### TIME FRAME

One class period can be budgeted for the initial investigation. One class period for the trash audit and one for the Socratic seminar. Multiple class periods (and as much as much as multiple weeks) may be used for Part II the action-oriented part of the lesson depending on how much data you wish students to gather and if they are to present to stakeholders outside of the classroom

#### **SUBJECTS**

Biology Environmental Science Geography Chemistry Engineering

#### SUSTAINABLE DEVELOPMENT GOALS

• The Learner is able to contextualize their needs within the needs of the greater surrounding ecosystems, both locally and globally, for more sustainable human settlements.

• Students will be able to describe the interconnectedness of artificial and natural systems, as well as the interconnectedness of local and global systems.

#### INSTRUCTIONAL GOALS

• Students will be able to explain the geography of their local watershed and its connection to the world's oceans, animals and ecology.

• Students will be able to assess the impact of their community's waste production on other parts of the world and design possible local solutions.

• Students will be able to identify a quantifiable goal to reduce plastic and/or other solid waste in their school/community.

• Students will evaluate the effectiveness of their plans based on quantitative data gathered.

#### **STANDARDS**

• MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

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

• MS-ESS3-4.Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

• HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

• HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

• HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

• HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

• 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.

#### UNDERSTANDING

• Students will be able to explain the connection of their local watershed to the ocean.

• Students will be able to internalize that their actions on a local level have global consequences.

• Through extensions, students will be able to develop an action plan on a related topic that interests them.

• Students will understand that actions taken on a small scale locally can have far-reaching benefits as well as consequences.

• Students will be able to explain that "taking action"/ activism can take many forms and requires an understanding of the barriers to the solution.

#### **ESSENTIAL QUESTIONS**

- Why is it important to preserve all components of the local and global ecosystem?
- How do actions you take on a local level affect the environment on a global level?

• What can, and should people be doing to improve local and global environment conditions?

• What are the possible forms of action a person can take to solve a problem?

• What forms of action are effective?

#### STUDENT LEARNING OBJECTIVES

• Students will be able to describe how trash related in their local ecosystem could travel to the ocean.

• Students will be able to describe the Pacific Ocean Garbage Patch.

• Students will be able to develop an action plan for decreasing trash and debris in the world's oceans.

• From The Asia Society's "Global Performance

System Rubric" for 10th grade science in the domain of "Take Action":

• Develop an action plan that details individual and collaborative actions or policy based on experimental or research findings that increase awareness and improve local and/or global conditions.

• Evaluate available technology and personal views to determine the impact on actions and to consider additional ways to address alternate viewpoints or solutions to the science issue.

Implement an action plan in creative or innovative ways and collects data and analyzes it to determine the impact of actions on the local or global science issue and identify possible unintended consequences.
Articulate how the project influenced feelings, thinking, choices, actions and awareness of alternative thoughts and ideas.

#### ASSESSMENT

- Students could create a journal entry describing an understanding of the learning objectives above.
- Students could create an advertisement (paper or digital) explain the problem and possible solutions.

#### FOR PART II

The following checklist from the Asia Society (http://asiasociety.org/files/science-10-rubric.pdf) could be used:

PLANNING	EVIDENCE OF IMPLEMENTATION	REFLECTION
<ul> <li>Considers previous actions and/or barriers</li> <li>Steps clearly described</li> <li>Student identifies personal steps</li> <li>Student identifies collaborative steps</li> <li>Plan is implementable</li> <li>Appropriate forms of media communication chosen</li> <li>Appropriate forms of data collection</li> <li>Plan is clearly linked to quantifiable goal (i.e. reduction of waste) informed by earlier audit</li> <li>Bonus: creativity of plan</li> </ul>	<ul> <li>Concrete evidence from a third party observer (letter, review, interviews)</li> <li>Transparent data gathered</li> <li>Other documentation (i.e. photos, journaling, etc.)</li> </ul>	<ul> <li>Honest analysis of data/ documentation</li> <li>Explores change in viewpoint</li> <li>Articulates limitations and/or notes suggestions for improvement</li> <li>Evaluates unanticipated consequences of action taken</li> </ul>

#### PART I - BACKGROUND

The learner will trace the journey of a piece of trash from their own local watershed to the ocean. They will be investigating the larger question of how garbage can get from their hands to the oceans if it is not properly disposed of (and sometimes even when it is), directly demonstrating their own interconnectedness with natural systems and the connectedness of their own local watershed with global ones.

