



Lesson 13:

What Can We Do About Pollution?

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In this economics lesson, students will analyze several approaches to limiting externalities – in this case, pollution. They do this by taking part in a simulation which is a variation of the games Charades and Taboo™. They consider the question “what can be done if someone’s choices are putting a burden on others?”

Teacher note: This lesson includes the economic concepts of markets and externalities and may be most effective after you have introduced these concepts to your students. If you want more background in this topic before you teach it, refer to the resources in the lesson procedure and the extension.

Description of the lesson

In this lesson, students study ways to reduce externalities. To do this, they play a word-guessing game in which they try to maximize the “production” of words, while keeping noise - an externality - to a minimum. In the game, teams of students try to guess a word that is acted out by one teammate by playing Charades – with one round where they can talk and the second where there is no talking, only gestures. Students can also try to guess the word using talking – in the style of the classic games Taboo™ or Catch Phrase™. The version of the game using talking is much easier, but it creates noise. With noise as a metaphor for pollution, the students do three different versions of the game that reflect classic strategies in environmental economics for reducing externalities, including cap and trade.

Economics

Markets fail to deliver the optimal amount of goods and services when producers and consumers do not “feel” all the effects of their market choices. When someone makes a choice where some of the costs and benefits of that choice spill over to a third party, this is called an externality. Externalities can be any “spillover” behavior, from noise pollution to carbon emissions. When externalities exist, too much or too little of a good or service is consumed/produced at the market price. Pollution is one of the most persistent externalities, and finding ways to reduce pollution is a critical social and ethical issue. The possible solutions revealed in this lesson help students better understand how to deal with pollution.

Teacher note: Externalities can be positive (spillover benefit) or negative (spillover cost). While the two are important to production and consumer decisions the focus on this lesson will be on negative externalities.

Ethics

Ethics is the study of right and wrong. Ethical frameworks help explain human behavior and evaluate policies, even if the frameworks seem to conflict with one another. In this lesson, we focus especially on outcome-based ethics and the twin problems of human and environmental well-being. That is, we will study the effects of people’s choices on other people and the physical environment. This includes all forms of pollution, including carbon emissions. By analyzing the outcomes of various approaches to solving environmental problems, students will consider solutions to the question “what can society do if someone’s behavior is putting a burden on others?”

Objectives:

After completing this lesson students will be able to:

- define and provide examples of externalities.
- compare and contrast three approaches to address negative externalities.

Standards

- [Voluntary National Content Standards in Economics](#)¹
- Standard 2: Decision Making
 - Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are “all or nothing” decisions
- Standard 7: Markets and Prices
 - A market exists when buyers and sellers interact. This interaction determines market prices and thereby allocates scarce goods and services.
- Standard 8: Role of Prices
 - Prices send signals and provide incentives to buyers and sellers. When supply or demand changes, market prices adjust, affecting incentives.
- Standard 16: Role of Government and Market Failure
 - There is an economic role for government in a market economy whenever the benefits of a government policy outweigh its costs. Governments often provide for national defense, address environmental concerns, define and protect property rights, and attempt to make markets more competitive. Most government policies also have direct or indirect effects on peoples’ incomes.

Concepts

Markets and Prices, Externalities, Role of Government

Time Required

60 minutes

¹ <https://www.councilforeconed.org/policy-advocacy/k-12-standards/>

Materials Needed

- Slide presentation: What Can We Do About Pollution?
- Decibel meter. There are free decibel meter apps available for smartphones, such as Decibel X™ and Sound Meter™.
- Copies of Activity 13.1 Guess the Word–Word Bank and Activity 13.2 Guess the Word - Additional Quiet Strategy Words. One complete set of words per team of 3-4 students. To be cut out ahead of class and made into a stack for each group. If you need more words, use an online charade word generator. *Note: Careful! Cutting out the word cards is the part of the preparation that will take the most time. If you have the name-brand games at home, you can use the cards from the game rather than printing and cutting. A set of Taboo™ cards should be sufficient to play the game.*
- Blank paper for teams participating in the Quiet Strategy, several pieces per student.
- Pencils, one per student
- Copies of Assessment 13: Methods for Reducing Externalities, one per student
- Copies of Activity 13.3 Guess the Word Payments - Dollars, one pre-cut sheet for each student regulator who will monitor two teams.
- Copies of Activity 13.4 Noise permits. One permit per team of 3-4 students.
- Optional: An adult to enter your classroom to complain to students that they are being too loud – coordinate so that the adult enters while students are playing the “Noisy” version of Taboo/Charades during the first round.
- 3 to 4 badges that say “Student Regulator”, depending on the number of teams.
- Video of the lesson being demonstrated in the classroom by the author (for teacher viewing)
<https://www.youtube.com/watch?v=QwPVSLvH7p0>

