

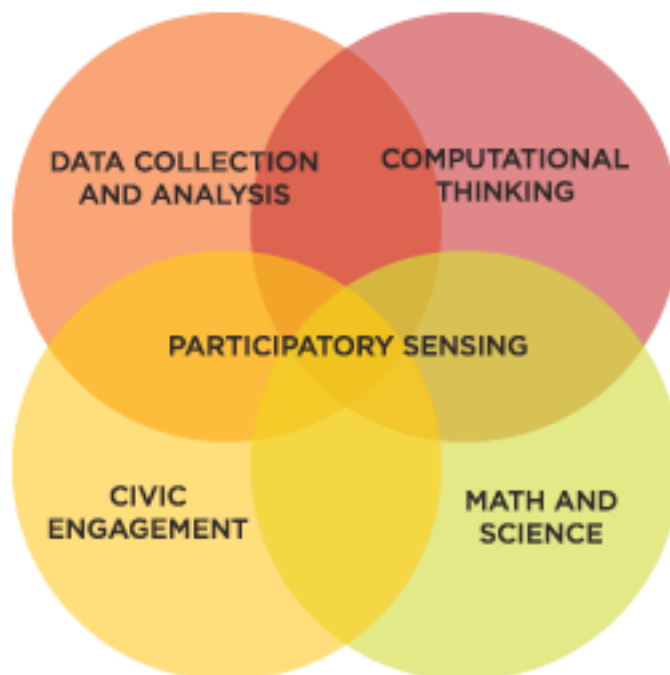


Office of Curriculum, Instruction, and School Support



**Mobilizing for Innovative Mathematics/Science Teaching and Learning
A Partnership between LAUSD and UCLA**

MOBILIZE 2014-2015 Science Curriculum





Science Curriculum

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Welcome

Welcome to Mobilize

Mobilize is an innovative partnership between UCLA and LAUSD that is funded by the National Science Foundation to develop barrier-breaking curriculum in science, mathematics, and computer science to teach students to think creatively, constructively, and critically about the role of data in science and in every-day life. Mobilize centers its curricula around participatory sensing campaigns, in which students use their mobile devices to collect and share data about their community and their lives, and analyze these data to gain a greater understanding about their world.

Mobilize breaks barriers by teaching students to apply concepts and practices from computer science and statistics in order to learn science and mathematics. Mobilize is dynamic: each class will collect its own data, and each class will have the opportunity to make unique discoveries. We use mobile devices not as gimmicks to capture students' attention, but as legitimate tools that bring scientific enquiry into our every-day lives.

In addition to addressing particular science education standards, Mobilize will lead students to:

- understand how data are used by professionals to address real-world problems;
- understand that data are used in all facets of modern life;
- understand how data support science to identify and tackle real-world problems in our communities;
- analyze statistical graphics to identify patterns in data and to connect these patterns back to the real world;
- understand that by treating photos, words, numbers, and sounds as data, we can gain insight into the real world.
- learn to analyze data, including: posing questions that can be answered by considering relations among variables in a dataset, using collected data to generate hypotheses for future data collection, critically evaluating shortcomings and strengths in the data and the data collection process, and informally evaluating hypotheses using data at hand



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Unit Overview

Standards:

ESS3.C: Human Impacts on Earth Systems

The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.

Science Learning Objectives:

Students will learn what trash, recyclable, compostable and upcycled items are. Through laboratory investigations and data collection of their habits, students will quantify the amount of trash they generate on a daily basis, explore their disposal habits, consider the ramification of the products they consume, and develop a plan to reduce the impact their trash has upon the environment. Students will be able to identify that the rate of trash generation in our country far exceeds the rate at which nature can biodegrade. Students will learn that the manner in which we handle our trash potentially affects biodiversity and the environment that supports it.

Mobilize Learning Objectives:

Students will understand that data, especially those collected through **Participatory Sensing**, can be used to understand daily habits and real-world processes. Personal data can be compared to national or local practices to (what would be the goal for this...to understand how individual patterns relate to national, local trends?). Students will learn to be critical about what data show as well as what they do not show. They will be able to identify patterns in data so that they may be able to evaluate the use of data as evidence in claims. They will know how to interpret statistical graphs to gain understanding about real-life processes. They will know how to formulate questions and hypotheses that can be addressed by the data at hand.

Technology Requirements:

- Computer
- LCD projector
- Speakers
- Internet
- Class time in computer lab/cart (2 -3 days)
- Smartphones or mobile devices i.e. tablets, iPod touch

Time Requirements:

Approximately 9 90-Minute Periods

Background and Prerequisites:

This Mobilize unit is designed to empower students to consider the impact of human activity on the environment. Students will have the opportunity to connect many ideas from the Biology course in a meaningful way. Students are introduced to the concept of civil engagement through the use of **Participatory Sensing** via the Mobilize APP. Students begin the process considering the impact of Big



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Unit Overview

Data on their lives and how we can use technology to tackle difficult problems. Upon completion of the unit introduction, students will predict the amount of trash they generate on a daily basis. Using the Mobilize APP, students will have the opportunity to gather data about their trash generation, identify their consumption habits, compare their personal data to the class, read about various ecological impacts trash has upon their community and the ecosystem, explore national waste data and create research questions regarding trash. Armed with data collected at the school site, students will seek solutions to an environmental problem they have identified regarding waste.

To maximize the efficacy of this unit, students should have been taught the following topics prior to starting the unit:

- a. Photosynthesis: Plants absorb carbon from the air and via photosynthesis incorporate it into plant materials that are also usable to other consumers.
- b. Food Web and Energy Pyramid: Energy moves through the ecosystem through feeding relationships. Much energy is lost as it moves through the trophic levels. A healthy ecosystem depends upon decomposers that constantly cycle matter through the ecosystem. Producers are necessary in converting light energy into chemical energy and are the food source for most other consumers in the food web.
- c. Carbon Cycle: Carbon moves through the ecosystem in many different ways. The carbon cycle is composed of both natural processes such as volcanic eruptions and photosynthesis as well as human processes such as burning of fossil fuels.

If your students have not covered the topics above, some support materials have been provided in the reference section.

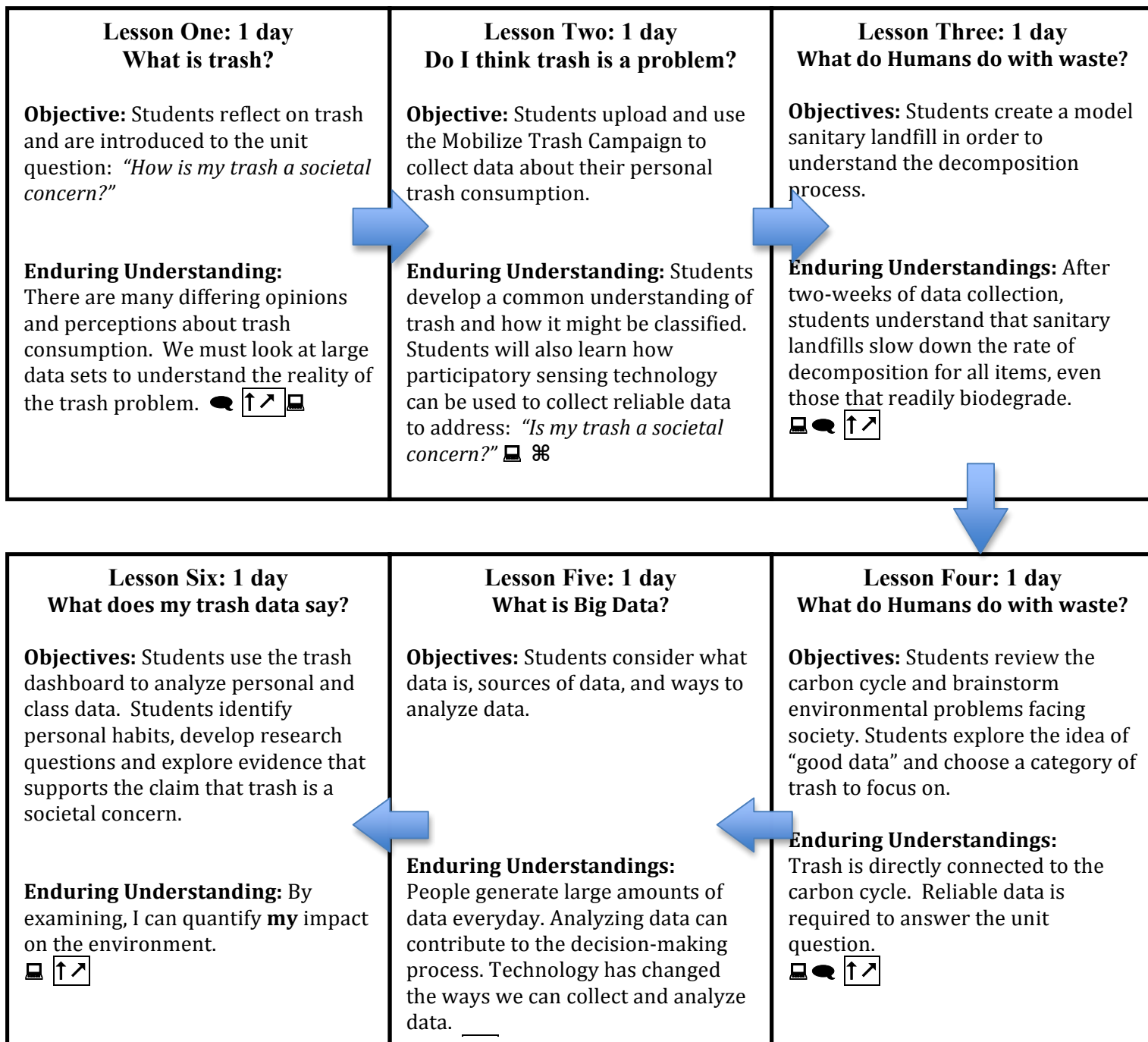
Cooperative Grouping and Teamwork:

This unit will require students to work in small teams in many portions of the unit. There are many forms of cooperative grouping used in the classroom. The particular type may vary as long as students have assigned roles and are accustomed to the requirement of individual and shared tasks. Examples of opportunities to use cooperative grouping are interspersed throughout the unit. Should this type of grouping be new to your classroom, please refer to the reference section for support materials.