#### **SEQUENCE OF ACTIVITIES**

## Use the following or something similar (another video or article) to introduce the lesson:

https://www.nationalgeographic.com.au/animals/ how-did-sea-turtle-get-a-straw-up-its-nose.aspx

https://www.washingtonpost.com/video/national/ researchers-remove-straw-from-sea-turtlesnose/2017/06/13/8d4fdcae-5077-11e7-b74e-0d2785d3083d\_video.html?noredirect=on&utm\_ term=.02f06cf56039 • Pose the questions to students: "Where do you think that straw came from? Could it have come from here? IF it came from here, HOW could it have gotten to the turtle?"

• Have students use computers or tablets with internet access to trace where the rivers in their local watershed go until they exit to the ocean.

• Look at ocean currents and determine where trash might go from where the trash enters the ocean.

• Have students create maps showing the journey of garbage from their hometowns to the ocean. Challenge them to look for the furthest place they can trace a direct route to.

• Have students discuss implications for improper disposal of garbage on local watersheds as well as the oceans via a Socratic Seminar. (see attached resources for directions on Socratic Seminars)

• Investigate the Great Pacific Garbage Patch and develop a publicity and action campaign.

• Investigate the use of plastics in our society and try to recommend alternatives.

• Investigate where recycled plastics go and what they can be used for and create a publicity campaign.

• Create a publicity and action campaign challenging other students to eliminate plastics from their lives. Is it even possible? Collect feedback.

• Research the garbage patch, plastics or other related issues. Write letters to their legislators asking for change, citing scientific data.

#### **RESOURCES FOR STUDENTS**

List print or online resources that can support students in carrying out the activities (see teacher resources below).

Resources will vary based on geographic location. There should be a state department in charge of keeping data for your local watershed. Have students choose the closest stream or river to them and trace where it goes until it gets to the ocean. Students could be given a map to trace the path, so they can see this graphically. Then they should look at the ocean currents in the region where the final river enters the sea to determine where their trash might go from there.Resources will vary based on geographic location. There should be a state department in charge of keeping data for your local watershed. Have students choose the closest stream or river to them and trace where it goes until it gets to the ocean. Students could be given a map to trace the path, so they can see this graphically. Then they should look at the ocean currents in the region where the final river enters the sea to determine where their trash might go from there.

#### PART II - ACTION PLAN

#### OVERVIEW

#### **SEQUENCE OF ACTIVITIES**

1. Review conclusions reached during Part I (it may be worth doing a school audit) 5- 10 minutes

2. Examples of Different Types of Actions (10 -20 minutes)

 > Videos of different types of actionsreducing waste by reusing materials, creating biodegradable alternatives, engineering design to remove existing waste

3. Student plan action to reduce plastics (see following page). Depending on the class size and atmosphere, they will carry out the action in groups or as a class. Some examples students could pursue: placing recycling bins in classrooms and creating an environmental club to empty them, replacing plasticware and serving trays with reusable silverware or paper trays, campaigning local government for a bag ban, creating a video to encourage classmates to use reusable bottles.

4. Students Carry Out the Determined Action-Depending on time, class size, and initiative of students, the action plans could be carried out during class or outside of school.