Procedure

1. Tell students that today they will be studying ways to reduce **externalities**, which are defined on slide 2 of the slide presentation “What Can We Do About Pollution?” Externalities are costs and benefits of someone’s choice that spill over to a third party who is not involved in the transaction. Today we will focus on **negative externalities**, which are when the choice results in a cost to a third party – someone who wasn’t the original consumer or producer.
2. Remind students that **markets** are an interaction between buyers and sellers, as defined on slide 3. Markets help people **allocate**: that is, to choose what to produce, how much to produce, and who consumes what is produced. Market interactions create **market prices**, which are signals that help allocate scarce goods and services. As an analogy, market prices are for the economy what traffic signals are for traffic: they coordinate the actions of many people.

3. If students need a review of markets, marginal analysis, and externalities, display slide 4, and show them the video [“Externalities”](#)² (7:38 minutes).
4. Remind students that ethics is the study of right and wrong. Ethical frameworks help explain human behavior and evaluate policies, even if the frameworks seem to conflict with one another. In this lesson, we focus especially on outcome-based ethics. That is, we will study the effects of people’s choices on other people and the physical environment. See slide 5. Note: as an extension, students may consider whether this outcome-based view of pollution and production is adequate.
5. Tell students that we will be analyzing three different ways to reduce negative externalities: “command and control;” “taxes;” and what we will call “property rights plus bargaining.” Definitions and examples are displayed on slides 6, 7, and 8 and are as follows:
 - a. Command and control (“C”): Government (or other authority) makes rules limiting the externality.
 - b. Taxes (“T”): Government charges a fee on anyone creating the externality. The tax can be high enough that no one wants to produce the externality, or it can be lower so that some externality is allowed.
 - c. Property rights plus bargaining (“PR+B”): assigning clear liability, responsibility, or property right to people who can reduce the externality. Then providing a way to sell, trade, or take responsibility for the externality. Includes any time people negotiate about how much one person can bother another.
6. Tell students that in order to study these ways to reduce externalities, we will be playing a game called “Guess the Word,” which uses the rules of Charades and Taboo™. Instructions are included on slide 9.
7. Explain the following rules of the game.
 - a. The goal of the game is to guess, or “produce” the most words from the stack of words provided by the teacher from Activity 13.1 Guess the Word (Word Bank). Each team will be paid a dollar from Activity 13.3 Guess the Word Payments – (Dollars) for each word produced.
 - b. An additional goal is to keep the noise in the classroom at an acceptable level. Loud noise represents pollution that is imposed on other people – a negative externality.
 - c. Students will be divided into teams of 3-4. Each team chooses a teammate to be that round’s leader. The leader draws a card from the stack and provides verbal clues or gestures to help the teammates guess the word. If a word is too difficult, teams can pass and draw a new card. Remind students to keep the guessed words in a separate pile to make it easier to count at the end of each session.

² “Externalities” <https://www.youtube.com/watch?v=yC5R9WPld0s>

- d. A student regulator will be assigned to a set of teams. This student will ensure appropriate rules are followed and all payments are made.
- e. Prepare to keep track of data for each round using Visual 13.1, as depicted on slide 10. Record the average decibels per minute (your decibel meter app should give you the average), the average decibels for both minutes combined, and tally up the total production in the class. Using this table, you can compare the success of each strategy for each round. You can either use the slide to record the data or draw the table on the whiteboard.
- f. The class will participate with two different strategies, as depicted in slides 11 and 12.
- g. The first is called the Noisy Strategy, which is like the game Taboo™. Both the leader and the other teammates may talk as the team tries to guess the words. The leader is **not** allowed to say the word or part of the word listed at the top of the card. This is the word the team is trying to guess. The leader also may not use any words or parts of the other words printed on the card. The leader may also not say “rhymes with...” If they break any of these rules, they must discard the word and pick a new one. The leader may gesture. When a team guesses the word correctly, the leader gives them a thumbs-up, draws a new word, and the team repeats the process until time is up. Remember, if a word is too difficult, the leader may discard it and pick another card.
 - i. Ask for a show of hands for who knows how to play Taboo™. Choose a few students to come up and model these games. Play one round of the Noisy Strategy using the demo word card from Activity 13.1 Guess the Word–Word Bank. Complain that the Noisy Strategy is too loud: it is causing a negative externality. Be sure to discard the card used for the example as students will have already seen it and to ensure it does not get handed out to a team.
 - ii. Use a decibel meter to monitor the noise level of the class. Measuring decibels allows you to provide an objective measurement of your noise externality. Write the decibel level on the slide (or the board if you choose). Do this during the demo and during the first minute of each of the three rounds of the activity. (50 decibels is “low” noise pollution. 90 decibels is “high” noise pollution.)
- h. The second strategy is the Quiet Strategy, which is like Charades. The leader must act out the bold-faced word from the card. The team tries to guess the word without talking. They must write their guesses on sheets of paper and show them to the leader. No one on the team may talk! (Ignore the other words on the card: those are for the Noisy Strategy.) When a team guesses the word correctly, the leader gives them a thumbs-up, draws a new word, and the team repeats the process until time is up.

- i. Have students demonstrate Charades without talking—the “Quiet Strategy.” Play one round of the Quiet Strategy using the demo word card from Activity 13.1 Guess the Word–Word Bank. Reiterate how nice and quiet the room was using the Quiet Strategy. Again, be sure to discard the card used for the example as students will have already seen it and to ensure it does not get handed out to a team.
 - ii. Use a decibel meter to monitor the noise level of the class for the Quiet Strategy. A quiet classroom will have a decibel level of around 60 – “low” noise pollution. Measuring decibels allows you to provide an objective measurement of your noise externality. Write the decibel level on the board. Do this during the demo and during the first minute of each of the three rounds of the activity.
 - i. Teams will record how many words they guessed correctly in the time allotted, 2-minute rounds, and will be paid one dollar for each word.
8. Divide the class into groups of 3-4 students (leaving a few to be student regulators). Be sure to have students who modeled the games divided into the various teams. It may be important to have someone who has experience with the games on each team. Encourage these students to be the leader in the first round of the game, as a demonstration to their teammates.
 9. Distribute pre-cut stacks of words from Activity 13.1 Guess the Word–Word Bank to each team or use cards from Taboo™ (recommended).
 10. Assign a student regulator to assist and monitor two or three teams. Provide each student regulator with a sheet’s worth of pre-cut Activity 13.3 Guess the Word Payments - Dollars.
 11. Display slide 13. Tell the students that in the first round, they will use the Noisy Strategy for one minute, and then the Quiet Strategy for one minute.
 12. Ensure everyone is clear on the task and ask if there are any questions before getting started.
 13. Play the game! Ready? Set... Go! Start a timer and let students shout for one minute of Noisy Strategy. Measure the noise level with a decibel meter and write the level on the board. After one minute, stop the play, have teams note the number of words produced with the Noisy Strategy, pick a new card, and start the Quiet Strategy for one minute. Then call an end to the round. Have the student regulator pay each team a dollar for every word produced in the round.
 14. Optional: have an adult enter your classroom to complain about the noise level – our third party who is experiencing the “cost” of loud noise.

15. Record the data for the round on Visual 13.1 (or draw the table on the whiteboard—recommended). Record the average decibels, and record production by asking each team captain (or regulator) to tell you how many words their team guessed.
16. Debrief Round 1 by asking the questions on slide 14. Ask students:
- How many words did your team produce using the Noisy Strategy? Quiet Strategy? Are there any teams that produced almost as much with the Quiet Strategy? **Answer: Students should have produced more words with the Noisy Strategy. Write the total number of words produced in the entire class next to the decibel level for Round 1.**
 - How is guessing words similar to producing something in an economy? **Answers may vary but include: It requires work and the use of human capital. This question is important for connecting the metaphor of the game to real life.**
 - How is loud noise similar to pollution? **Answers may vary but include: They are both externalities. They impose costs on a third party—the students on other teams had a hard time guessing because a team near them was so loud they could not hear much. It might even bother the class next door.**
 - Did you have any choice about when you were noisy or quiet? What strategy for reducing pollution was this? **(No, the teacher dictated this. This round was a demonstration of “command and control” to reduce pollution. Refer to slide 6 to re-teach this you need to.)**
 - If a teacher wanted a nice, quiet classroom, would the Noisy Strategy have created a negative externality? **Answer: Yes.**
 - What was the tradeoff between the Noisy Strategy and the Quiet Strategy? **Answers may vary but include: The noisy part was extremely noisy, but easier to produce words while the quiet part did not disturb others but made it much more difficult to produce words. But different teams have different skill sets. Teams that produced a lot of words with the Quiet Strategy are “clean” producers who do not pollute as much!**
17. Display slide 15, which provides rules for round two with taxes as a disincentive for noise. Tell the students that in the next round, they can choose the strategy they wish to use, Noisy or Quiet, but the government—the teacher!—will charge them a tax of two dollars for every minute they choose to use the Noisy Strategy. They must have enough money to pay the tax and they must decide as a team right now how much noisy time they want to buy (0, 1, or 2 minutes worth). Have teams pay the amount they owe to their student regulator. Remind student regulators to monitor and enforce their teams’ choices. Tell students that they are to use their Noisy Strategy period(s) they bought, if any, first. Remind them that you will announce a period being over every one minute. They may only talk for the number of periods for which they paid the tax. Teams may, if they choose, select a new leader to provide clues at this point.
18. Remind students that after the round, they will also need to identify which strategy for reducing pollution we used: command and control, or taxation, or property rights plus bargaining.

19. Play Round 2, for two minutes. Record the noise level from the first minute on the board. After one minute, announce that the first one-minute period is over and teams must switch to the Quiet strategy if they did not pay for two minutes of noisy tax.
20. Have the student regulator pay each team a play dollar for every word produced in the round. If you want every student to get a chance to play, student regulators may switch with a team member after each round.
21. Debrief Round 2 on slide 16. Ask students:
 - a. Did any team choose to pay the tax to be noisy for both minutes of the round? If so, was it worth it? **Answers will vary. This is an important step for them learning the value of noise for producing words. It will help in the next step.**
 - b. Did you have any choice about when you were noisy or quiet? What strategy for reducing pollution did we use in this round? **(Yes, more than in Round 1. Students got to choose whether or not to pay a fee to buy a Noise Permit. This gives students more flexibility, but the government has to make an accurate guess about how much students are willing to pay to pollute. This strategy for reducing pollution is called "taxation." Refer to slide 7 if you need to reteach this.)**
 - c. Did any team choose to keep their dollars, not pay for the right to be noisy, and participate with only the Quiet Strategy? Was it worth it? **Answers may vary but some groups will have stayed quiet and possibly did not produce much compared to other teams or they might have been unable to produce as much because of the noise.**
 - d. Did any team choose to pay the tax for one minute of Noisy and use Quiet for the other minute? Was it worth it? **Answers may vary.**
 - e. Was the tax too high? Too low? **Answers may vary. In this scenario, a tax of \$2 is often too low to reduce pollution by very much. Many teams value the Noisy Strategy at more than \$2.**
 - f. Ask each team how many words did you produce? Write the total number of words produced in the class next to the decibel levels for Round 2.
22. Display slide 17. In this final round, Round 3, students will purchase the right to pollute – that is, to be noisy – from one another. Have the student regulators distribute one Noise Permit cut out from Activity 13.4: Noise Permits to each team. Each Noise Permit allows one minute of Noisy Strategy. For every minute a team produces without a permit, they must produce with the Quiet Strategy.
23. Give teams three minutes to go around the room and trade Noise Permits for dollars. They must negotiate with each other about how many dollars a permit is worth. Remind them that before they trade, they should talk to each other and decide whether they want to sell or buy permits.
24. Tell teams to give their student regulator the Noise Permits they now have. The student regulators will enforce the appropriate strategy for each team in the final round.

25. Remind teams they can again change leaders to provide clues for the words. Just like round 2, notify students if they have only one noise permit, it must be used in the first period.
26. When ready, proceed with the final round, Round 3. Start the timer and begin the period. Record the noise level from the first minute on the board. After one minute, announce that the first one-minute period is over and teams must switch to the Quiet Strategy if they only have one Noise Permit.
27. After the Round, have the student regulators pay each team a dollar for every word produced in the round.
28. Debrief Round 3 with slide 18. Ask students:
- How many words did you produce in Round 3? Write the total number of words produced in the class next to the decibel level for Round 3.
 - Did you have any choice about when you were noisy or quiet? What strategy for reducing pollution did we use in this round? *(Yes, students got to choose whether to buy, sell, or hold their Noise Permits. The trading of permits allowed students to find what the permits were worth to others. This strategy for reducing pollution is called “property rights plus bargaining.” Refer to slide 8 if you need to reteach this.)*
 - With a show of hands: Which teams bought permits? Which teams sold permits?
 - What did you pay for the permits? **Answer: There will be various prices. Call attention to the different prices. In this scenario, the market price for permits is often \$4. Record the prices of the permits on the board.**
 - Why did some teams value the permits higher than others? Why did some teams value the dollars higher? **Answers may vary but include: Some students are confident in their Quiet Strategy skills. Others are not. The prices for the permits will vary depending on how productive each team is.**
 - Did you pick the right number of permits? Why or why not? **Answer: Accept student answers. They may debate this amongst themselves.**
 - Did the externality permits allow you to choose how much overall pollution there was? **Answer: No. The teacher, acting as the government, decided the overall amount of pollution to allow (one minute per team), but each team/firm then decided how much of that total they wanted to be able to produce by buying the noise permits.**
 - What was the benefit of allowing people to trade for the right to pollute? **Answer: It both reduces pollution and allows people to offer the price that makes it worth it to them. It reduces the externality in the most efficient way, a way that allows each firm to determine the value of producing the externality.**
 - How could we reduce the overall noise pollution in this last round? **Answer: reduce the number of Noise Permits that are allowed in the classroom.**
 - How would this affect the teams and price of the Noise Permits? **Answers may vary but include: Some of the teams wouldn’t get an allocation of Noise Permits so the class would have to find a way to figure out how to distribute them. Once the teams are allowed to trade the prices would likely be much higher as more teams are trying to get the Noise Permits.**

29. Show slide 19. Tell students that “the ‘property rights plus bargaining’ approach is interesting because it shows us how we can use negotiation to reduce any externality. For example, if your neighbor’s dog is barking, you can just go and talk to the neighbor about when the dog can bark freely and when you’d appreciate it be taken inside. However, in the real world it needs two things if it is going to work: clear property rights or responsibility for an externality, and an easy way to bargain or to make someone accept their responsibility (also called ‘low transaction costs’). When we see pollution in a real-world situation, it’s likely that one or both of these things is missing. In our game, we see transaction costs when you all traded noise permits, when the market itself caused noise!

Closure

30. Close the lesson by reviewing the three methods of limiting externalities that we used during these three rounds on slide 20. **1) Command and control, that is, rules about when the externality could be created and when it could not. 2) Taxing the externality and allowing teams to choose if they were going to pay the tax for the right to pollute. And 3) Tradable externality permits in a market that allowed teams to choose how much to pay.**

31. Continue to close the lesson by engaging in a class discussion on slide 21. Ask the following:

- Which of the three versions of the game was best for producing words? **Answers will vary but allow for students to talk about their strategy or what was best for them, likely the Noisy Strategy.**
- Which of the three versions of the game was best for reaching the goal of a quiet classroom and overall limiting noise? **Answers may vary and refer to the recorded decibel levels and classroom production for each round to answer.**
- How was guessing words similar to or a metaphor for producing goods and services? **Answers may vary but include: Many jobs involve producing words. It might not be guessing them in a game, but it takes human resources, including human capital to produce words in this game.**
- Was noise a good metaphor for a pollution externality? Why or why not? **Answers may vary but include: Yes. Both pollution and noise are negative externalities because they bother third parties who had no part in the choice to produce.**
- What can society do if someone’s behavior is putting a burden on others? **Answers may vary but include: determine who is polluting and who has the property, then assess a strategy to limit the effect of the burden on the third parties. Depending on the situation, it might mean the government needs to enact a tax to limit behavior or it might mean neighbors need to have a conversation and come to a mutually beneficial agreement. Lastly, all countries have law courts in which people can settle disputes using legal methods. This is the main way that people use the “property rights plus bargaining” approach.**

32. Show slide 22. Tell students that “it’s important to understand that each of the methods we have learned have their uses. Command and control can work when people just want simple, clear rules. Taxation or fees can work when transaction costs stop people from bargaining, or when a government is trying to raise revenue. And property rights plus bargaining help us find ways to reduce externalities efficiently.”
33. Tell students that these three methods of reducing externalities from the game are the three broad ways that economists think about reducing negative externalities in real life. In an assessment/worksheet, they will think of more situations in which these methods may be used.

Assessment

34. Distribute copies of Assessment 13: Methods for Reducing Externalities to each student. Explain that each line describes an action to reduce externalities using one of the three methods we studied: command and control; taxes; and property rights and bargaining. In the spaces below, fill in “C+C” if you think the method is command and control, or “T” for taxation, or “PR+B” for property rights and bargaining.

Some sample assessment items:

1. What is it called when the costs of production spill over onto unwilling third parties?
 - a. Opportunity Cost
 - b. Positive externalities
 - c. Negative externalities**
 - d. Outcome-based ethics
2. Government makes a rule that farms must limit the amount of pesticides that run off into the watershed. What kind of externality-reduction method is this?
 - a. Price controls
 - b. Command and control**
 - c. Taxation
 - d. Property rights and bargaining
3. A landlord owns a house that has an old fence. The house also has a steep median that the landlord hates mowing. He rents the house to Tonya. The landlord wants to tear down the fence so he can mow the median more easily. But Tonya loves the fence; it keeps her dog in the yard. Tonya offers to mow the median herself if the landlord agrees not to tear down the fence. He agrees. What kind of externality-reduction method is this?
 - a. Price controls
 - b. Command and control
 - c. Taxation
 - d. Property rights and bargaining**

Extension

35. Continuing the conversation: Do a think, pair, share activity in which students discuss the following questions with a partner:
- “Is there a connection between pollution and our economic well-being?”
 - “‘Property-rights-and-bargaining’ includes any time that people negotiate to reduce negative externalities. For example, when a neighbor asks another neighbor to turn their music down. What are some other examples of times that people negotiate to reduce externalities?”
36. Use this lesson alongside current events or case studies in environmental problems (e.g. climate change). Ask students to see how and if any of the three approaches they studied in this lesson could apply to their issue. Ask students to prepare an action plan to address their issue.
37. This lesson gave a very cursory overview of the different ways to deal with externalities. For a deeper exploration, assign advanced students the Externalities course from [Marginal Revolution University](#). Each section is helpfully labeled, so if students need more information on one of the three methods of externality-control, you can quickly find it.
38. This lesson uses **outcome-based ethics**, or “consequentialism,” as an ethical assumption (see step 4 of the lesson procedure and slide 5 and 6). Ask students what kinds of questions we might ask if we added duty-based or virtue-based views of ethics into the discussion. Refer to [Ethics, Economics, and Social Issues Lesson 1: How Can You Apply Ethics and Economics to Any Issue?](#) for additional help using other ethical frameworks. *(Possible answers: what has caused us to want to reduce pollution in the first place, or to increase production? Do we want to reduce pollution out of a sense of duty, or of virtue, or some other reason? Should the government set an even lower level of pollution than it did in the game, even if that means people suffer due to lack of production?)*
39. In 2023, the states of Washington and California faced a choice about whether or not to join their pollution permit markets together. There were costs and benefits to joining the markets.

Students are to read the following article about this issue. In the article, the permit market is called “cap-and-trade.” <https://www.eenews.net/articles/will-california-and-washington-marry-their-carbon-markets/>

Students must then write a short letter addressed to a state senator in which they take the role of an environmental economist. Each student must choose to write to either a California or a Washington state senator – each student may choose which. This outline can help give their letter structure and help them practice thesis-driven writing.

“Dear Senator, when making your decision about whether to vote for joining California’s and Washington’s cap-and-trade markets, I want you to be aware of the following important conclusion that I have reached:

I believe this for two reasons:

1)

2)

Finally, I realize that not everyone agrees on the issue of environmental policy, especially cap-and-trade. I understand that some believe:

Because...

Thank you for taking my research into account.

Sincerely,

References

Externalities (Accessed, July 2022). *The Econ Lowdown Podcast, Episode 11.*

<https://www.stlouisfed.org/education/economic-lowdown-podcast-series/episode-11-externalities#:~:text=Government%20can%20discourage%20negative%20externalities,services%20that%20generate%20spillover%20benefits.>

Mulkern, A. C. (October 23, 2023). *Will California and Washington marry their carbon markets?*

ClimateWire. <https://www.eenews.net/articles/will-california-and-washington-marry-their-carbon-markets/>

Visual 13.1: Production and Pollution

	Round 1 (C&C)	Round 2 (T)	Round 3 (PR+B)
Minute 1 Decibels	<i>50 (example)</i>		
Minute 2 Decibels	<i>70 (example)</i>		
Minutes 1 + 2 decibel average	<i>60 (average)</i>		
# Produced (\$)	<i>5 words (example)</i>		

("C" refers to "command and control." "T" refers to taxation. "PR+B" refers to "property rights plus bargaining.")

Assessment 13: Methods for Reducing Externalities

Each line below describes an action to reduce externalities using one of the three methods we studied: command and control; taxes; and Property rights and bargaining.

In the spaces below, fill in “C+C” if you think the method is **command and control**, or “T” for **taxation**, or “PR+B” for **property rights-and-bargaining**.

Externality (what is the problem?)	Action (what are we doing about it?)	Method (how does it work?) “C+C,” or “T,” or “PR+B”
Loud music at party next door is keeping you awake	Police shut the party down	
Loud music at party next door is keeping you awake	Police make hosts pay a fine	
Loud music at party next door is keeping you awake	You ask the hosts to turn the music down a bit and to please end the party at midnight. They agree.	
CO2 emissions are causing climate change	Government measures carbon output at factories and makes them pay a fee for every ton of carbon emitted	
CO2 emissions are causing climate change	Government allows factories to emit 50,000 tons of carbon per year, but no more	
CO2 emissions are causing climate change	Government gives each factory permits to emit 40,000 tons of carbon. They can buy or sell these carbon permits if they want to.	
Overpopulation of deer is leading to crops and forests being destroyed	Government sells deer hunting permits	
Overpopulation of deer is leading to crops and forests being destroyed	Government creates deer hunting season, but restricts deer hunting in the off-season	
There are not enough parking spaces in New York City.	A company creates an app that pays people to send an alert when they are leaving a free parking space. Other people pay to receive alerts.	

Assessment 13: Methods for Reducing Externalities, continued

Short answer

1. Describe a particular negative externality. Describe a way this externality could be fixed using one of the three methods from this worksheet.

2. Overfishing is an externality, as it causes fish populations to decline. A “property rights plus bargaining” solution to overfishing could be to allow fishing companies to buy and sell the right to fish in different areas of the ocean. But this idea probably wouldn’t work. Why not?

Essay

Scenario: take the role of the owner of a high-tech manufacturing company. Your company uses lots of energy. You read in the news that your state government is creating new regulations to decrease energy use in order to further fight the varied negative effects of air pollution (e.g. climate change, breathing problems, damage to buildings, harm to wildlife, etc.). You think that some kind of new regulation to your business’ energy consumption will happen no matter what.

Pretend you are explaining the situation to your middle-school-aged children. Tell them 1) two of the strategies for reducing air pollution you think the government might take, 2) which one you would prefer, and 3) why.

Assessment 13: Methods for Reducing Externalities ANSWER KEY

Each line below describes an action to reduce externalities using one of the three methods we studied: command and control; taxes; and Property rights and bargaining.

In the spaces below, fill in “C+C” if you think the method is **command and control**, or “T” for **taxation**, or “PR+B” for **property rights-and-bargaining**.

Externality (what is the problem?)	Action (what are we doing about it?)	Method (how does it work?) “C+C,” or “T,” or “PR+B”
Loud music at party next door is keeping you awake	Police shut the party down	C+C
Loud music at party next door is keeping you awake	Police make hosts pay a fine	T
Loud music at party next door is keeping you awake	You ask the hosts to turn the music down a bit and to please end the party at midnight. They agree.	PR+B
CO2 emissions are causing climate change	Government measures carbon output at factories and makes them pay a fee for every ton of carbon emitted	T
CO2 emissions are causing climate change	Government allows factories to emit 50,000 tons of carbon per year, but no more	C+C
CO2 emissions are causing climate change	Government gives each factory permits to emit 40,000 tons of carbon. They can buy or sell these carbon permits if they want to.	PR+B
Overpopulation of deer is leading to crops and forests being destroyed	Government sells deer hunting permits	T
Overpopulation of deer is leading to crops and forests being destroyed	Government creates deer hunting season, but restricts deer hunting in the off-season	C+C
There are not enough parking spaces in New York City.	A company creates an app that allows people to pay other people for alerting the app when they are leaving a parking space	PB+B

Assessment 13: Methods for Reducing Externalities ANSWER KEY, continued

For each of the questions below, write a short paragraph in response.

Describe a particular externality.

The student must give a specific example. Partial credit for only giving a definition.

Describe a way the externality above could be fixed using one of the three methods from this worksheet.

Their answer must faithfully describe one of the three strategies. Consider giving full credit even if the strategy might not work well in that situation.

Overfishing is an externality, as it causes fish populations to decline. A “property rights plus bargaining” solution to overfishing could be to allow fishing companies to buy and sell the right to fish in different areas of the ocean. But this idea probably wouldn’t work. Why not?

The answer should include one of the two problems that a property-rights-plus-bargaining solution often faces. 1) high transaction costs make it difficult to trade fishing rights. However, this is probably not a problem in this instance. 2) Difficulty assigning property rights. This is the more likely problem in this scenario. Fish swim away, so they wouldn’t stay in a fishing company’s assigned area. For this reason, overfishing is usually addressed by fishing quotas (command and control) or by paying a government fee for getting a fishing permit (taxes).

Essay

Scenario: take the role of the owner of a high-tech manufacturing company. Your company uses lots of energy. You read in the news that your state government is creating new regulations to decrease energy use in order to further fight the varied negative effects of air pollution (e.g. climate change, breathing problems, damage to buildings, harm to wildlife, etc.). You think that some kind of new regulation to your business’ energy consumption will happen no matter what.

Pretend you are explaining the situation to your middle-school-aged children. Tell them 1) two of the strategies for reducing air pollution you think the government might take, 2) which one you would prefer, and 3) why.

The answer should faithfully describe at least two of the three methods of reducing externalities, along with a description of the benefits of one particular method. See steps 31-33 in the “Closure” part of this lesson plan for further explanation of these benefits.

Activity 13.1: Guess the Word–Word Bank

YOU Demo Word Noisy (do not make copies for each team)	MARRY Demo Word Quiet (do not make copies for each team)	ME	CAFE
ME HIM I NOT HER	WEDDING KNOT RING GROOM BRIDE	NOT YOU I MYSELF PERSON	FOOD SNACK COFFEE DRINK EAT
TELEVISION	SOCCER	VIOLIN	BOAT
WATCH CARTOON DRAMA CHANNEL TV	BALL BLACK & WHITE ROUND PLAY SPORT	STRINGS ORCHESTRA CONCERTMAS TER MUSIC INSTRUMENT WOOD	WATER SEA SHIP CAPTAIN TRANSPORT

FATHER	RAIN	CLOWN	DAY
PARENT HUSBAND MAN FAMILY WORK	PRECIPITATION WATER SKY WET DROPS	JOKER CIRCUS RED NOSE MCDONALDS MAKE-UP	NIGHT LIGHT SUN NO SLEEP WORK
LIPSTICK	FEAR	SEA	CHICKEN
RED LIPS PURSE WOMEN BEAUTIFUL	PHOBIA SCARE TABOO TERROR SPIDERS	BLUE SKY WATER RED OCEAN	FOOD EGG KFC FRIED ROOSTER

NAPKIN	DIAMOND	BEE	HONEY
WIPE MOUTH CLEAN STACK SPILL	ROCK ENGAGEMENT RING JEWEL STONE BRILLIANT	HONEY INSECT HIVE STING BUMBLE	BEE SWEET HIVE FOOD ALLERGY
HUSBAND	COURT	FOOT	MILK
MARRY WIFE RING WEDDING KIDS	JUDGE SUE LAWYER JURY WITNESS	SHOE SOCK TOES SMELL BODY	WHITE CEREAL DAIRY LIQUID HEALTHY

MOTHER	MARRIAGE	SUNNY	DANCE
WOMAN HOUSE WIFE PARENT CHILDREN FATHER	RING WEDDING COUPLE LOVE CHURCH	BRIGHT MORNING SUMMER DAY YELLOW	MOVE MUSIC PARTY NIGHT CLUB BANDS
GORILLA	BEAR	PANDA	TIGER
IT IS BIG IT IS STRONG BROWN OR BLACK LIVES IN AFRICA EATS BANANAS	BROWN, BLACK, OR WHITE IT IS STRONG TEDDY EATS FISH DANGEROUS!	EATS BAMBOO LIVES IN CHINA BLACK AND WHITE BIG NOT DANGEROUS	LIVES IN INDIA VERY DANGEROUS! ORANGE, BLACK, AND WHITE BIG BIG CAT

TABLE	HAIR	BONES	GLASS
ROOM DISH FURNITURE WOOD CHAIR	GROW ACCESSORIES HEAD CLIPS LONG	BREAK SKELETON BROKEN BODY DOG	CUP DRINK TRANSPAREN T WATER PLASTIC
MONEY	KETCHUP	PRETTY	WEATHER
ATM BUY WALLET PRESIDENTS RUPIAH	TOMATO SAUCE RED FRENCH FRIES BOTTLE	GOOD LOOKING SWEET BEAUTIFUL GIRL ATTRACTIVE	CLIMATE COLD HOT RAIN SUNNY

AIRPORT	STREET	HOLIDAY	BASKET
CHECK-IN SUITCASE BOARDING PASS TICKET FLIGHT	ROAD PAVEMENT DRIVE TRAFFIC HIGHWAY	SUN BEACH FREE SUMMER SCHOOL	FRUIT FLOWER RATTAN STRAW WASTE
FISH	CLOCK	SOFA	TURTLE
SWIM SEA ANIMAL SHARK AQUARIUM	WATCH TIME TICK TOCK MINUTES WALL	SIT LIVING ROOM TV FURNITURE RELAX	GREEN SLOW ANIMAL BROWN OCEAN

BRAIN	VEHICLE	MOTORCYCLE	SERVICE
HEAD	CAR	HELMET	CUSTOMER
THINK	BIKE	DRIVE	SERVICE
MIND	ENGINE	YAMAHA	GIVE
SKULL	BUS	HONDA	SMILE
REMEMBER	TRANSPORTA TION	HARLEY	BROKEN

Activity 13.2: Guess the Word - Additional Quiet Strategy Words

Use these if students are quickly going through Quiet Strategy words and need more

Coffee pot	School
Engineer	Dinosaur
Smart	Win
Candle	Vacation
Sweater	Trash

Activity 13.2: Guess the Word - Additional Quiet Strategy Words, continued

Play video games	Rock 'n roll
Break up	Movie
Stressed	Change diaper
Monster	Shampoo
Hot	Computer
Bowling	Social media

Activity 13.3: Guess the Word Payments - Dollars

\$ One Dollar \$	\$ One Dollar \$
\$ One Dollar \$	\$ One Dollar \$
\$ One Dollar \$	\$ One Dollar \$
\$ One Dollar \$	\$ One Dollar \$
\$ One Dollar \$	\$ One Dollar \$

Activity 13.4: Noise permits

Noise Permit! Use the Noisy Strategy for one minute	Noise Permit! Use the Noisy Strategy for one minute
Noise Permit! Use the Noisy Strategy for one minute	Noise Permit! Use the Noisy Strategy for one minute
Noise Permit! Use the Noisy Strategy for one minute	Noise Permit! Use the Noisy Strategy for one minute
Noise Permit! Use the Noisy Strategy for one minute	Noise Permit! Use the Noisy Strategy for one minute
Noise Permit! Use the Noisy Strategy for one minute	Noise Permit! Use the Noisy Strategy for one minute