Seas, Trees, and Economies

Lesson 7:
Cycling and Recycling Around the Classroom

Author

Curt Anderson, Ph.D., Professor Emeritus, University of Minnesota-Duluth

Standards and Benchmarks (see page 7.13)

Lesson Description

Students pretend to be natural resources moving through the cycle of production, consumption, and recycling.

Grade Level

6-8

Economic Concepts

Benefits

Capital resources

Consumption

Costs

Human resources

Natural resources

Production

Recycling

Resources

Scarcity

Objectives

Students will be able to

- define recycling, resources, production, natural resources, consumption, capital resources, scarcity, human resources, benefits, and costs;

- explain that recycling allows people to produce more goods and services from a given amount of a natural resource;

- identify costs and benefits; and

- explain that activities should be undertaken if the benefits exceed the costs.

Compelling Question

How do societies benefit from recycling?

Time Required

60 minutes

Materials

- Visual 7-1

- Copies of Handout 7-1, cut apart to produce at least four times as many cards as there are "tetra" students

- A copy of Handout 7-2 for each student

- Five 11" x 14" pieces of poster board to create five signs: Resources, Production, Consumption, Recycling, and Waste Disposal

Preparation

Prior to the lesson, prepare the classroom so that there are two areas, each large enough for most students to stand in. Place the "Resources" sign in one area and the "Waste Disposal" sign in the other. In addition, prepare small stations (large enough for one to three students) for "Production," "Consumption," and "Recycling." There must be paths allowing students to move among all areas. A suggested classroom arrangement is to place all student desks or tables in the center of the room. Then use one side of the room for the resource area, the front of the classroom for the production and consumption stations, the other side of the room for the recycling station, and the back of the room for the waste disposal area. Place the appropriate sign in each area.

Procedure

1. Explain that the class will look at recycling in this lesson. Define **recycling** as the process of removing and reusing useful materials found in waste. Discuss the following:

    - What items do you and your family recycle at home? (*Newspapers, aluminum cans, glass bottles and jars, plastic containers, cardboard*)

- Why do you recycle? (*Students will probably say that recycling reduces the amount of waste that is dumped into the environment.*)

2. Explain that **resources** are things that are used to make goods and services. The process of using resources to make goods and services is called **production**. One type of resource we use in production includes natural resources. **Natural resources** are things that occur naturally in and on the earth that are used to produce goods and services. Ask for examples of natural resources. (*Land, water, trees, plants, coal, oil*)

3. Point out that recycling helps us reduce the amount of natural resources needed to produce more goods and services.

4. Explain that students will investigate the benefit of recycling by role-playing as natural resources in the production process. They will participate in four production rounds.

5. Select a large group of students (most of the class). The number in this group should be divisible by four. (For best results, assign 12, 24, or 36 students to this group.) Explain that each student in this group represents a pound of "tetra." Tetra is an imaginary natural resource used to produce an imaginary product—widgets. One pound of tetra is used to produce one widget.

6. Select one to three students to act as widget producers and one to three students to work at the recycling station.

   NOTE: In a class of 25, 20 students would have roles as the tetra, three would have roles as widget producers, and two would have roles as recycling station workers.

7. Organize the class in the following way:
   - Tell the tetra students to go to the resource area and stand in a single-file line.
   - Give the cards from *Handout 7-1: Widget Cards* to the producers and tell them to go to the production station.
   - Tell students who recycle to go to the recycling station.

   NOTE: The teacher should also go to the recycling station because this is the best place from which to direct this activity and be certain that everyone plays his or her role correctly.

Round 1

8. Explain that the tetra students will walk in an orderly line from the resources station to the production station and will receive a widget card from one of the producers. Point out that this step indicates the tetra will be "used up" in the production of a widget.

9. Explain that after leaving the production station, the tetra students (now widgets) will then move to the consumption area. Point out that **consumption** occurs when people use goods and services. As students pass through the consumption station, tell them to act used up, tired, or worn out.

10. Explain that the "used up" widget students will then walk toward the recycling area. Tell the students who recycle that they should point to the waste disposal area because there is no recycling at this time. The widget students will pass by the recycling station and continue to the waste disposal station.

11. Answer any questions students have about the procedure. Tell the tetra students to walk through the process.

12. Once all tetra/widget students are in the waste disposal area, count and collect the widget cards. In this first round, the number of widget cards equals the number of tetra students. Record this number of produced widgets in the first row of the third column on *Visual 7-1: Widget Production*.

Round 2

13. Return the widget cards to the producers. Tell all tetra students to return to the resources station. Explain that in this round, some tetra students will be recycled. They will walk through the stations as before—first to the production station to collect a widget card, then to the consumption station, and then to the recycling station.

14. Explain that in this round, as the tetra/widget students reach the recycling station, the recycling workers will act as traffic controllers. They will direct the first of every four tetra students back to the resource area and the remaining three to the waste disposal station as before.

15. Tell the tetra students that if they are directed back to the resources station, they should go immediately to the end of the resource line and pass through the production, consumption, and recycling stations again.

