Lesson 3: Focus on Recycle/eCycle

This lesson focuses on recycling, with an emphasis on how recycling saves energy and the importance of e-cycling, commonly referred to as eCycling.

Length of Lesson: 2-3 class sessions

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

Objectives

Students will:

- Assess their current knowledge of recycling in the US.
- Calculate the environmental impact of their personal recycling efforts.
- Examine the life cycle of a cell phone and apply that life cycle to environmental decisions.
- Design an e-cycling plan for home and school electronics.

Materials

- Student Activity Sheet- Recycling Challenge
- Access to Internet
- Access to other areas of the school
- One or more cell phones
- Optional: old electronic equipment (battery operated CD player, radio, or telephone) that is no longer working and that can be opened to show the parts inside of it (for safety, do not use computers, televisions or any equipment that requires 120 volts or any equipment with liquid inside of it. If you are unsure, consult with an electrician.)

Background Information

- Recycling is the process of collecting, processing, remanufacturing, and reusing materials instead of discarding them. This helps conserve raw materials and energy that manufacturers would otherwise use in producing new products. Recycling also reduces the amount of material going into landfills. Recycling helps lessen the pollution that may result from waste disposal. Reducing our consumption of materials and reducing the waste of materials also adds to the conservation of our resources. A variety of resources about recycling can be found at www.thinkgreen.com/recycling.
- Recycling has many environmental benefits including energy savings, conservation of natural resources, impact on global climate change, financial savings, pollution reduction, and conservation of landfill space. Specifically, with regard to energy, recycling reduces for nearly eliminates the need for harvesting, extracting and processing the raw materials used to manufacture new products. This is a huge energy savings. In fact, recycling just one aluminum can saves the energy it takes to run a television set for three hours.
- e-Cycling, or electronics recycling, is the process of recycling electronic products such as televisions, phones, cell phones, answering machines, fax machines, printers, DVD players, pagers, portable music players, etc. As the use of electronics in our society

grows, so too does the need to reduce use of, reuse, recycle and recover our electronics safely and effectively.

- Consumer electronics – including TVs and other video equipment, computers, assorted peripherals, audio equipment, and phones – make up almost 2% of the municipal solid waste stream. Although electronics comprise a small percentage of the total municipal solid waste stream, the quantity of electronic waste that we are generating is steadily increasing. In 1998, the National Safety Council Study estimated about 20 million computers became obsolete in one year. Fast forward to 2007 — that number has more than doubled according to EPA's most recent estimates.
- Cell phones are made from copper, other valuable metals and plastics – all of which require energy to extract and manufacture. Recycling cell phones helps recover these valuable resources and saves energy. Recycling just a million cell phones reduces greenhouse gas emissions equal to removing 1,368 cars off the road for a full year.

Procedure (Session 1)

1. Ask students to share what they know about recycling. Then tell them that this lesson is going to focus on some facts they may not already know and some new and creative ways of recycling.
2. Distribute the Recycling Challenge activity sheet to students and challenge them, individually or in pairs, to complete the sheet.
3. Review answers. What, if anything, surprises the students?
4. Review the many environmental benefits of recycling with students, including energy savings, conservation of natural resources, impact on global climate change, financial savings, pollution reduction and conservation of landfill space.
5. Ask students to elaborate on how recycling saves energy and why this particular benefit is so important given our current energy situation. Encourage students to visit www.thinkgreen.com/recycling to learn more.
6. Ask students if they have any idea how much energy it would save to recycle a sheet of paper or one aluminum can.
7. Using the following categories, have students list what they recycled the previous day or week: glass bottles, plastic bottles, aluminum cans, pieces of paper.
8. Then have students go online to www.thinkgreen.com/widget where they can enter their data to calculate the energy savings of their personal recycling efforts. Have students record their data and then calculate how much energy the whole class saved. What conclusions can students draw?