5. Students fill out Reflection Sheet-depending on time and scale of project, this could also be a presentation made to the class or other stakeholders

GROUP PROTOCOL	WHOLE CLASS PROTOCOL
<ul> <li>a. Provide individual students with paper/</li></ul>	<ul> <li>a. Provide individual students with paper/</li></ul>
whiteboards/computer to brainstorm possible	whiteboards/computer to brainstorm possible
solution actions for 5 minutes <li>b. Students join groups of 3 to 4 students and</li>	solution actions for 5 minutes <li>b. Students share ideas with whole class 10</li>
share ideas 10 minutes <li>c. Groups will evaluate and select a plan (as a class</li>	minutes <li>c. Class deliberates and selects an action plan (as</li>
or in groups) 10-20 minutes	a class or in groups) 10-20 minutes
Questions to ask in groups:	Questions to ask class:
• Is the plan concrete?	• Is the plan concrete?
• Does the plan involve data gathered from the	• Does the plan involve data gathered from the
audit?	audit?
• Is the plan implementable?	• Is the plan implementable?
<ul> <li>d. Groups fill out the Action Plan sheet 45 minutes</li> <li>e. Once the Action Plan sheet is filled out, groups should conference with the teacher for critique and approval using the assessment rubric for "Planning" provided earlier. If action plan is unsatisfactory, the teacher could instruct students to rewrite it.</li> </ul>	D. The class discusses how to fill out the action plan

#### **DIFFICULTIES WITH LESSON**

Students may have plans such as "Recycle" or "Stop Using Plastic" which is not specific enough, so it will be important to have a check-in conference with individual groups before they try to implement their plan.

- You may need to prompt with further questions such as: • What specific objects will you target for recycling/ reduction etc.?
- How will you ensure that it is recycled/reduced etc.?
- How will you get buy in from others to recycle/reduce those items?

Another option is to present example action plans before students begin brainstorming. See included materials below. One example uses an unrelated problem (so students won't copy the example). Another example is a possible action related to the trash project. Ask student:

• What makes the "Meets" side better than the "Do not meets"?

• Are any of the answers connected to each other? How? (i.e. if people thought impoverished shouldn't have to buy bags, action is to give away free reusable bags)

#### **RESOURCES FOR STUDENTS**

#### INITIAL QUESTIONS FOR BRAINSTORMING & EVALUATING IDEAS

#### **PLANNING A SOLUTION**

• What is your goal? Relate it to your findings during the trash audit. Express in quantifiable terms (i.e. how many kg of plastic waste will be reduced or removed).

- Why is this goal important for your community and the planet?
- What has already been done in your area to help reduce plastics or other solid waste?

• What barriers/obstacles existed then or now that might get in the way of your plan? Think of physical, economic or cultural barriers (i.e. people think a bag ban will restrict their freedom).

• What form will your action take? Is your solution education/advocacy/engineering/behavioral modification?

- Describe concrete steps to your plan.
- What steps can you personally take towards the goal?
- What steps require the assistance of others? How will you enlist their help?
- What forms of media will you use to communicate with others? Why?
- What do you need to learn?
- What resources/materials do you need? How will you acquire them?
- How long will it take you to implement your plan?
- What forms of evidence can you gather to show that you attempted your plan?

• What forms of evidence can you gather to show the impact of your plan? How will you collect and record data?

#### **REFLECTION AFTER THE EXPERIMENT**

• What parts of your plan went well? Why?

According to the data you gathered, what progress did you make towards the goal we set? Please explain how the data was collected and informs conclusions.

- 1. Was the goal realistic?
- 2. Could the goal be reached if given more time?
- 3. How might the progress you made impact the global concern of trash/solid waste/plastic?
- 4. What barriers or obstacles did you come across as you tried to implement your plan?
- 5. How did you try to overcome these barriers/obstacles?
- 6. What unanticipated consequences or benefits came about because of your plan?

7. If you were to repeat your plan, what changes would you make?

8. Overall, how did this project impact your view of yourself as someone who could take action and create change?

9. How did this project impact your view on the problem of solid waste/plastic on the global scale and the future?

#### PLANNING A SOLUTION - TEACHER EXAMPLE A

This is an example to show to students to give greater clarity of expectations and depth of answers.

What is your goal? Relate it to your findings during the trash audit. Express in quantifiable terms (i.e. how many kg of plastic waste will be reduced or removed). Why is this goal important for your community and the planet?