    NOTE: Students should stay in the order in which they were lined up in the first round; that is, they should not "pass" a student.

16. Begin the procedure and continue cycling the tetra students through the stations until all of them end up in the waste disposal station. Count and collect the widget cards. Those who were recycled will have more than one widget card. If there were 24 tetra students, there should be 32 widgets. Record the results on Visual 7-1 in the second row of the third column.

Round 3

17. Tell all tetra students to return to the resources station. Explain that this round is the same as Round 2 except that the first two of every four students will be directed to the recycling station.

18. Begin the procedure and continue cycling the tetra students through the stations until all of them end up in the waste disposal station. Count and collect the widget cards. Those who were recycled will have more than one widget card. If there were 24 tetra students, there should be 48 widgets. Record the results on Visual 7-1 in the third row of the third column.

Round 4

19. Tell all tetra students to return to the resources station. Explain that this round is the same as Rounds 2 and 3 except that the first three of every four students will be directed to the recycling station.

20. Begin the procedure and continue cycling the tetra students through the stations until all of them end up in the waste disposal station. Count and collect the widget cards. Those who were recycled will have more than one widget card. If there were 24 tetra, there should be 96 widgets. Record the results on Visual 7-1 in the fourth row of the third column.

    NOTE: If n = the number of tetra students, then the number of widgets produced in each round can be calculated as follows. Round 1: number of widgets = n; Round 2: number of widgets = (4/3 × n); Round 3: number of widgets = (2 × n); Round 4: number of widgets = (4 × n).

21. Display Visual 7-1 and discuss the following:

    • In the first round, how many resources were recycled? (*Zero, there was no recycling in Round 1.*)

    • In the second round, how many resources were recycled? (*One out of four resources were recycled—25 percent.*)

    • In the third round, how many resources were recycled? (*Two out of four resources were recycled—50 percent.*)

    • In the fourth round, how many resources were recycled? (*Three out of four resources were recycled—75 percent.)*

22. Point out that with one out of four (1/4) resources recycled, production of widgets increased by 8. When resources were recycled at a rate of two out of four (2/4 or 1/2), production of widgets doubled. When resources were recycled at a rate of three out of four (3/4), production of widgets tripled. Discuss the following:

- In any round, were there resources that didn't end up as waste? (*No, in every round all tetra students eventually ended up in the waste disposal station.*)

- In which round did resources end up as waste most quickly? (*Round 1—no recycling*)

- In which round did it take the most time for all resources to become waste? (*Round 4—3/4 recycling*)

23. Explain that recycling delays the creation of waste; however, all natural resources brought into a production process eventually end up as waste, and people must dispose of the waste.

    NOTE: Students may mistakenly believe that recycling allows natural resources to be used virtually forever; however, this is not the case. Only a 100 percent recycling rate would prevent resources from eventually ending up as waste. This, unfortunately, is not likely physically possible. As James R. Kahn wrote, "Some materials become mixed with other materials during the production process, rendering recycling extremely difficult. The point is that if a fraction of the material is lost every time a material is used and recycled, the material will eventually be exhausted." (Kahn, James R. *The Economic Approach to Environmental and Natural Resources, 3rd Edition*. South-Western College Publishing, 2004.)

24. Discuss the following:

    - Why do you think people don't recycle at a rate as high as 50 percent? (*Answers will vary.*)

    - What happens to items that you and your family recycle? (*They eventually become new products.*)

25. Using aluminum cans as an example, explain that the cans must be taken to a recycling center. They are placed in a truck and hauled to a reprocessing factory. At the factory, they are cleaned and melted down to form liquid aluminum. The aluminum can be used to make new cans.

26. Point out that transporting, cleaning, and melting the aluminum cans uses resources just as production does. Some resources are workers such as truck drivers, factory workers, and workers at the recycling center. Some of these resources are capital resources. **Capital resources** are goods that have been produced and are used to produce other goods and services. They are used over and over again in the production process. For example, the trucks used to transport the cans to the factory are capital resources. The buildings and machines used to melt the cans back into useable aluminum are also capital resources.

27. Explain that all resources are scarce. **Scarcity** is the condition that exists because there are not enough resources to produce everyone's wants. Society wants more goods and services than there are resources available. This means that when we use resources to produce one good or service, those resources can't be used to produce other goods and services.

28. To illustrate this idea, select five students to represent scarce human resources. **Human resources** are people who do mental and/or physical work to produce goods and services. Tell the class that each of these human resources can make four widgets each day, or he or she can convert four used widgets back into useable tetra. Have all five students go to the production station and ask the following questions:

    • How many widgets could be produced in a day? (*4 widgets per student × 5 students = 20 widgets*)

    • How many of these widgets would be recycled? (*None because there are no workers at the recycling station*)

29. Ask one of the five students to move to the recycling station and repeat the two questions from above. Answers are as follows:

    • *4 widgets per student × 4 students = 16 widgets*

    • *4 widgets recycled into useable tetra × 1 student = 4 recycled tetras; i.e., a recycling rate of 1/4 or 25 percent*

30. Ask one of the four students in the production station to move to the recycling station and repeat the two questions from above. Answers are as follows:

    • *4 widgets per student × 3 students = 12 widgets*

    • *4 widgets recycled into useable tetra × 2 students = 8 recycled tetras; i.e., a recycling rate of 8/12 or 67 percent*

31. Point out that as more of the limited human resources are used for recycling (to get a higher recycling rate), fewer are available to produce widgets. The cost of more recycling is less widget production per day.