Extension

- Have students conduct an experiment that demonstrates how some mixed material products require special efforts to recycle. Give each group an empty juice box, bowl of hot water, and hand mixer. Have students tear a 2-inch square from the front of the juice box. Place the square in the water, then have a student place the hand mixer in the water and turn it onto high speed for five to seven minutes. The beater should remain on top of the square if possible. Students should begin to see the separation of materials (plastic, paper and aluminum foil). This is called hydro-pulping (mixing materials in water that leads to separation). What might these individual layers get recycled to? What other mixed products do students commonly recycle?

Procedure (Session 2)

1. Write the word, "e-cycling" on the board and ask students if they know what this term refers to. Explain to students that e-cycling is recycling electronics.
2. In small groups, have students brainstorm a list of things in their home that would be e-cycled. You can choose to generate a master list. Tell students that not everything that is electronic can be e-cycled.
    a. What products do they think could get e-cycled?
    b. Do students currently e-cycle their electronics? If so, how do they do this? If not, what prevents them from doing this?
    c. Why is e-cycling so important in today's society?
3. Explain to students that an important part of understanding the recycling or e-cycling process for a product is to understand its life cycle. A life cycle is the process of making a product, from its raw materials to its processing to its packaging. Each stage of a product's life cycle can impact the environment differently. Some products are made of many different parts, each of which has its own life cycle.
4. If you have one or more old battery operated electronic device(s), show students the inside of an old radio or telephone or other safe electronic equipment. Have them identify as many of the different materials they see inside of it as they can.
5. Divide students into groups. Show a cell phone to the class or have students examine their own cell phones. Then challenge each group to write what they think the life cycle of a cell phone would be. They should include the following categories in their life cycle:
    d. Materials Extraction (Raw materials extracted and used)
    e. Materials Processing (How raw materials are combined)
    f. Manufacturing (How parts are put together to make a cell phone)
    g. Packaging and Transport (How cell phones are packaged and sent to stores, etc.)
    h. Use (How cell phones are used)
    i. End of Life (How cell phones are reused).
6. Have students share their life cycles. Then direct them to the Environmental Protection Agency's (EPA) Web site where they will find a graphic entitled, "Life Cycle of a Cell Phone." http://www.epa.gov/osw/education/pdfs/life-cell.pdf. Have them compare their answers with the graphic.
7. Understanding a product's life cycle can help us make environmental choices about purchasing, using, and recycling. How does knowing a cell phone's life cycle help students make environmental decisions? Considering the fact that Americans buy more than 100 million cell phones each year, why is it so important to e-cycle cell phones and other electronic products? What might happen if people did not e-cycle their cell phones?
8. Challenge students to apply the 4 R's to a cell phone. How could they reduce use, reuse, recycle and/or recover with regard to this particular product? Discuss
    j. In what way will buying environmentally responsible electronic products help in the process of e-cycling?
    k. What might be the challenges of e-cycling?
    l. What are the risks of not e-cycling? (Knowing the life cycle can help answer this question. Many electronics contain lead and other hazardous materials, both to humans and to the environment. So, in addition to the typical risks of not recycling, electronics provide additional risks if they are not e-cycled.)

9. Direct students to review e-cycling at the website http://www.thinkgreen.com/recycle-what-detail?sec=electronics&tab=get_started and have them take their original list of electronics found in their homes and divide them into two groups: e-cyclable or not e-cyclable.
10. Do students know if their school or school district e-cycles? If not, how can they find out?
11. List all of the electronic products in their classroom, the school's media center or, if possible, the entire school. Divide the products into categories such as printers, fax machines, phones, etc. Then go to Waste Management's e-cycling site at www.wm.com/ecycling for a list of drop off locations that Waste Management provides. You can also reference the Environmental Protection Agency's (EPA) e-cycling site at http://www.epa.gov/epawaste/conserve/materials/ecycling/live.htm to learn specifically where in your community you can e-cycle each type of product.