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Lesson Flow Diagram



Legend

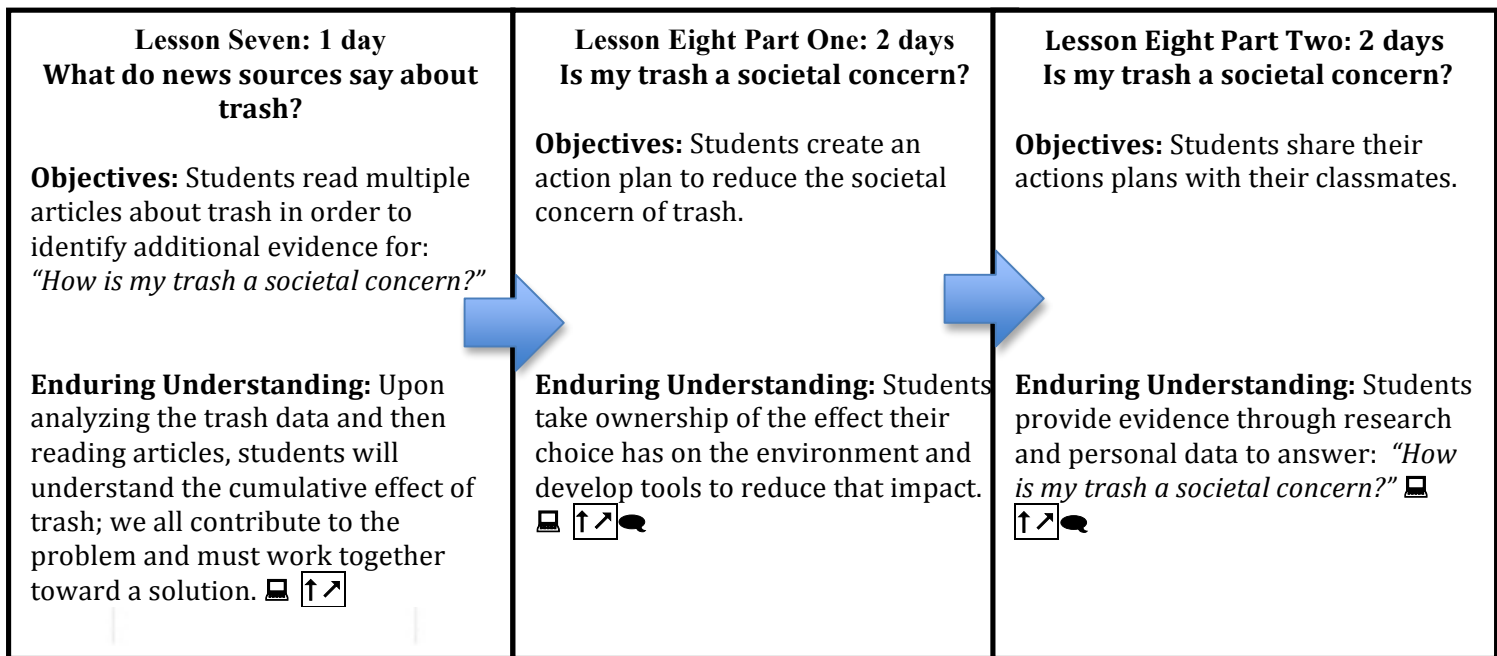
⌘ = Cell phone/mobile device 🗨️ = discussion 📱 = tech/computer use

↗️ = data collection/analysis 📖 = reading



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Lesson Flow Diagram





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Lesson 1: What Do I think About Trash?

Time: 1 90-minute period

Lesson Overview

Students view photographs of various types of trash and the context in which it was generated and then record their observations or thoughts. Next, students will work collaboratively to guess how much trash each student creates in a day. Teams create a class visualization of these guesses and consider how they could collect actual data instead of their guesses. The unit question: *“Is my trash a societal concern?”* is introduced as the area of focus for the entire unit. Students are introduced to the idea that to answer questions such as our unit question, we must have a way to collect reliable data. Guessing the items of trash we create, merely allows us to form an opinion, not a claim, as it is not centered based on data. (Science Practice: Analyzing Data and Creating Explanations)

NGSS Standards:

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals:

- understand how data supports science to identify and tackle real-world problems in our communities;
- analyze statistical graphics to identify patterns in data and to connect these patterns back to the real world;

Enduring Understanding

There are many differing opinions and perceptions about trash and our consumption habits that generate it. We can better understand our consumption through collecting and analyzing data. We must look at large data sets to understand the totality of the trash problem.

Language Objective

1. [CSS.ELA-Literacy.CCRA.SL.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.

Materials:

- Computer with Biology Trash PowerPoint
- LCD Projector
- Post Its
- Poster Paper
- Markers



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Lesson 1: What Do I think About Trash?

Performance Task/Essential Question

"What Do I think about trash?". Through photographs, group discussions, exploring estimates, and graphic visualizations, students explore their current perceptions of trash.

Vocabulary (in context of this lesson)

- Values-a numeric amount that may be mathematically manipulated or visually represented.
- Guess-a value chosen by an individual that may or may not be based on logic
- Estimate-a guess based on logical rationale or prior experience
- Data-information gathered through observation or measurement
- Quantitative-providing numeric values rather than descriptors
- Graph- a type of visualization that typically displays data. In this lesson students graph their estimates



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Lesson 1: What Do I think About Trash?

Lesson 1— One Day	
Teacher/Student Activities	Time / Notes
<p>Engagement:</p> <ol style="list-style-type: none"> 1. Inform the students that an important skill or trait that future employers are looking for is the ability to contribute to a team to complete a task. To build this skill, students will work collaboratively in teams of four to five. Within this team, each person will have an assigned role and jobs to help the team complete their tasks during key experiments and their final project. <ol style="list-style-type: none"> a. Remind the class of the different roles in their group. Possible cooperative group roles include: (see student job description) <ol style="list-style-type: none"> i. Team Manager ii. Procedure Specialist iii. Supply Master iv. Recycling Engineer 2. 4 Square Brainstorm: Using the Mobilize Biology Trash PowerPoint, guide the students to complete the 4 square trash introduction. Instruct the Supply Masters to retrieve the materials from your designated location. Circulate around the room while the teams are completing the poster. Make sure that the entire team is contributing and that the assigned role is simply recording for the group. After two to three minutes, progress to the next slide to help teams generate more ideas. <ol style="list-style-type: none"> a. Purpose: The Powerpoint presentation in this lesson provides students an opportunity to view photographs of trash and explore their initial opinions and ideas they have surrounding the unit question. Images range from open landfills to photographs of trash washed upon the shore. b. The following members are responsible for recording the ideas of the group in the appropriate box. <ol style="list-style-type: none"> i. Team Manager-Box 4 What are Challenges related to trash? ii. Procedure Specialist-Box 3 What are benefits of trash? iii. Supply Master-Box 2 What questions do you have about trash? iv. Recycling Engineer-Box 1 What do you know about trash? 3. Project PowerPoint images of trash/landfill. For each slide, students will write down in their science notebooks one observation or opinion for each image in complete sentences. This is individual task. <ol style="list-style-type: none"> a. ELD connection: Give the students possible sentence starters to guide their thinking: <ol style="list-style-type: none"> i. This image is related to... ii. This photo is not related to me because... iii. I believe... iv. I observe... 	<p><u>Time Suggestion:</u> 15 minutes Total</p> <p>Cooperative group work</p>
<p>Team Brainstorm: Round Robin:</p> <ol style="list-style-type: none"> 4. Proceed to the slide with the team Brainstorm topic, “Trash, is it something to worry about?” Working in student groups, review the following rules, checking for 	<p><u>Time Suggestion:</u> 15 minutes</p>



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Lesson 1: What Do I think About Trash?

<p>understanding by asking a student from each team to repeat and explain their understanding of the rule or the implication for their team.</p> <p>Review the Team Rules:</p> <ol style="list-style-type: none">1. Each role will have a number: Recycling Engineer 1, Supply Master 2, Procedure specialist 3, Team Manager 4.2. You will be given a topic to brainstorm, “Trash, is it something to worry about?”. First write down your ideas individually for 2-3 minutes. No talking or discussing ideas yet.3. Next you will put your ideas together as a team. You will have 5 minutes to develop a team strategy for providing answers.4. I will call on each team for <u>one</u> idea and move to the next team for a different idea.5. Team member 1 will provide the first idea in round one. Team member 2 gives the second idea, in round two, and so on. Strategize to ensure that no one on your team will run out of ideas to share. <p>Explain the Team Points:</p> <ol style="list-style-type: none">1. Teams will gain a point for each idea shared.2. Repeating an idea already given by a previous team will cause you to lose a point, so <u>LISTEN</u> carefully.3. ‘Pass’ if your team member has no ideas. No points gained or loss.4. Wait time for each idea is 5 seconds. (Count down “5-4-3-2-1”.) <p>Points are an excellent management tool. It ensures teams are listening to all of the answers, so they won’t repeat an answer. It also prevents students from shouting out answers, which would also results in the loss of a point. In that each answer must be given within 5 seconds, teams stay on task</p> <p>Exploration:</p> <ol style="list-style-type: none">5. Upon completing the Round Robin activity, students will transition from thinking about trash abstractly and begin to make more personal connections to the trash in their lives. Ask the students to individually respond to the following question:<ol style="list-style-type: none">a. <i>How much trash do you think you generate on a daily basis? How did you determine the amount or value of that number?</i>6. Ask at least five Supply Masters to share their values. Be sure to guide students into considering the variety of answers. It is likely that many students will respond with qualitative answers such as “a lot, many, grip load”.<ol style="list-style-type: none">a. <i>Point out that there are different ways to quantify the amount of trash by weight or number of items or even number of trash bags.</i>b. <i>Ask the students to revise their predictions in writing so that their responses are a quantitative value, i.e. an actual number, of individual items thrown away.</i><ol style="list-style-type: none">i. Team Manager will assist and ensure the team’s tasks are completed.ii. Procedure Specialist will sum the predictions for the team creating a group total and round to the nearest 10.iii. The recycling engineer will use small post its to create a bar graph. Each post it represents 10 trash itemsiv. The supply master will create a post it label for the x-axis with first	<p>Guidelines, which are set for classroom discussion, generate an equitable environment for students to share ideas. They ensure that all students are included in the discussion. Setting clear student expectations is critical in building an environment in which students can explore and discuss ideas, build arguments, and critique the thinking of others.</p> <p><u>Time Suggestion:</u> Brainstorm- 3 min</p> <p>Note: Do not provide ideas for students. Critical thinking must be fostered. Students will build on their ideas or gain new insights from team members during the team strategy time.</p>
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Lesson 1: What Do I think About Trash?

names of each team member.	
<p>v. <i>Class data should be displayed as a bar graph. Leave room on the x-axis for each group number.</i></p> <p>1. <i>Note:</i> The bar graphs represent the best guess or predictions made by your students. Because the students did not generate these values from observations we should refrain calling from referring to these values as estimates or data.</p> <p>7. Ask the teams to look at the group totals and predict in their notebooks:</p> <p>a. How much trash does a student in this class make in a 24-hour period?</p> <p>i. Avoid using the term average here. Depending on the shape of your bar graph, students may use the median, mean, mode or some other means to select a value.</p> <p>b. How did your team determine that number?</p> <p>c. How accurate do they believe that this number is?</p> <p>8. Ask the team to discuss the answer and inform them that the recycling engineer is responsible for sharing their team's suggestions and ideas to the class. After hearing several teams, if data collection methods have not been brought up, ask the students to consider:</p> <p>a. How would you collect data to help you better estimate the amount of trash per person? What would you record? How often? Who would you record?</p> <p>b. This unit will use smart phones to track the amount and variety of garbage generated by each student over time so that they can become informed of their habits, practices and tendencies and ultimately determine whether or not there are any issues with the amount of trash we create on a daily basis.</p>	
<p> HOMEWORK:</p> <p>In your science journals:</p> <p>1. Recall: How did your team develop their estimate for the amount of trash generated in one day?</p> <p>2. Explain: Explain whether you think a guess is different than a prediction.</p> <p>3. Opinion: Why do you think that the amount of garbage per person has increased dramatically over the last 40 years?</p> <p>4. Wonder: How could we use technology to collect better data regarding the amount of garbage we each produce?</p> <p>Remind students to bring their phones tomorrow!</p>	



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Lesson 2: Do I Think Trash Is A Problem?

Time: 1 90-minute period

Lesson Overview

Students will explore the different terms used to describe trash and form a common understanding of trash, recyclable, and compostable. They will observe the amount of trash collected by the teacher in one day and then consider different methods to collect data of their own trash. Using sample garbage from the teacher, students will upload and use the Mobilize Trash Campaign to collect data about their personal trash consumption. They will learn that they can use mobile technology to collect data and explore their personal habits. We will use the data to explore our unit question, “Is my trash a societal concern?”

NGSS Standards:

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals:

- understand that data are used in all facets of modern life;
- understand how data support science to identify and tackle real-world problems in our communities;
- critically evaluate shortcomings and strengths in the data and the data collection process

Enduring Understanding

Students develop a common understanding of trash and how it might be classified. Students will also learn how participatory sensing technology can be used to collect reliable data.

Language Objective

[CCSS.ELA-Literacy.RST.9-10.7](#) Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[CCSS.ELA-Literacy.SL.9-10.1c](#) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

[CCSS.ELA-Literacy.SL.9-10.4](#) Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task




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Lesson 2: Do I Think Trash Is A Problem?

1. Students will listen to the opinions and positions of their peers to evaluate and or refine their own thinking.
2. In writing, students will defend their opinions by providing their rationale.
3. Students will present their observations and opinions in a team and class discussion.

Materials:

- Computer with Biology Trash PowerPoint
- LCD Projector
- Post Its
- Poster Paper
- Markers
- Mobile Device
- Mobilize APP
- CENS Participatory Sensing Video
-  Teacher's trash collected for one day
- **Handout 1:** Tracking Trash Data Chart.
- **Handout 2:** Mobilize App Instruction Sheet

Performance Task/Essential Question

“What is Trash?” Through photographs, group discussions, exploring estimates, and graphic visualizations, students explore their current perceptions of trash.

Vocabulary (in context of this lesson)

- Survey
- Participatory Sensing
- Trash/garbage/waste
- Recycle/Recyclable
- Compost/Compostable
- Campaign



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Lesson 2: Do I Think Trash Is A Problem?

Lesson 2 – One Day	
Teacher/Student Activities	Time / Notes
Warm Up: 1. We left off considering what types of data we could collect to understand the questions we have had about trash. ?” How might we use data to help us answer this question? “What is the impact of trash on our society and environment?” Individual Journaling a. Remember that data is considered plural, hence the use of “are”.	7 minutes
2. Allow the team manager at each station to share out their team’s predictions for the amount of garbage generated by each team 3. Transition students back to trash and methods of collecting data rather than just guessing, by showing them a bag of garbage that you collected the previous day (Note: teacher, collect all your garbage within a 24 hour period.) a. Revisit the previous days activity by reminding the students of their graph they made with their team trash guesses. Reveal the amount of individual pieces of garbage you, the teacher, generated in 24 hours. Weigh the total trash and reveal the weight. b. Poll the class with a thumbs up/down, “How many are surprised by the amount of garbage I created?” c. Ask the class: i. Look at the variation in guesses made by your teams in terms of the amount of trash, why do you think there is so much variation in the team’s responses? ii. We want students to consider whether in reality each person creates vast different amount of trash and how the methods they used to develop their guess impacts the values they came up with. iii. How could we get collect accurate data for the entire class? d. Ask the students to consider the following question and respond in their notebooks, i. “What factors may influence the amount of trash a person generates in one day?” In other words, is the number of trash items shown by the teacher a “fair” representation of his or her daily trash? We want students to think about the variability in the data they collect and potential reasons for this variation. e. If we want to compare the amount of trash each person is creating, then we all need to use the same methods of collecting data. This will allow us to determine that the variation in trash data is more likely due to the individual’s habits.	Time Suggestion:
4. At this point, we have not defined what garbage is. For the class to collect “good” data, we need to have the same understanding of the terms that we are using. Point out to the class some of the different terms you have heard students use to refer to the garbage. a. Say: “During the course of this unit we will use garbage, trash, solid waste, and refuse interchangeably.”	



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Lesson 2: Do I Think Trash Is A Problem?

<p>b. Ask: Hold up a recyclable item such as a bottle or can in the air, “Is this trash?” Have the student vote thumbs up or down. Ask three or four students to explain their thinking.</p> <p>5. Teams will work collaboratively to complete a Frayer on Trash inside their notebooks. You may assign the recycling engineers the task of using a Smartphone or computer in class to help their team create a definition.</p> <p>a. Merriam-Webster defines trash as: “things that are no longer useful or wanted and that have been thrown away.</p> <p>6. The procedure specialist should post up the group definition in the front of the class either on the board, with a document camera, or teams could submit their definitions to an electronic shared whiteboard such as http://www.scriblink.com/ or http://www.twiddla.com/</p> <p>a. The ambiguity in student definitions of garbage is no longer acceptable at this point. The class will need a common definition to collect data that is more accurate.</p> <p>b. Develop a common definition of trash and post it in the room.</p> <p>7. Direct the students back to your bag of trash. The downside of tracking garbage is that it smells and is messy and the scavengers, decomposers and detritivores often accompany or follow the garbage.</p> <p>a. Ask: “What is a better way of analyzing the trash?” Imagine how stinky the room would get if we all brought in our trash to analyze. Allow several students to respond.</p> <p>8. Video: Play the CENS Participatory sensing video</p> <p>a. Ask: How could we apply the concepts presented in the video to our challenge of determining whether or not trash is a societal concern?</p> <p>b. Share with students the term Participatory Sensing and its definition. (PPT)</p> <p>a. Definition: Participatory Sensing is an approach to data collection and interpretation in which individuals, acting alone or in groups, use their personal mobile devices and web services to systematically explore interesting aspects of their worlds ranging from health to culture.</p> <p>b. Within the context of this unit, we are using participatory sensing as a method of data collection that will allow students to actively collect and analyze data in powerful ways. Through the personalization of the data collection and analysis, students are empowered to make choices and recommendations to mitigate the impact of their trash on the environment. This approach differs from the traditional data tables and line graphs they normally create in class.</p>	
<p>9. Inform the class that they will be using their Smart phones or other web enabled devices as sensors to track their garbage throughout the day instead of bringing it into class. If they do not have Smart phones or other web enabled portable devices, they will still be able to input their data manually and use the computers to visually represent the data for them.</p>	



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Lesson 2: Do I Think Trash Is A Problem?

<p>10. Work together with the class to develop a set of norms for using the smartphone in class and at school.</p> <ul style="list-style-type: none">a. Create a poster with the title “Working Agreements”. <p>Prompts to consider may include: When do we use the cell phone? What does responsible use of a cell phone look like in the classroom?</p> <p>11. Students will use the technology download handout to help them move through the software installation process of the Mobilize App. Support slides are also available on the PowerPoint.</p> <ul style="list-style-type: none">a. Circulate the room and help students download the APP. Encourage students to work collaboratively, especially those students that complete the download process more quickly than others.b. Students that do not have access to mobile devices will collect data on paper. This data collection chart has the same questions as the App minus the picture. Inform students that they can collect their trash information on paper and then upload their data daily by using any computer and or a friend’s/family’s mobile device. <p>12. Demonstrate how to use the APP by using an item from your personal garbage. Point out to students that the picture is of the garbage only. Review the ethics of photos and rules.</p> <ul style="list-style-type: none">a. They may not include faces or any identifying features. An arm with prominent tattoos holding an empty soda bottle would not be allowed.b. They may not document any trash related to the bathroom, even if it is hair products, make up, shampoo, the toilet, are ALL off limits.c. Note: In the past, naturalist would document specimens they were studying by drawing every aspect or chemists would document precise equipment diagrams. These pictures allowed the scientists to revisit data much later and in manners they may have not initially considered important. <p>13. Once the class has installed the APP instruct the teams to obtain some of the garbage you showed them at the beginning of class.</p>	
<p>14. The students will practice collecting data with your trash and the APP they just downloaded. Model this process first with an object from your bag. After you have taken a picture, typed the item name, the prompt will ask you to classify the object as either recyclable, compostable, or trash. Inform the class that just as we needed a common definition of garbage, we will also need one for recyclable and compostable. Write down the class definition of these two terms under your class definition of trash. Students should copy all three definitions downs in their notepad, address book, or saved draft email section of the phone for reference during the data collection.</p> <ul style="list-style-type: none">a. Ask: How might the data we collect be impacted if we all use different definitions or understanding of what a recyclable item is? For example, the term upcylce is used to describe when something is repurposed for a new use, often fashionable or creative. It is a version of recycling.	



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Lesson 2: Do I Think Trash Is A Problem?

<p>15. Provide the students approximately 15 minutes to practice collecting data with their smartphones. Students that do not have a phone or phones that are compatible with the APP will document their trash items in Lesson 2 Tracking Trash Data Chart.</p>	
<p>HOMEWORK: For homework, students will document the trash they generate beginning after school today until they go to sleep Sunday. This will provide 4 days of data collection, 2 school days and 2 non school days. Be sure to remind students to consistently upload and share their data.</p> <p>Students should create a concept map in their notebook showing the relationship between the concepts covered today. To start this concept map, students should dedicate two pages in their notebook. Remind students that concepts maps show the relationships between two or more ideas in a visual manner. Example can be found in appendix.</p> <ul style="list-style-type: none">• Trash• Compost• Recycle• Data <p>Possible connecting terms may include: participatory sensing, society, measure, technology etc.</p>	<p>Reminder: The students need to collect data for four days. So this lesson needs to be assigned on a Wednesday or Friday.</p>



Science Curriculum

Lesson 3: What Do Humans Do With Trash?

Time: 1 90-minute period

Lesson Overview

Students create a model of a sanitary landfill in order to understand the ways in which our approach to deal with waste impacts the natural decomposition process. The amount of waste we create and the inability for it to biodegrade in the human life span is an example of the imbalance often present within our societies. Mismanagement or accidents involving our waste disposal may lead to pollution. Students will brainstorm the types of ways trash may be a societal concern in small groups and then use an example of the trash dashboard to formulate some of the questions they are interested in exploring.

NGSS Standards:

LS4D: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals

- understand that by treating photos, words, numbers, and sounds as data, we can gain insight into the real world.
- learn to analyze data, including: posing questions that can be answered by considering relations among variables in a dataset, using collected data to generate hypotheses for future data collection, critically evaluating shortcomings and strengths in the data and the data collection process, and informally evaluating hypotheses using data at hand.

Enduring Understanding

After two-weeks of observing their individual models, students understand that sanitary landfills slow down the rate of decomposition for all items, even those that readily biodegrade.



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Lesson 3: What Do Humans Do With Trash?

Language Objective

[CCSS.ELA-Literacy.RST.9-10.7](#) Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[CCSS.ELA-Literacy.SL.9-10.1c](#) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

Materials:

- Computer with Biology Trash PowerPoint
- LCD Projector
-  Sanitary Landfill Supplies: See materials list for experiment
- **Student Handout 1:** Sanitary Landfill Activity and Student Handout
- **Student Handout 2:** Team Copies 16 Circle Challenge

Performance Task/Essential Question

“What is Trash?” Through photographs, group discussions, exploring estimates, and graphic visualizations, students explore their current perceptions of trash.

Vocabulary (in context of this lesson)

- Sanitary Landfill
- Biodegrade/biodegradation
- Visualization
- Autotrophs*
- Heterotrophs*
- Decomposers*



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Lesson 3-One Day	
	Time / Notes
<p>Warm Up:</p> <ol style="list-style-type: none">Showing students a photograph of a sanitary landfill, ask the students what ultimately happens to the paper they wrote their homework on it was thrown away and sent to a landfill?<ol style="list-style-type: none">Be as descriptive as possible and you may choose to use pictures to help explain your thinking,Ask the students to silently complete a read-around with their table. Students will switch notebook with a partner at their table. They will quietly read their Warm Up response and then write down in their notebook:<ol style="list-style-type: none">I agree with _____ because...I disagree with _____ because...	Time: 7 minutes
<p>Lesson Engagement:</p> <ol style="list-style-type: none">Poll the class with a “thumbs up-thumbs down”, how many students predicted that their paper homework would break down over time and disintegrate or disappear?Ask several students to share why they think the paper would break down over time.Remind students that the key players in the Food Web and Carbon Cycle are autotrophs (organisms that generate their own food energy through photo or chemosynthesis and the decomposers). Decomposers release the minerals such as nitrogen, back to the soil--the amount of time it takes something to break down depends upon many variables such as temperature, biodiversity of microbes in the soil, and oxygen content.Show the students the Garbage Video to review the ecological benefits of decomposers: http://www.teachersdomain.org/asset/tdc02_vid_decompose/ <p>Lesson Exploration:</p> <ol style="list-style-type: none">Introduce the term biodegradation to the students. Biodegradation is the rate at which an item breaks down or biodegrades. Today, you will create a model of a landfill to determine the rate at which common materials such as paper and food biodegrade or if they biodegrade at all.<ol style="list-style-type: none">During this portion of the lesson, teams will create two models of a landfill, an open pit and a sanitary landfill. The students will use materials provided to document the rate of decay of common items such as paper or fruit. By constructing the model and carrying out observations over time, students should see that common items do not biodegrade easily in a sanitary landfill. This is in stark contrast to composting in which all the	Note: Students will need to understand the role of decomposers in an ecosystem prior to this lesson. If they have not learned about energy transfer in the food web and the carbon cycle then that should be done prior to this lesson. See example.



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necessary ingredients for optimal decomposition of certain materials are provided.

- b. Pass out the student directions for the constructing a sanitary landfill and allow students to predict to what extent materials will break down. Students will create a claim centered around which of their containers will have the fastest break down of materials. Students will collect observational data noting the rate of biodegradation over two weeks. (35 minutes)
 6. In the experiment, students worked with materials that are typically thought of as biodegradable. We know that we cannot watch materials such as plastic break down but we do know approximate timeline it takes to break down these materials.
 - a. In groups, students will brainstorm a list of 20 typical trash items they encounter on a daily basis and how long they think it would take for these items to break down.
 - b. How might the students find out the actual rate of decay for these items?
 7. Ask the students to think back to the three categories they are organizing their trash in:
 - a. How do we as teams decide whether or not something is recyclable? How might our understanding of what is recyclable or compostable impact the data we are collecting?
 - b. Are all plastics recyclable? What about paper cups?
 - c. If something is not put into the recycling or green waste/composting bin, where does it end up?
 - i. Students need to make the connection that typically everything goes to landfill by default. Items discarded into a trashcan will end up in a landfill, hence the interchangeable use of the terms.
 8. Just because we have a common definition of our three categories, doesn't mean that we always know how to classify something in the field when we are collecting data. What items might you find hard to classify? Why?
-
9. **16 Circle Challenge.** :Remind the class of the unit question, "Is trash a societal concern?" Each team will complete a **16 Circle Challenge**. The 16 circle challenge is brainstorming method used to help individuals or teams explore different aspects of a topic. The team will have four minutes to fill each circle with a question they have about their waste they are hoping to learn about from the data. You may provide the student with pictures of trash printed up and or projected as inspiration for the questions.
 10. Provide each team with two actual visualizations of trash data from a student and log into the Dashboard and project class data. Introduce students to the term visualization: "A visualization tries to communicate data in a picture or image. " Visualizations help us see patterns that may not be apparent in the "raw numbers" often found in data charts. Inform the class, that soon you will be



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looking at your personal data and the data of the class. Before we do so we need to develop a set of questions that we want to try and answer about trash.

11. Each team will select two to three questions to share out to the class. On poster paper in front of the class and students within their notebook, chart out the questions in a T-Chart (see example). The left column is to write down the actual question. Once the team has shared out the questions, ask the students to explain what the purpose of the question and the type of response needed to answer the question (see parentheses) example in chart below.

Questions	Variable
What <u>trash</u> was most common? (description)	Type of trash
How much trash did she make? (quantity)	amount
How many recyclables end up in compost, litter or trash?	Recycled items and location it was disposed of
I wonder if the student is a good recycler? (Explanation using data)	Amount of recycled materials compared to landfill (2 variables)

12. After the list of questions is written on poster paper for the class, ask teams to discuss with their shoulder partners at least three questions we may possibly have collected data to answer.
13. Ask teams to share out the questions that they may be able to answer. Ask teams to write down on the right side of the t-chart, the types of data that they would need to look at to answer the question. Demonstrate a one and two variable example.
14. Log onto the Dashboard and show the students the interactive Trashboard. Key features to point out to students include:
 - a. The filter function on the word cloud.
 - b. That when you click on the recycle button, all the data shown is for recyclable.
 - c. Point out the reset button and the total number changes as they click through the different functions.
 - d. How you can click on individual day to focus on hourly patterns. Show the students the leaderboard where you look to see how many items each student has contributed.
15. Using the trashboard, choose two or three of the class questions to help drive navigation of the page. Use this as an opportunity to steer and navigate the Mobilize Trashboard prior to students exploring the page. As you show students the visualization, students may become inspired to generate more questions, these questions should be added to the class list. It is important to note, that the Dashboard may answer not all questions generated. Questions that fall beyond the data set we are collecting are still valid and should be encouraged. Students will have opportunities to explore alternative data sets to answer burning questions left unanswered from the Trash Dashboard. The Plot App will allow you and the students to look at additional relationships from our data sets.



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<p>HOMEWORK:</p> <p>For homework, students will continue documenting the trash they generate beginning after school today until they go to sleep Sunday. If students are not using mobile devices to track their trash, then they should manually input their trash data using the WebFront End for their homework.</p> <p>Add the following terms to your concept map:</p> <ul style="list-style-type: none">• Sanitary Landfill• Biodegrade/biodegradation• Visualization• Autotrophs• Heterotrophs• Decomposers	



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Lesson 4: What Does Nature Do With Trash?

Time: 1 90-minute period

Lesson Overview

Students review the carbon cycle through playing a game in groups. This game allows students to revisit the components of the carbon cycle and consider the elements of the cycle that are unique to human activity. The raw materials, energy required creating and shipping products, and eventual process of disposal all connect back to the carbon cycle. Next, student groups will access their prior knowledge and brainstorm environmental problems they believe exist in our world today. Referring back to the unit question, students reflect upon the sources through which they learned about these environmental problems. Rather than relying upon data or analysis presented externally, students are empowered to collect their own data and explore their personal impact upon the environment. Through a whole group activity, the teacher will mediate and exploration of the idea of “good data”—what does that look like and how can we be more critical about data that we look at. Lastly, students will choose a category of trash (landfill, recyclable, compostable) to focus on.

NGSS Standards:

LS4D: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals

- critically evaluating shortcomings and strengths in the data and the data collection process

Enduring Understanding

All products and foods come from resources harvested from our planet. There are natural cycles that typically balance inputs and outputs. The rate of which humans consume goods is greater than most cycles can balance, trash is a prime example. Reliable data is required to answer the unit question.




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Lesson 4: What Does Nature Do With Trash?

Language Objective

2. [CCSS.ELA-Literacy.RST.9-10.8](#) Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
3. [CSS.ELA-Literacy.CCRA.SL.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.
4. [CCSS.ELA-Literacy.CCRA.SL.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.

Materials:

- Computer with Biology Trash PowerPoint
- LCD Projector
-  **Student Handout 1** (Class set) Carbon Cycle Game Exploration
- White board or poster paper
- Can of Pepsi/Coke or photographs

Performance Task/Essential Question

What does nature do with waste?

Vocabulary (in context of this lesson)

- Food Web
- Decomposers
- Autotrophs
- Heterotrophs
- Data



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Lesson 4: What Does Nature Do With Trash?

Lesson 4- One Day	
	Time / Notes
<p>Warm Up:</p> <p>Read the Monty Python lyrics from Decomposing Composers projected. Draw a picture to describe how decomposers help the environment. Be sure to use labels/descriptions and arrows in your diagram.</p> <ul style="list-style-type: none">• Beethoven's gone, but his music lives on And Mozart don't go shopping no more You'll never meet Liszt or Brahms again And Elgar doesn't answer the door• Schubert and Chopin used to chuckle and laugh Whilst composing a long symphony But one hundred and fifty years later There's very little of them left to see• They're decomposing composers There's nothing much anyone can do You can still hear Beethoven But Beethoven cannot hear you <p>Connect to student's prior knowledge by reviewing the food web and the role of decomposers in breaking down matter and returning it to the ecosystem. Key discussion points to reinforce include:</p> <ol style="list-style-type: none">a. Decomposers are our natural recyclers.b. Energy from the sun is captured through photosynthesis and stored within the plants.c. Autotrophs and heterotrophs which including decomposers are all interconnected within the food web.	Time: 7 minutes
<p>Lesson Exploration:</p> <ol style="list-style-type: none">1. Carbon Cycle Game Exploration: will allow students to rotate the classroom visiting different stations that represent various components of the Carbon cycle. Students will first have the opportunity to explore different elements of the carbon cycle through a game that introduces students to different components of the cycle in a meaningful way. Depending upon your students familiarity with the Carbon Cycle, you may choose to have students complete the following reflection questions or use the review video found at the following hyperlink (also embedded in powerpoint) http://education-portal.com/academy/lesson/cycles-of-matter-the-nitrogen-cycle-and-the-carbon-cycle.html#lesson . <ol style="list-style-type: none">a. What happens to carbon atoms as a result of respiration?b. What happens to carbon atoms as a result of decomposition?c. What happens to carbon atoms as a result of combustion?d. Much of the food eaten by each organism is metabolized (broken down) in cell respiration. Why is this so? What does the organism need and get out of this process and how does it get it? <i>Hint: Food Web and Energy Pyramid</i>	Note: Students will need to understand the role of decomposers in an ecosystem prior to this lesson. If they have not learned about energy transfer in the food web then that should be done prior to



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- e. In the course of the carbon cycle, are carbon atoms themselves ever created? Ever destroyed? Ever changed into other kinds of atoms? Ever changed into other compounds? Explain.

this lesson.

2. **Selecting Logo Partners:** Throughout this unit, students will be working in different arrangements. To increase the student's exposure to various points of view and provide an opportunity for students to move in the classroom, students will form logo partners similar to "Time or Clock Partners". Students should copy down the Reduce, Reuse, Recycle, Upcycle Logo in their notebooks (see powerpoint). For each stage in the cycle, student should find a partner in the class that doesn't sit at their table. A different student's name should be written at each stage. (Four partners in all).
 - a. Example: If Karla chooses Louis as her Reduce partner, then Louis would write his name on Karla's logo at the reduce stage, and she will write her name on his logo as well at the reduce stage.
 - b. Students will continue until they have filled all four positions.
3. Once students have filled all four positions, have students pair up with their recycle partner and spend 2 minutes brainstorming a list of environmental or ecological problems that exist for their generation, especially those that may be related to garbage. Allow recycle pairs to pair up with other recycle pair and compare list.
4. **Think-Write-Pair-Share Class Discussion:** Upon completion of the activity, lead a brief discussion asking students to consider the ways in which humans impact the Carbon cycle. The goal is for students to see that the rate and volume of human consumption and waste is too great for nature to process.
 - a. To help students connect the Carbon cycle to their personal lives, ask the students to look back at their personal carbon cycle handout from the game. Students will complete one round of Think-Write-Pair-Share-Squared.
 - b. **Think:** *I want you to quietly think about "What parts of the Carbon cycle do you have a direct impact on?"*
 - c. **Write:** *Now that you have created some of your own thoughts, you have two minutes to write down your ideas.*
 - d. **Pair:** *Find your reduce partner (see below) and share what each of you wrote down.*
 - e. **Squared:** *Find your recycle partner and share what each of you wrote down.*
5. Allow students to return to their seats. Referring back to the 16 Circle Brainstorm challenge and the materials they have seen thus far, compile a class list of environmental problems the class is aware or concerned about.
6. Ask the students what proof they have that these problems exist? How do they know for certain that these are issues?

Lesson Elaboration:

7. Either underline or direct the students (if the students did not suggest it) to the



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guiding question for the entire unit, **“Is trash a societal concern?”** Explain to the students that the data that they are collecting is to determine the impact of all of our garbage on the environment and if there is anything we can do to help. Rather than simply trusting a news article or textbook, we are collecting data within our community to be able to understand and respond to the question.

- a. **Ask: Imagine a student realizes that they forgot to track their garbage the night before. Afraid he or she will lose points, the student enters the same item, a soda can, over and over, to give the illusion they had been tracking their trash.** How might this affect the data we are collecting and conclusions we make about that person’s habits?
 - b. It is important to guide students to consider whether volume of data is more important than accuracy. A rich data set will represent the variety of trash generated throughout the day. Although having a large data set is important, “faked” data may lead us to inaccurate conclusions. Remind students that we are collecting information to help us respond to the unit question.
8. To illustrate the importance of students collecting as many data points (i.e. documenting their trash) by completing a White Board Survey. Have 5 students sit in the front of the class and give each a whiteboard and marker. Ask the volunteers to write down which drink is the best? Hold up cans or pictures of Pepsi and Coke. While they are writing their answers, secretly look for two students that wrote the same thing. Instruct the volunteers that after they have written down their opinions, they should place the board face down in their laps.
 9. Inform the class that they should also write down their favorite of the two during this activity.
 10. Ask the two students with the same response to hold up their boards for the class. Write your claim as a declarative statement on the board that *“In a survey of 5 High School Students we found that most prefer _____ as their drink.”* Many students will disagree with the declaration.
 11. Ask the class to hold up on their hands the sample size of this survey, 5 fingers should be in the air. Did the class hear from all five participants? No. It is important that all opinions or data is initially looked at. Allow the other three students to display their favorite drink. Write a new declarative statement on the board that matches the results from the 5 student surveys, inform students that this is the claim you are making about soda consumption for teenagers.
 12. Ask the Team Captain to lead a discussion at their table centered around the following two questions:
 - a. How could we increase our confidence that the statement that was written on the board was accurate?
 - b. How would people’s opinions affect whether or not they wanted more or less data?
 13. Allow each Procedure specialist to share out one thought from the discussion.



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<p>14. Ask the class to divide up, Pepsi lovers on the right and coke lovers on the left. What conclusion can we draw now from the evidence? Can we make a general statement for all high school students with this sample size or do we need more data? Students may state that they need more data, however someone may suggest that adding a warrant or qualifying statement such as “High school students in Ms. Ruiz’s class prefer Pepsi” will work. Revise the original statement because you teach 5 periods, “Is polling 1/5th of the students a large enough amount of data?” BUT, if we were making this statement for all high school students, we would want BIGGER data. Send students back to their seats.</p> <p>15. Ask the students to share with an elbow partners something they have noticed while tracking their personal garbage. Ideally, some students may have begun to realize that the amount of trash they create is greater than they initially realized. This is why we are using technology to help us analyze our personal trash usage and then compare it to each other. As we analyze ourselves and our habits we can make personal changes that may help the environment. As we analyze a bigger set of data, the data from all of your classmates, we may see larger patterns and be able to devise better plans.</p>	
<p> HOMEWORK: For homework, students will continue documenting the trash they generate. Remind students to upload and share their data at the end of the day.</p> <p>Reflect: Think about the Mobilize App and the photos you have been taking. How has this data collection process affected what, when, or how you throw something away? Add your thinking to your concept map.</p>	



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Lesson 5: What is Big Data?

Time: 1 90-minute period

Lesson Overview

This inquiry lesson will engage students' thinking about Big Data and how it affects their lives. Students will become aware that Data are everywhere, and in this age of technology, they must become users of data and not just generators of data. They will become aware of the large amounts of data they generate through social media, how it is monitored and analyzed, and therefore their role in generating data responsibly.

This lesson will set the stage for computational thinking, the conceptual underpinnings of computer science, as well as many modern scientific and mathematical disciplines. What is data and how the use of data in today's society affects us is foundational to this unit. Having students think of how and why marketing companies use data to affect teens will be a catalyst to have student think about how they can use data and computers to analyze data in their own lives to engage students in problem solving using computational and statistical thinking. .

Enduring Understanding

Upon completing this one-day lesson, students will have the long-term understanding about the amount of data they generate in this age of technology, and become more aware of the number of ways data is being collected, with their approval, but also some ways in which data is used.

Students will have the lasting understanding of modes of data collection, data usage, and data Visualization. Discussions around these topics will help students become more aware of their role in creating data as well as the implications for future jobs.

Language Objective

1. Students will use complex sentences to construct a summary statement about their understanding of data, how it is collected and how it is used.
2. Students will present their summary statements and engage in a class discussion stating their position in reference to those presented by their peers.
3. Students will use complex sentences to write two paragraphs addressing the overarching question for the lesson: **How can data affect my life now and in the future?**

Additional Materials:

A chart-size copy of the Four-Fold organizer

Lesson Power Point: Lesson 5_Big Data in Our Lives.pptx

PBS Video: Hunting for Cool

Student Handout 1 The Data Four-Fold organizer

Student Handout 2 Video Notes Organizer

Performance Task/Essential Question

Based on evidence presented from several social networks and industry data sources, students make a claim in response to the prompt:

How can data affect my life now and in the future?



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Lesson 5: What is Big Data?

Claims will be supported by three pieces of evidence selected from the presented sources. Students are required to generate a summary statement based on this evidence.

This question is asked initially to collect students' prior knowledge regarding data and again at the end of the lesson to assess learning. The guiding question for the lesson is: How and Why is data collected on you and your family? Discussions around this topic will help students become more aware of their role in creating data, as well as the implications for their future.

Vocabulary

Students may need frontloading of the following terms:

- Big Data
- Target audience
- Focus group



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Lesson 5: What is Big Data?

Lesson 5 – One Day	
Teacher/Student Activities	Time / Notes
<p>ENGAGEMENT:</p> <p>Working collaboratively, students will engage in a brainstorming activity that will provide foundational ideas and understandings that will be used to construct arguments about how data is collected and used. Students will complete Student Handout 1, the Four-Fold organizer, as a tool to sort ideas for discussion on four prompts: (Slide 2)</p> <ul style="list-style-type: none">• What is data?• How is it used?• Where does it come from?• How can data affect my life now and in the future? <ol style="list-style-type: none">1. Pass out the Four-Fold organizer as you explain the brainstorm activity to the students. The questions should not be pre-printed on the organizer. Have students write them in as they appear on the screen, which will allow them ample time to think on each idea before moving to the next idea. This organizer will be collected to assess the level of student knowledge prior to the lesson and again after the lesson. (Accept all answers with clarification)2. The Round Robin approach below for sharing answers in this activity ensures that every student will have a chance to respond with assistance from the team and is thus held accountable for contributing.	<p><u>Time Suggestion:</u> 28-30 minutes Total</p> <p>The Four-Fold organizer is a modification of the Fruyer Model, which is a vocabulary development tool. In contrast with providing a straight definition, the model helps to develop a better understanding of complex concepts by having students identify not just what something is, but where it comes from, or how it is used. The center of the diagram shows the concept being identified, while the quadrants around the concept are used for providing other details.</p>
<p>IDEA BRAINSTORM: Round Robin (Slide 3 & 4): Divide students into groups of three or four.</p> <p>Review the Team Rules:</p> <ol style="list-style-type: none">1. Have each team number off from 1 to 4.2. Tell students they will be given a topic to brainstorm. Students will first write down their ideas individually for 2-3 minutes, without talking or discussing ideas yet.3. Next students will put their ideas together as a team. They will have 5 minutes to develop a team strategy for providing answers.4. Tell students that each team will be called on for <u>one</u> idea and then the next team will be called on or a different idea.5. All member #1s will provide the answer to the first question in round one. All member #2s will give the answer to the second question, in round two, and so on. Strategize to ensure that no one on your team will run out of ideas to share.	<p><u>Time Suggestion:</u> Individual Brainstorm Rules & Points - 3 mins to review & Check for understanding</p> <p>Guidelines, which are set for classroom discussion, generate an equitable environment for students to share ideas. They ensure that all students are included in the discussion. Setting clear student expectations is critical in building an environment in which students can explore and discuss ideas, build arguments, and critique the thinking of others.</p>



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Lesson 5: What is Big Data?

Teacher/Student Activities	Time / Notes
<p>5. Explain the Team Points:</p> <ol style="list-style-type: none">Teams will gain a point for each idea shared.Repeating an idea already given by a previous team will cause you to lose a point, so <u>LISTEN</u> carefully.'Pass' if your team member has no ideas. No points will be gained or loss.Wait time for each idea is 5 seconds. (Count down "5-4-3-2-1".) <p>Check for understanding by asking a student from each team to repeat and explain their understanding of the rule or the implications for their team.</p> <p>Note: Points are an excellent management tool. It ensures teams are listening to all of the answers, so they won't repeat an answer. It also prevents students from shouting out answers, which would also results in the loss of a point. In that each answer must be given within 5 seconds, teams stay on task.</p> <p> Begin with Individual Journaling: (Slide 5) It is critical for students to first develop their own ideas and therefore have the ability to contribute ideas and strategies to the team as a whole.</p> <p>Each question appears one by one on the slide.</p> <ol style="list-style-type: none">Reveal Question 1 and have students write the question in the top left quadrant. Allow students a couple of minutes to generate ideas just on question 1.Reveal question 2, which should be written in the top right quadrant, allowing a couple of minutes of think time.Reveal question 3 in the same manner.Prior to answering question 4, have teams strategize and share answers for 1-3 via Round Robin. <p>Note: <i>Students' ideas about "data" may be narrow, focusing on T-charts and graphs generated in class. By engaging students in this brainstorming activity we will determine their current knowledge level, any misconceptions, and how to build on their current foundation. Some students may have a broader sense of data connected to technology, which will expand the level of others during the sharing process.</i> Using the Round Robin rules:</p> <ol style="list-style-type: none">Call on every team for an answer to question 1, starting with team1, member 1. Member 1 will answer for each team. Record each answer in the top left quadrant of a chart size copy of the Four-Fold. Clarify answers as needed, trying not to reject any answers if possible.Continue with Round 2, collecting an answer for question 2, from member 2 of every team. Wait only 5 seconds for each answer, and continue recording answers on a chart size copy of the Four-Fold.After each round and all teams have answered, record a point per team for every answer. Make note of points that were lost or teams that passed. <p>Warn students that shouting out answers could cause the loss of points.</p> <ol style="list-style-type: none">Continue gathering answers until all three questions have been answered. When complete, ask students what did they learn from the activity. Report the points for each team.	<p>Check for understanding:</p> <ul style="list-style-type: none">What's an important point in the rules?Can you add to this?Will you lose points for a pass?Can you add to what was said?" <p>Time Suggestion: Brainstorm- 6 min (2 min each question)</p> <p>Note: Do not provide ideas for students. Critical thinking must be fostered. Students will build on their ideas or gain new insights from team members during the team strategy time.</p> <p>Sharing – 9 minutes (3 min each quad)</p>



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Lesson 5: What is Big Data?

<p>Class Discussion: Ask teams to talk about the brainstorm for a minute.</p> <ol style="list-style-type: none"> Ask the following question to generate discussion: <ul style="list-style-type: none"> Did any of the answers give you new ideas about the concept of data? Were any of the answers a surprise you or confuse you? Why? Did you learn anything new? After the discussion, give students 1-2 minutes to fill in the last quadrant with the answer to the essential question: (Slide 6) <p>“How can data affect my life now and in the future?”</p> <ol style="list-style-type: none"> Construct a team response using team Roles: Introduce roles. 1 – Facilitator, 2 – Recorder, 3 – Time Keeper, 4– Spokesperson <ul style="list-style-type: none"> Facilitators: starting with team member 1, having each member share their response with their team. Be sure everyone is listening then move on to student 2, 3 and 4. Timekeeper: Use a timer to remind students to stay on task, and get their ideas summarized all in 5 minutes. Each member should have less than a minute to read his or her answer, leaving 2 minutes to generate a team response. Recorders: After all team members have shared their responses, determine if answer had anything in common that can be used in the final team response. Ask what were some unique ideas that we would like to include? Using complex sentences, construct a summary statement for the team on Question 4 that represents everyone’s ideas. Spokesperson: Present the teams response to the class. Summarize the ideas collected <u>after</u> students have shared, as well as the learning objectives for this lesson: <ul style="list-style-type: none"> The idea of data has changed in this age of technology. Data is collected in many different ways. Data is being gathered online every time we post on social networks or order products and services. We must be careful and responsible about the data that we put out in cyber space. “Big Data” is a new term based on the large amounts of data generated on the Internet and mobile devices today. Who are you giving your data to? Ask students if they have noticed how advertisements that pop up when they are on the internet is related to something they have searched for or bought. Or, how coupons in the store are also for things that they normally buy. Why is that? It is because a database of information is stored on our purchases to better serve us. <p>Can this data affect your life now or in the future? How is data used to influence your spending? How do you make decisions on how you will dress or buy?</p> 	<p>Discussion – 3 minutes</p> <p>Question 4 - 1-2 minutes Let students know you will collect their sheets at the end of class.</p> <p>Team Response – 5 minutes</p> <p>Using the Five Talk Moves have students contribute to the answer of others.</p> <ol style="list-style-type: none"> echoing: “Can someone tell me what Pam said about...” restating: “How would you express Dan’s idea in your own words?” apply your own reasoning: “Do you agree or disagree?” Further Participation: “Would someone like to add something?” wait time: Allow all students time to process the information before responding.
<p>EXPLORATION: Now we will look at a real life example of how data is collected from teens and how it is used. This should add to students’ ideas about data and how it affects their lives.</p> <p>Video Introduction: It is a Frontline Documentary (slide 7)</p> <ol style="list-style-type: none"> As you discuss the background of the video give students Handout 2: 	<p>Time Suggestion: Introduction – 3-5 minutes</p> <p>Handout 2 will keep students engaged in the</p>



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<p>Video Notes Organizer (slide 8) to take notes while watching the Video.</p> <p>2. Background: Hunting for Cool is a Frontline documentary on ‘coolhunting’. Coolhunting is a term coined in the early 1990s by marketing professionals whose job was to observe teens and predict changes of new or existing social trends.</p> <p>3. Have students explore the idea of “cool” in preparation for the video.</p> <ul style="list-style-type: none">* If someone asked you “What is cool today?” what would you say?* Who defines “Cool?” Is it teens or is it what is advertised?* What influences you to follow trends? Why is this important to stores? <p>Take a few answers to prepare students for what they will see.</p> <p>Video Notes Questions:</p> <p>1. What data is collected or presented? In this video you will hear a large amount of facts or data about teens. Capture it in quadrant 1.</p> <p>2. How is the data being collected? You will see coolhunters collecting data about teens. Write what it is in quadrant 1 and in quadrant 2 write how they are collecting data.</p> <p>3. How is the data being used? What data do marketers want and how will they use that data? Capture this information as you can in quadrant 3.</p> <p>4. How can data affect my life now and in the future?</p> <p>Challenge Students to take as many notes as possible.</p> <p><i>“Let’s see which team will ‘collect’ the most correct data?”</i></p>	<p>ideas of data while watching the data and provide new ideas about data and how it is used.</p> <p><i>These are questions are to get students thinking about why certain marketing organizations would want data on teens?</i></p>
<p>EXPLORATION/ EXPLANATION:</p> <p> Video: Hunting for Cool (Slide 9)</p> <p>1. Start Video: The video presents data on just how large the teen market is and how much money teens and their parents spend each year.</p> <p>2. Use teachers’ notes on data from the video in handouts:</p> <p>After the video, discuss Questions 1-3. Ask students what they could add to the question “What is Data?” Make a new chart for video information.</p> <p>Revisit the essential question: How does this data affect me now and in the future? In your adult life, i.e. jobs?</p> <p>Give students 1-2 minutes to fill in the last quadrant with the answer to the essential question.</p> <p>3. Collect the Data Four-folds and video notes. Compare students’ answers to the essential question before and after the video.</p>	<p>Video - 8 min</p> <p>NOTE: Students may want to discuss being trendsetters, but focus them on Data. Using a Four-Fold to write ideas on “What data is being collected on teens, why, and how is it collected?”</p>
<p> HOMEWORK:</p> <p>Science Journals: In your journals reflect on the main questions of the lesson:</p> <ul style="list-style-type: none">• What is data?• How is it used?• Where does it come from?	



Science Curriculum

Lesson 6: What Claims Can I Make About My Trash?

Time: 1 90-minute period

Lesson Overview

Using the questions developed in lesson three and those provided by the teacher, students use the trash dashboard to explore and analyze their personal and class data. Students identify their personal habits that may impact their trash generation, explore possible research questions and explore evidence that supports the claim that trash is a societal concern.

NGSS Standards:

LS4D: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals

- analyze statistical graphics to identify patterns in data and to connect these patterns back to the real world;
- understand that by treating photos, words, numbers, and sounds as data, we can gain insight into the real world.
- learn to analyze data, including: posing questions that can be answered by considering relations among variables in a dataset, using collected data to generate hypotheses for future data collection, critically evaluating shortcomings and strengths in the data and the data collection process, and informally evaluating hypotheses using data at hand

Enduring Understanding

By examining the Dashboard, I can quantify **my trash's** impact on the environment.

Language Objective


[CCSS.ELA-Literacy.RST.9-10.7](#) Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.



Science Curriculum

Lesson 6: What Claims Can I Make About My Trash?

Materials:

-  Computers for each students
- Mobilize Dashboard URL and Student login information
- **Student Handout 1:** Analyzing Trashboard Graphic Organizer
- **Student Handout 2:** for Trash Template
- LCD Projector

Performance Task/Essential Question

What claims can I make about my trash?



Vocabulary (in context of this lesson)

- Visualization
- GPS



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Lesson 6: What Claims Can I Make About My Trash?

Lesson 6-One Day	
Teacher/Student Activities	Time / Notes
<p>Warm Up:</p> <ol style="list-style-type: none"> Review the class list of questions students developed in lesson four. Remind the students that they are reviewing their data to find answers to the questions that they generated. If the questions do not appear to drive analysis of the graphics, you may add questions similar to those listed below and can also be found in the Analyzing TrashBoard Graphic Organizer. 	<p>In advance, pull up the plot builder of some student data .</p> <p>Computer access for all students in required for this activity.</p>
<ol style="list-style-type: none"> Inform the students that there are two sets of data that we will be exploring today. The data is displayed on what we call the dashboards. The first set of data we will look at is our individual data. Once we have looked at our own patterns, then we will look at the data collected for the entire class. <ol style="list-style-type: none"> If computers are limited, have students pair up with their Upcycle partners to take turns using the terminal to view their trash data on the Dashboard.  Students will then log in and begin exploring first their personal data on the dashboard. Ensure that students are looking at their individual data, not the entire class. Students may not be able to answer every question, especially if they entered the data in manually on a computer. <ol style="list-style-type: none"> What day did you produce the largest amount of trash? What two-hour window did you create the largest amount of trash? Looking at the histogram at the bottom of the screen, does the amount of trash vary greatly or is it consistent? Why do you think that is? What activity were you doing to generate that largest trash amount? What did you learn about the amount of trash, recyclable, and compostable items you create? Do you have any habits or patterns that contribute to your trash generation? Hint: look at the GPS map to see where you entered your data and the word cloud. Of the recyclable and compostable items, how many items did you actually recycle or compost? In a paragraph, explain which visualization impacts you the most and why? Be sure to include the visualization by screen grabbing the image. Open another window and select to view the class data on the dashboard. <ol style="list-style-type: none"> How does your daily average of trash items, recyclable items and compostable items compare to your classmates? What factors do you believe contribute to the difference in these numbers? Look at the response data and time graphs at the bottom of the page. How does the data vary during the day? Looking at the GPS trash data, what can infer about the habits of your classmates before and afterschool? Looking at the word web, what can you infer about the eating habits of 	<p><u>Time</u> <u>Suggestion:</u> <u>50</u></p>



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Lesson 6: What Claims Can I Make About My Trash?

<p>your classmates.</p> <p>e. Do students recycle at your school? Use at least two visualizations to support your claim.</p> <p>f. Select two visualizations you believe strongly supports the claim, “Trash is a problem at my high school?” Explain why you chose each one.</p>	
<p> HOMEWORK: Look over your concept map. What are three things you can add to your concept map from the trash data you looked at today? Add those three items.</p> <p>Create a claim that addresses the question, “Is trash a societal concern?” and cite three pieces of evidence from your personal data.</p>	.



Science Curriculum

Lesson Seven: What Claims Are Made About Trash in the News?

Time: 1 90-minute period

Lesson Overview

Students will look at their Sanitary Landfill models and identify how the structure impacts the rate of decomposition. Students break up into expert groups and are assigned different news articles to read. Through paired readings and graphic organizers, students work together to identify the author's claim made in the article and the evidence provided to support their stance. These articles are potential sources of evidence for students to use when answering the unit question as well as helping students to select an area of focus for their final project.

NGSS Standards:

LS4D: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Mobilize Goals

- understand how data support science to identify and tackle real-world problems in our communities;
-

Enduring Understanding

Upon analyzing the trash data and then reading articles, students will begin to understand the cumulative effect of trash. Students are able to make claim regarding trash that is supported by multiple sources of evidence. Students should be able to cite evidence to the claim that we all contribute to the problem and must work together toward a solution

Language Objective

[CCSS.ELA-Literacy.RST.9-10.8](#) Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

[CCSS.ELA-Literacy.RST.9-10.9](#) Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

[CCSS.ELA-Literacy.SL.9-10.4](#) Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task



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Lesson Seven: What Claims Are Made About Trash in the News?

Materials:

- **Student Handout 1:** News Graphic organizer
- **Student Handout 2:** News articles

Performance Task/Essential Question

What claims are made about trash in the news?

Vocabulary (in context of this lesson)

- Sanitary Landfill
- Claim
- Evidence
- Validity
- Reliability
- Extrapolation



Science Curriculum

Lesson Seven: What Claims Are Made About Trash in the News?

Lesson 7-One Day	
Teacher/Student Activities	Time / Notes
Warm Up: <ol style="list-style-type: none">1. We started this unit with the hopes of discovering how our trash impacts the world around us. Have students check in on their sanitary landfill models and view whether the materials have begun decomposition.<ol style="list-style-type: none">a. Claim: Sanitary landfill structures slow the rate of decomposition.b. What observational evidence would you need from your model to support or refute this claim? Write this down into your notebook.2. Students should then find their reuse partners and share three things that they have learned so far about their personal trash through the Mobilize App and the data from the dashboard.	
Lesson Exploration: <ol style="list-style-type: none">1. Inform the class that today we are going to look at what other people are saying about trash. We can use this information to answer some of the questions we still have regarding trash. The articles will also help students to focus on an area they may be interested in researching for their final project. Students will complete a literature review of three articles regarding trash: trash in China, marine garbage patches, and trash generation on school campus during lunch.<ol style="list-style-type: none">a. Graphic Organizer: Prior to passing out the article, review the graphic organizer that students will be using to collect information in. Inform the students that the graphic organizer is designed to help students identify the claim the author is making, the evidence provided that supports the claim and how the article may apply to the unit question. Partner Reading Strategy: Number students off 1-3. Students will show their number on their fingers and find a like partner. Once partnered up, review the partner reading strategy. Each pair will have the same article. Partner A reads the first paragraph, then partner B gives a summary or main point statement in the paragraph. Partner B reads the second paragraph, then partner A gives the summary statement. Repeat the pattern until the end of the readingb. Once the article is completed, students will return to their original teams and share what they learned regarding garbage by sharing the main idea and the quotes that they selected.c. The articles should encourage students to think about trash on a larger scale than themselves or their friends. Collecting data over weeks and years or a larger sample size, such as China's population size requires computational power of technology.2. Students should find their reuse partner and share their thoughts regarding the homework question, "Did the APP change how much trash they created?" Lead	 Time Suggestion:



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Lesson Seven: What Claims Are Made About Trash in the News?

the class to share out what their thoughts are about collecting this data and how their awareness of having to document their trash may impact the validity of the data.

- a. **Ask the Team manager to poll the team: How might your trash data appear different if the data was collected without you knowing it?**

3. At this point, we have information from three reputable news sources, class data and individual data. What does our data look like when we extrapolate it over time. Pull up the class data and identify the class average of trash, recyclable and compostable items per day, write these numbers on the board. In teams, students should take turns sharing out what visualization impacted them the most from the dashboard.

Data Discussion:

4.  Once each student has shared out, lead the class in a discussion to analyze some of the patterns seen in the class data. Identify a few of the questions the class created to review as well as the discussion questions below:

- a. **Ask: What are the advantages of using the average number of trash items from the class data instead of our personal number?**

Disadvantages? We all have different consumption patterns. Although averages provide a greater picture of society as a whole, it may be very misleading. The amount of trash produced by a Native American living in communal could potentially be much lower than a Jet-Setting Basketball player.

- b. **Ask: Did everyone have the same amount of trash each day?** Because everyone creates different amounts of trash at different times, increasing the length of time we collect data would allow us to identify a more accurate daily average and allow us to have a better idea of how the data varies over time.

- c. **Reliability** is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials. How does the APP collection method of data compare to collecting all of your garbage in a bag and then analyzing or recording the data on a data chart? Which approach is more reliable?

- d. **Validity** is a measure of how well the experiment we did measure what we wanted it to measure? Which of the above methods of tracking trash appears to be more valid? As scientists and researchers, we must choose researching approaches that best fit the questions we are trying to answer and the resources we have at our disposal. What advantages can we see with using a Participatory Sensing activity like this APP over collecting garbage in bags and then analyzing?

- e. Using the class daily average, ask the students to calculate the amount of trash that would be generated by an individual in one week, one month, one year, average life span of 80 years?

- f. **Ask: How does this extrapolation over time impact your perception of trash and the impact on society?**



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Lesson Seven: What Claims Are Made About Trash in the News?

- g. Think about a gum wrapper accidentally dropped into the gutter. We surely drop at least one piece of trash once a year. There are currently 38 million people in California that would equal 38 million wrappers in one year—accidentally.
 - h. **Ask: But is all trash created equally? What is our data not telling us?** We collected information about the items of trash not the volume or weight. How do we compare a gum wrapper to a refrigerator box? How is a broken cell phone different than one piece of paper in terms of environmental impact?
5. There is not an easy solution to complicated issues such as trash or climate change. Indeed, there are many aspects of pollution that we have little control over.
 - a. **Ask the class: *What types of data and information have we collected thus far about trash and how it impacts the environment? Use your concept map as a place to refresh your memory of what we have done.*** Mobilize APP, articles, and sanitary landfill and resources moving through the carbon cycle.
 - b. Ask teams to consider: ***In what ways can we use the data and information we have collected so far? How might we use this information in our personal lives? Would these personal changes have an impact on our community, society and environment?***
6. Write down the unit question on poster paper and ask the class to brainstorm all the potential issues that surround trash. List all these issues.
 - a. Examples: Amount of trash made at meal times, wrappers from foods, lack of easy access to recycling containers, not recycling recyclable material, lack of compostable containers at school or home, lack of trashcans on route to school, trash disposed of improperly such as streets, lack of biodegradation in sanitary landfills, ocean pollution,
7. Thus far, we have focused on three categories landfill, recyclable, and compostable. Each team will select one issue within one of the three categories (throwing away food that could be composted) that they would like to devise an action plan for. Inform students that they will need to collect evidence regarding their issue so careful consideration must be made to keep their scope narrow enough to collect data within a short timeframe. They should think about topics that they have personally collected data on using the APP or read about during the unit as a starting place.
8. Once students have chosen a topic, they will write it down into a flip card into their concept map (see example). They will then list as many questions they can think of regarding that topic.
9. ☞ Teams will divide up their questions below to research for their topic using mobile technology i.e. smartphones, tablets or computers, computers or external paper data you would like to provide such as the data from Biocycle found in the appendix. Students should also look for answers to the following questions:
 - a. What components of the terrestrial or aquatic environment are impacted by your



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Lesson Seven: What Claims Are Made About Trash in the News?

<p>topic? i.e. biodiversity, erosion, water quality, aesthetic value...</p> <p>b. What strategies could be used to mitigate or prevent this issue?</p> <p>c. How would we know that these strategies are effective? What would you be measuring over time?</p>	
<p>HOMEWORK:</p> <p>Either using the internet or the data and information you have recorded in your notebook thus far to find research to your assigned question.</p> <p>Add three things you learned from the articles and or your research to your concept map.</p>	.



Science Curriculum

Lesson 8: Is trash a societal problem and can we help solve it?

Time: Four 90-minute periods

Lesson Overview

Through reviewing the evidence collected in throughout the unit, internet research and discussions, students create an action plan centered on an area of focus: landfill, recyclable and compost in hope to reduce the impact their topic has upon the environment. Students will create visually stimulating informational presentations similar to a Public Service Announcement in hope of educating and influencing their peers to make choices that will help reduce the impact of trash.

NGSS Standards:

LS4D: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

ESS3D: Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Enduring Understanding

Students take ownership of the effect their choice has on the environment and develop tools to reduce that impact as well as provide evidence through research and personal data to answer the unit question.

Language Objective

[CCSS.ELA-Literacy.RST.9-10.8](#) Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

[CCSS.ELA-Literacy.RST.9-10.9](#) Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

[CCSS.ELA-Literacy.SL.9-10.4](#) Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task



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Lesson 8: Is trash a societal problem and can we help solve it?

Materials:

- Access to internet
- Poster Paper
- Marker
- Reference material for additional data such as books, websites (see Lesson 7 and 8 Website link handout), data pdfs (see reference folders for additional support materials)
- **Student Handout 1:** Lesson 8 PSA Graphic Organizer
- **Student Handout 2:** (Team Copies) PSA Rubric
- **Student Handout 3:** Peer Evaluation Rubric

Performance Task/Essential Question

Is trash a societal concern? What can I and my peers do to reduce or impact or design a solution to one aspect of the problem?

Vocabulary (in context of this lesson)

No new vocabulary



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Lesson 8: Is trash a societal problem and can we help solve it?

Lesson 8-Two Days Part One	
Teacher/Student Activities	Time / Notes
<ol style="list-style-type: none">1. Warm Up: Look at your Sanitary Landfill Models. What materials show evidence that they have begun decomposing or biodegrading? Why are some materials breaking down at different rates? How does the structure of your model impact the rate of biodegradation?2. Have teams make a poster of their findings and share out their answers to the question?<ol style="list-style-type: none">a. Poster should include: A claim about the two-landfill models.b. Observational Evidence to support their claimc. Explanation of what the observations taught them	<u>15 minutes</u>
Lesson Elaboration: <ol style="list-style-type: none">3. In lesson 7, students chose a type of trash to further investigate. Share with students that they will work collaboratively to develop a method to influence students at their school to change their habits thus reducing the amount of waste placed within the landfills. Students should be encouraged to utilize innovative methods, far beyond a poster or powerpoint.<ol style="list-style-type: none">a. Public Service Announcements may be in the form of a 2-minute video, a blog, a social media page, a slideshow, comic strip, a blueprint for an APP, Prezi presentation or brochure. Students should be encouraged to come up with other forms of PSA but must have the format approved by you. Their PSA must include the following elements:<ol style="list-style-type: none">i. Identify Type of Refuse: Recyclable, Compostable, Landfillii. Definition in your own wordsiii. Amount of that type of refuse generated by this group, the class, and America each year.iv. Five interesting facts collected from your research, experiments and or articles read in the classroom.v. Three or more data visualizations that illustrate the problem (at least two from the class data)i. Create a claim regarding a method to change the amount of your type of refuse and at least three pieces of evidence you or your classmates generated to support it. Students should generate a	Computer access for research is most beneficial <u>60-90 minutes</u>



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Lesson 8: Is trash a societal problem and can we help solve it?

<p>testable hypothesis using hypothetical inductive reasoning: If...then...</p> <ol style="list-style-type: none">1. Example: If we recycle all paper goods then out class trash production would be reduced by 50 percent.b. To help the students collect information as teams, a graphic organizer with the required elements for the PSA can be found in the appendix.b. Review the PSA rubric with the class. If possible, show students an example of a PSA or project such as “Garbage” from Teacher’ Domain. Allow students to watch the video and practice using the rubric to identify effective strategies and areas for improvement.c. http://www.teachersdomain.org/resource/lpsc10.sci.life.garbage/4. Provide students with additional sources of data via the internet or printed up for them. The reference data provided for lesson 7 and 8 are an excellent source of data to answer questions they may have or provide the teams with persuasive data for their projects. Access to the internet is also desirable so that students can collect additional data regarding their topic and or create their presentations.	
<p> HOMEWORK: Prepare for PSA presentation</p>	.



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Lesson 8: Is trash a societal problem and can we help solve it?

Lesson 8 Part two	
Teacher/Student Activities	Time / Notes
Warm Up: Students will complete the Lesson 8 Peer Evaluation Rubric that documents the peer's individual contribution to the team over the PSA project.	Computer access for research is needed
<ol style="list-style-type: none">1. For every presentation, each team will help evaluate the PSA by completing a group rubric. Inform the class that the group rubrics will be returned back to each team. PSA's that earn less than a 4 will have the opportunity to revise their final project and resubmit to the teacher. (Subsequent submissions will not be shown to the class)2. Final reflection either assigned as homework or in class essay when presentations are done: Students will revisit the guiding question from lesson four and submit a paragraph using the CEE process (Claim, Evidence, Explanation). Students that require additional writing scaffolding may use a graphic organizer similar to the Claims Evidence Template in Lesson 6.3. Remind students to look over the last eight activities as a source of evidence to support their claims. a. Guiding Question: "When it comes to trash and our environment, Can one person make a difference? Lessons to help students answer the question include:<ol style="list-style-type: none">i. Article analysisii. Garbage data collected by teams and the classiii. Sanitary landfill modeliv. PSAv. Carbon Cycle Game	<u>Time Suggestion:</u> 2-3 periods depending on number of presentations and length.