DOES NOT MEET	MEETS	DOES NOT MEET	MEETS
Get students to do homework	Increase the amount of homework completion from 20% to 90%	Students need to do homework	Homework provides important practice for students outside of school, reinforces instruction in long term memory, and prepares students for in class learning activities. Students who do meaningful homework assignments learn more.

What has already been done in your area to help reduce plastics or other solid waste(or in this case increase homework completion)?

DOES NOT MEET	MEETS
Lots.	Students have planners. Teachers maintain websites with homework assignments. Teachers call home when students do poorly in class.

What barriers/obstacles existed then or now that might get in the way of your plan? Think of physical, economic or cultural barriers (i.e. people think a bag ban will restrict their freedom).

DOES NOT MEET	MEETS
Students don't like to do homework.	Some students refuse to carry backpacks and planners because they think they aren't cool. Many students have lots of sports/ jobs/activities and little time to do work. Some students don't have support at home. Some students believe homework is just "busy work". Some students don't have access to internet at home and can't access the website.

What form will your action take? Is your solution education/advocacy/engineering/behavioral modification? How will it help reach the goal? Describe concrete steps to your plan.

DOES NOT MEET	MEETS	DOES NOT MEET	MEETS
Make students write in their planners every day before class	Create a 25 minute time slot for whole school where students can complete "homework" and ask teachers for additional help. Students who have difficulty arranging rides for after school support will be able to see teachers. They will still be at school and have access to the internet and websites.	<ol> <li>Hand out planners.</li> <li>Tell students to take them out at the beginning of class each day</li> </ol>	<ol> <li>Draft a schedule that consider lunch and other conflicts</li> <li>Discuss with school "Time and Space" committee</li> <li>Meet with school board for schedule change approval</li> <li>Explain new schedule to students</li> <li>Arrange make up times with students during time</li> </ol>
			slot

What steps can you personally take towards the goal?

DOES NOT MEET	MEETS
Tell students to do homework	Draft the schedule Have more one on one conversations with students Create presentation for school board

What steps require the assistance of others? How will you enlist their help?

DOES NOT MEET	MEETS
School order planners	Need buy in from other teachers. Ask them to look over proposed schedule. Explain reduction of calls home and after school time supporting students. Need school board approval. Explain increased learning and no increase in teacher hours as some time will come from contract hours.

What forms of media will you use to communicate with others? Why?

DOES NOT MEET	MEETS
Whiteboard	Emails to other teachers and board members Prezi for board meeting- engaging

DOES NOT MEET	MEETS
A lot	Potentially 1 year as will have to wait until new school year to begin to make schedule changes. Then will need 1 month to gather data

What forms of evidence can you gather to show that you attempted your plan?

What forms of evidence can you gather to show the impact of your plan? How will you collect and record data?

DOES NOT MEET	MEETS
Students' homework	"Time and Space" committee meeting minutes School Board meeting minutes Documentation of arranged times with students

DOES NOT MEET	MEETS
A lot	Create a spread sheet of all homework assignments and number of students completing each assignment BEFORE schedule change and AFTER schedule change

How long will it take you to implement your plan?

#### PLANNING A SOLUTION - EXAMPLE B

This is an example to show to students to give greater clarity of expectations and depth of answers.

What is your goal? Relate it to your findings during the trash audit. Express in quantifiable terms (i.e. how many kg of plastic waste will be reduced or removed).

Stop using plastic bags	Decrease the use of plastic bags from 100 kg a week to 20 kg a week at the local grocery store
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Why is this goal important for you community and the planet?

Plastic is bad for the ocean.	A lot of our trash is plastic bags which won't decompose. We find lots of plastic bags around town. They can strangle ocean life.
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What has already been done in your area to help reduce plastics or other solid waste?

What barriers/obstacles existed then or now that might get in the way of your plan? Think of physical, economic or cultural barriers (i.e. people think a bag ban will restrict their freedom).

I don't know	People have already spoken to the town council to introduce a bag ban or charge 10 cents per bag, but it was voted down.
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People like convenience.	People think reducing plastic is important, but they believe a bag ban will restrict their freedom. Some have said poor people shouldn't have to choose between buying grocery bags and food.
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What form will your action take? Is your solution education/advocacy/engineering/behavioral modification?