Extensions

- E-cycling is relatively new in the US. Have students generate ideas that would encourage others to e-cycle.
- Have students write a five-minute script for a Talkin Trash segment on e-cycling. If technology is available, challenge students to film their segment.

Home Extension

According to the Consumer Electronics Association, the average household has 24 electronic products. Have students count the number of electronic products in their homes. This should include televisions, computers, printers, phones, cell phones, DVD players, answering machines, portable music players, etc. Then have them work with family members to design a plan to e-cycle each product once it is no longer used. They can consult the Waste Management website http://www.thinkgreen.com/recycle-what-detail?sec=electronics&tab=get_started

Evaluation

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

- **Three points:** Students make logical connections between recycling and energy savings; work effectively in groups to determine the life cycle of a cell phone; offer logical ideas about the different stages in a cell phone's life cycle, identify sound strategies for applying the 4 R's to electronics; and draw thoughtful conclusions about the risks of not e-cycling.
- **Two points:** Students make somewhat logical connections between recycling and energy savings; work somewhat effectively in groups to determine the life cycle of a cell phone; offer ideas about the different stages in a cell phone's life cycle, identify some strategies for applying the 4 R's to electronics; and draw conclusions about the risks of not e-cycling.
- **One point:** Students unable to make connections between recycling and energy savings; unable to work effectively in groups to determine the life cycle of a cell phone; offer illogical ideas about the different stages in a cell phone's life cycle, unable to identify strategies for applying the 4 R's to electronics; and unable to draw thoughtful conclusions about the risks of not e-cycling.

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: 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.
- Technological designs have constraints.
- Technological solutions have intended benefits and unintended consequences.

Subject: Science in Personal and Social Perspectives

Standard: Populations, resources and environments

Benchmark: When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.

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: Science and Technology in Society

Benchmarks:

- Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding and research.
- Technology influences society through its products and processes.

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

Strand 1: Questioning, Analysis and Interpretation Skills

Guideline: Organizing Information

Benchmark: Present environmental data in a variety of formats including charts, tables, plots, graphs, maps, and flow charts.

Strand 1: Questioning, Analysis and Interpretation Skills

Guideline: Drawing conclusions and developing explanations

Benchmarks:

- Consider the possible relationships among two or more variables.
- Use their proposed explanations to form new questions and suggest new avenues of inquiry.

Strand 2: Knowledge of Environmental Process and Systems

Guideline: Changes in matter

Benchmark: Explain an object's characteristics based on its composition and how it was formed.

Strand 2: Environment and Society

Guideline: Human/environment interactions

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

Strand 2: Environment and Society

Guideline: Technology

Benchmarks:

- Discuss technologies in the context of larger systems that have shaped the course of human history as well as human relationships with the environment.

- Identify some of the important environmental and social issues related to particular technological developments.

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.
- Speculate bout the effects of a proposed state or local environmental regulation.
- 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

Benchmark: 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 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Evaluating the need or citizen action

Benchmarks:

- Discuss whether action is warranted.
- Identify different forms of action that citizens can take in the economic, political and legal spheres, as well as actions aimed at directly improving or maintaining some part of the environment or persuading others to take action.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Planning and taking action

Benchmarks:

- Develop action plans they can carry out individually, in small groups, or within a class, club, or larger organization.
- Set realistic goals for action and include measures of success consistent with learners' abilities and an understanding of the complexity of the issue.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Guideline: Evaluating the results of actions

Benchmark: Analyze their own actions, explaining apparent effects and discussing them in light of students' goals and reasons for acting,

Strand 4: Personal and Civic Responsibility

Guideline: Recognizing citizens' rights and responsibilities

Benchmark: Identify rights and responsibilities associated with citizenship, including personal and civic responsibilities.

Strand 4: Personal and Civic Responsibility

Guideline: Accepting Personal Responsibility

Benchmarks:

- Analyze some o 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.