    NOTE: It is best to stop at this point, but note the following for your information. If yet another student were sent to work at the recycling center, the amount of widgets that could be produced would be 8 while the number that could be recycled would be 12. Since only 8 could be produced, only 8 could be recycled. The recycling rate is 100 percent but the extra recycling worker is not needed.

32. Explain that there are benefits and costs for recycling. **Benefits** are rewards gained from an action/activity. **Costs** are penalties that result from an action/activity. A benefit of recycling is that more can be produced from the same amount of natural resources. However, a cost of recycling is that other resources are required to recycle. So, while recycling saves some resources, society must weigh the benefits of recycling against the costs and decide how much recycling is best. If there isn't enough recycling, society could use up too many natural resources. If there is too much recycling, society could actually use up more resources than it saves.

Closure

33. Review the key points in the lesson by asking the following questions:

- What is recycling? (*Using goods to produce materials that are used to produce new goods*)

- What are natural resources? (*Things that occur naturally in and on the earth that are used to produce goods and services*)

- Does recycling eliminate the creation of waste? (*No*) Then why do we recycle? (*To delay the creation of waste and to produce more goods from the same amount of natural resources*)

- What is production? (*The process of using resources to make goods and services*)

- What is consumption? (*People using goods and services*)

- What are human resources? (*People who do mental and/or physical work to produce goods and services*)

- What are capital resources? (*They are goods that have been produced and are used to produce other goods and services. They are used over and over again in the production process.*)

- Why are resources scarce? (*People want more goods and services than there are resources available to produce those goods and services.*)

- What is a benefit? (*A reward gained from an action/activity*)

- What is a benefit of recycling? (*Producing more goods with the same amount of natural resources*)

- What is a cost? (*A penalty that results from an action/activity*)

- What is a cost of recycling? (*Using other resources in the recycling process*)

- What decision must societies make about recycling? (*How much recycling to do so that natural resources are saved without using up too many other resources*)

Assessment

34. Distribute a copy of *Handout 7-2: Assessment* to each student. Review the instructions and tell students to complete the work. Use the information below to check students' answers.

Students should consider the benefits and costs of recycling aluminum cans and the benefits and costs of recycling toilet paper. They should conclude that the benefits of recycling aluminum outweigh the costs, but the costs of recycling toilet paper outweigh the benefits.

Recycling aluminum is less expensive than mining new ore, and recycling saves energy costs. The costs of storing, cleaning, and sorting aluminum cans are relatively low. The benefits of recycling aluminum include saving energy, saving natural resources, and obtaining more goods

from the same amount of natural resources. Storing and reprocessing toilet paper have very high costs. These include the loss of aesthetic pleasure (odor created), potential health damages in dealing with the dirty paper, and the tremendous amount of resources required to actually separate the "good" paper fibers that could be reused. This means that more resources would be used recycling the paper than would be saved making recycled paper. The costs of recycling in this case are greater than the benefits.

Visual 7-1: Widget Production

Round	Amount of recycling	Number of widgets produced
1	0 out of 4 = 0/4	
2	1 out of 4 = 1/4	
3	2 out of 4 = 2/4 = 1/2	
4	3 out of 4 = 3/4	

Handout 7-1: Widget Cards

WIDGET	**WIDGET**	**WIDGET**	**WIDGET**
WIDGET	**WIDGET**	**WIDGET**	**WIDGET**
WIDGET	**WIDGET**	**WIDGET**	**WIDGET**
WIDGET	**WIDGET**	**WIDGET**	**WIDGET**

Handout 7-2: Assessment

Read the information below and write a response using complete sentences.

Some things are recycled at a very high rate. Some things are recycled at lower rates.

Aluminum cans are recycled at a very high rate, but toilet paper isn't recycled at all. Explain why.

Standards and Benchmarks

Voluntary National Content Standards in Economics

Standard 1: Scarcity

- **Benchmarks: Grade 4**

   7. Natural resources such as land are "gifts of nature"; they are present without human intervention.

   8. Human resources are the people who do the mental and physical work to produce goods and services.

   9. Capital goods are goods that are produced and used to make other goods and services.

- **Benchmark: Grade 8**

   1. Scarcity is the condition of not being able to have all of the goods and services that one wants. It exists because human wants for goods and services exceed the quantity of goods and services that can be produced using all available resources. Scarcity is experienced by individuals, governments, and societies.

Standard 2: Decision Making

- **Benchmark: Grade 4**

   2. A cost is what you give up when you decide to do something. A benefit is what satisfies your wants.

- **Benchmark: Grade 8**

   1. To determine the best level of consumption of a product, people must compare the additional benefits with the additional costs of consuming a little more or a little less.