Tell people toNuse reusableobagsgaaaa	We will set up a media center at the local grocery store for 1 week and distribute free reusable bags.
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Describe concrete steps to your plan.

Tell	1. Carry out fundraisers or
people	approach local business to
to use	donate to purchase of reusable
reusable	bags.
bags	2. Create a video presentation to
	display on laptop about reusable
	bags.
	3. Find a company to make
	reusable bags online or locally
	and make an order
	4. Contact grocery store to ask
	permission to set up table.
	5. Hand out reusable bags for
	free to customers.

What steps can you personally take towards the goal?

Take reusable bags to the store.	Contact individual businesses
-	Write script and film video.

What steps require the assistance of others? How will you enlist their help?

Other people- tell them plastic is bad	Contacting the grocery store-tell them our free bags may reduce their costs Business donations-offer to put names of businesses on reusable bag Art department or Graphics Design at vocational school - to design bags.

What forms of media will you use to communicate with others? Why?

Talking?	Phone calls and emails for grocery store and businesses - need to write script Video is engaging, and we might get tired explaining to lots of people

Nothing. I know that	Who makes reusable bags and how much they cost?
plastic is bad.	How to use graphics design software

What do you need to learn?

What resources/materials do you need? How will you acquire them?

Bags	Funding from local
	businesses
	Access to graphics
	design software
	-

How long will it take you to implement your plan?

1 day to get bags	1 week to contact businesses A couple days to design bags Time it takes for bags to be made 1 week at grocery store 1 months' worth of data
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What forms of evidence can you gather to show that you attempted your plan?

Picture of people with reusable bags	Emails Photos of finished bags and photos of us at supermarket
Uags	supermarket

What forms of evidence can you gather to show the impact of your plan? How will you collect and record data?

Count bags	Ask supermarket to tell us how many bags they use in 1 week before plan (boxes opened) Ask supermarket how many bags were used each week for 4 weeks
U	before plan (boxes opened) Ask supermarket how many bags were used each week for 4 weeks

#### **RESOURCES FOR TEACHERS**

- https://www.nationalgeographic.com.au/animals/how-did-sea-turtle-get-a-straw-up-its-nose.aspx
- http://time.com/5339037/turtle-video-plastic-straw-ban/
- https://www.plasticsoupfoundation.org/en/files/what-to-do-with-plastic-waste/
- https://news.nationalgeographic.com/news/2015/01/150109-oceans-plastic-sea-trash-science-marine-debris/
- https://www.usatoday.com/story/tech/science/2018/03/22/great-pacific-garbage-patch-grows/446405002/
- $\bullet\ https://the west.com.au/news/sound-southern-telegraph/city-of-kwinana-initiative-nets-impressive-results-ng-b88919325z$
- $\bullet\ https://www.usnews.com/news/news/articles/2018-09-08/massive-boom-will-corral-pacific-oceans-plastic-trash$
- https://www.sltrib.com/news/2019/01/06/huge-trash-collecting/
- https://2minuteshowersongs.com/
- https://www.facinghistory.org/resource-library/teaching-strategies/socratic-seminar

#### SCHOOL WASTE AUDIT

STUDENT GROUP:

#### DATE:

#### DIRECTIONS

1) Collect garbage from a variety of locations around the school (cafeteria, classrooms, gym, hallways, etc.)

2) Separate garbage into appropriate waste streams (compost, recyclable plastics, nonrecyclable plastics, glass, landfill, milk cartons, etc.)

- a. Place each waste stream in large bags so they can be weighed
- 3) Using a fish weight scale, weigh and record each waste stream
  - a. Determine the overall weight and the percentage of total waste for each waste stream
  - b. Determine the appropriate destination for each waste stream

				BEST D	ESTINATION FOR WASTE			
WASTE STREAM	WEIGHT (POUNDS)	PERCENTAGE OF TOTAL WASTE	LANDFILL	RECYCLE	REUSE	REDUCE	COMPOST	OTHER

TOTAL WEIGHT COLLECTED:

