Lesson 1: Trash Talk

Students increase awareness about the human and environmental consequences of too much waste and identify potential solutions to the problem.

Length of Lesson: 2-3 class sessions

Subject Area(s): Science, Social Studies, Language Arts, Technology

Objectives

Students will:

- Examine several items that could be found in their class or home trash and predict the path each may take from trashcan to landfill.
- Identify how long waste items last in a landfill, as well as several facts about the history, current status, and future of waste production in the United States.
- Investigate the environmental and human consequences of increased waste production in the U.S
- Brainstorm how technology could help create solutions to these problems,

Materials

- Items from school or home trash can with the following cleaned items in it: banana peel, candy wrapper, plastic bag, tuna fish tin can, aluminum can, glass bottle and Polystyrene foam
- Student Activity Sheet- How Long Will I Last
- Student Handout- Environmental Protection Agency (EPA) Waste Generation and History Data Tables.
- Student Handout- Typical Anatomy of a Landfill (http://www.wm.com/wm/environmental/documents/Anatomy_of_a_Landfill.pdf)
- Student Handout- The Science of Managing Waste (http://www.wm.com/wm/environmental/documents/WMscien_mnging_waste.pdf)
- Access to the Internet.

Background Information

- Waste, also called trash or garbage, is anything that is discarded, rejected, surplused, abandoned, or otherwise released into the environment in a manner (or quantity) that could have an impact on that environment. Most students don't really think about what happens to waste once it is thrown away or placed in a recycling bin. The paths of waste are important for our environment and new waste-related technologies can lead to far-reaching environmental solutions.
- The United States leads the world in waste production. In 2007, Americans generated about 254 million tons of trash. (This was nearly triple the waste production in 1960.) A breakdown of specific waste categories is shown in Graphic 1 on the Student Handout entitled Environmental Protection Agency (EPA) Waste Generation and History Data Tables and Access to the Internet.

- The average person throws away 4.5 pounds of trash per day.
- Too much waste has serious human and environmental consequences including pollution, depletion of natural resources, lack of landfill space, unclean water, financial burden, and increased greenhouse emissions.
- Waste can take many different paths. The majority of waste is sent to landfills. Landfills are carefully designed structures in the ground that collect trash and safely isolate it from the rest of the environment. Some items decompose in landfills but others remain there in the same state indefinitely. To help you and your students understand the science behind landfills, watch http://www.thinkgreen.com/secret-life-of-landfills or review the student handouts, Typical Anatomy of a Landfill or The Science of Managing Waste. All three are great resources to take you and students inside of a landfill.
- New technologies use landfill gas as a renewable energy source, generating power for nearby homes. Students can learn more about this at "Talkin Trash: Fuel for Thought" at http://www.thinkgreen.com/fuel-for-thought.
- In addition to being sent to landfills, trash can also be recycled and recovered into material and energy resources. More about these strategies can be found in Lessons 2, 3 and 4.
- Answers to the How Long Will I Last student activity sheet are: 1. c; 2. e; 3. a; 4. g; 5. b; 6. d; 7. f

Procedure

1. Place the class trashcan in front of the room and pull out (or have students look at) 5-10 random items made of different materials. Ask students to examine each item and to try to identify what it is made of, where it originally came from, where it likely will go once it leaves the trashcan, and whether there might be other uses or paths for this item to take.
2. Then pull out a previously assembled trash bag with the following items in it: banana peel, candy wrapper, plastic bag, tuna fish tin can, aluminum can, glass bottle and Polystyrene foam.
3. Ask students how many of these items they typically throw away. Again, challenge students to identify where each comes from, where it likely will go, and whether there might be another use or path for this item to take. Share with students that, unless reused or recycle, each item likely will end up in a landfill. Review the definition of a landfill from the background information above. Then have students watch, Talking Trash: The Secret Life of Landfills at http://www.thinkgreen.com/secret-life-of-landfills for a quick inside look at a landfill. If time permits, this is also a good time to distribute and review the two student handouts, Typical Anatomy of a Landfill and The Science of Managing Waste.
4. Distribute the How Long Will It Last? student activity sheet and challenge students, individually or in pairs, to guess how long it would take each item to decompose, if at all, in a landfill.
5. Share answers and ask students to draw conclusions about how these decomposition times change the way they look at waste.
6. Ask students how much waste they typically throw away in a week. (The average person throws away 4.5 pounds of waste each day.) Given this average, challenge students to calculate how much waste the average person throws away in a week, a month, a year? How much would their class collectively throw away in a year? Share with students that Americans generated about 254 million tons of waste in 2007! (As a comparison, the

Washington Monument, made mostly of solid stone and 555 feet tall, weighs only 80,000 tons. It would take over three thousand monuments to equal that weight of trash.)

7. Ask students what items they imagine make up the majority of America's waste. Then show or distribute Graphic 1 on the Environmental Protection Agency (EPA) Waste Generation and History Data Tables handout. Review. Is the class trashcan somewhat consistent with this list?
8. Have students imagine what their homes and schools would be like if there was no trash pickup for a week. A month? A year? How can they relate this image to the nation's trash?
9. Share with students that only 88 million tons of waste was generated in 1960 and 151 million in 1980. Graphic 2 on the Environmental Protection Agency (EPA) Waste Generation and History Data Tables shows the history of U.S. waste production from 1960-2007.
10. Why do students think that waste production has increased so much? How might the categories of waste have changed over the years? How will the categories likely change in the future? If this trend continues, how much waste production might there be 30 years from now?
11. Have students generate a list of the risks associated with too much waste production in the United States. Examples of risks include pollution, depletion of natural resources, lack of landfill space, unclean water, financial burden and increased greenhouse emissions.
12. Divide students into groups of three or four. Have them select one of the risks from their list to investigate further. Direct them to the Web sites at the end of this lesson or other school-based or Internet resources to help with their research. Challenge them to find out at least five facts about how too much waste relates to their risk; whether their risk is environmental, human or both; and what the local and national implications are. Have each group share their information.
13. Then have the class share actions or solutions they already do or know about that help reduce the waste production locally, nationally or globally. Poll students to see how many of them implement these existing actions and solutions, and how many of them could do a better job of implementing them.
14. Finally, challenge students to come up with a new action or solution that would either reduce the amount of current waste production or use existing waste to somehow improve our environment or society. Encourage students to think creatively and without limits.
15. Have students present their ideas.

Extension

- Have students track local and national news sources for environmental issues related to waste.
- Have students trace and draw a model of the path(s) of waste in their community.

Home Extension

Ask students if they think their family generates more, less or about the same amount of waste as the national average. Then challenge them to conduct a home waste analysis to learn the answer. First have them consider the waste categories that their family generates and gather individual receptacles for each category. Categories could include glass, plastic, paper, metal,

food, and other. Then have them ask family members to place appropriate waste items in each bin. On the seventh day, have students (and family members) weigh each bin to determine how much of a trash impact they make. Finally, challenge students and their family members to come up with ideas for reducing their overall waste output.

Evaluation

You can evaluate your students using the following three-point rubric:

- **Three points:** Students generate logical reasons for the waste problem in the US; identify risks of this problem; work well in their teams to investigate one risk; and generate creative ideas for new technologies.
- **Two points:** Students generate fairly logical reasons for the waste problem in the US; identify some risks of this problem; work fairly well in their teams to investigate one risk; and generate ideas for new technologies.
- **One point:** Students unable to generate reasons for the waste problem in the US; unable to identify risks of this problem; difficulty working in teams to investigate one risk; and unable to generate ideas for new technologies.

Standards Correlation

This lesson plan may be used to address the National Science Education Standards listed below.

Subject: Science as Inquiry

Standard: Abilities necessary to do scientific inquiry

Benchmark: Identify questions that can be answered through scientific investigations.

Subject: Physical Science

Standard: Transfer of energy

Benchmark: Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei and the nature of a chemical.

Subject: Science and Technology

Standard: Abilities of technological design

Benchmarks:

- Identify appropriate problems for technological design.
- Design a solution or product.
- Implement a proposed solution.

Subject: Science and Technology

Standard: Understandings about science and technology

Benchmarks:

- Scientific Inquiry and technological design have similarities and differences.
- Perfectly designed solutions do not exist.

Subject: Science in Personal and Social Perspectives

Standard: Populations, resources and environments

Benchmarks:

- When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.
- Causes of environmental degradation and resources depletion vary from region to region and from country to country.

Subject: Science in Personal and Social Perspectives

Standard: Natural hazards

Benchmark: Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.

Subject: Science in Personal and Social Perspectives

Standard: Risks and benefits

Benchmark: Individuals can use a systematic approach to thinking critically about risks and benefits.

Subject: Science in Personal and Social Perspectives

Standard: Science and Technology in Society

Benchmark: Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding and research.

This lesson plan may be used to address the North American Association for Environmental Education Guidelines for Learning listed below.

Strand 1: Questioning, Analysis and Interpretation Skills

Guideline: Questioning

Benchmarks:

- Identify environmental questions based on personal experiences both in and outside school, newspaper, and magazine articles, television or radio news, or videos.
- Clarify their own beliefs about the environment and discuss how those beliefs are reflected in the questions they ask.

Strand 1: Questioning, Analysis and Interpretation Skills

Guideline: Designing Investigations

Benchmark: Select types of inquiry appropriate to their questions.

Strand 1: Questioning, Analysis and Interpretation Skills

Guideline: Drawing conclusions and developing explanations

Benchmarks:

- Propose explanations based on what they observed or learned through research, selecting which evidence to use and accounting for discrepancies.
- Use their proposed explanations to form new questions and suggest new avenues of inquiry.

Strand 2: Knowledge of Environmental Processes and Systems

Guideline: Changes in matter

Benchmarks:

- Describe a variety of chemical reactions and offer examples from daily life and the local environment.

Strand 2: Knowledge of Environmental Process and Systems

Guideline: Human/environment interactions

Benchmark: Explain how human-caused environmental changes cause changes in other places.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Identifying and investigating issues

Benchmarks:

- Clearly articulate and define environmental issues.
- Identify key individuals and groups involved, their viewpoints and the types of action they support.
- Investigate the issue using secondary sources and original research where needed.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Sorting out the consequences of issues

Benchmarks:

- Describe the effects of human actions on specific elements, systems and processes of the environment.
- Analyze issues by looking at tradeoffs that have been made.
- Predict the consequences of inaction or failure to resolve particular issues.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Identifying and evaluating alternative solutions and courses of action

Benchmarks:

- Identify different proposals for resolving an environmental issue.
- Explain why various strategies may be effective in different situations.
- Independently and in groups, develop original strategies to address issues.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Forming and evaluating personal views

Benchmarks:

- Discuss personal perspectives with classmates, remaining open to new ideas and information.
- Justify their views based on information from a variety of sources.

Strand 4: Personal and Civic Responsibility

Guideline: Accepting Personal Responsibility

Benchmarks:

- Analyze some of the effects that their actions have on the environment, other humans, and other living things.
- Identify ways in which they feel responsible for helping resolve environmental issues within the community.