

LESSON 9: Getting to School: What's the Cost?

LESSON OVERVIEW

In this lesson students will consider the monetary, environmental, safety, and practical costs of different modes of transportation. Partners will share how they get to school in the morning and why they use this mode of transportation. As a class, students will consider the reasons why students use different modes of transportation. Students will be asked to help Traveling Tony evaluate the monetary and environmental costs of walking, bicycling, and being driven to school. Students will also consider the “safety cost” of the different modes of transportation that Traveling Tony can take to school and identify ways to make Tony’s morning commute as safe as can be (bicycle helmets, seat belts, etc.). Finally, students will write letters to Traveling Tony explaining their recommendations for how he can get to school.

OBJECTIVE

- Evaluate the monetary, environmental, safety, and practical costs of different modes of transportation.

TOPIC

Impacts of Walking and Bicycling to School

STANDARDS SUPPORTED IN THIS LESSON

Common Core State Standards for English Language Arts

Writing Standards

Grade Four

- **CCSS.ELA-Literacy.W.4.1:** Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Grade Five

- **CCSS.ELA-Literacy.W.5.1:** Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Common Core State Standards for Mathematics

Grade Four

- **4.NBT.B.4** (CCSS.Math.Content.4.NBT.B.4): Fluently add and subtract multi-digit whole numbers using the standard algorithm.
(Note: 4th graders who have not learned about decimals can use the calculation 1 mile = 1 pound of air pollution.)*
- **4.NBT.B.5** (CCSS.Math.Content.4.NBT.B.5): Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Grade Five

- **5.NBT.B.7** (CCSS.Math.Content.5.NBT.B.7): Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

California Health Education Content Standards

Injury Prevention and Safety – Grade Four

Standard 7: Practicing Health-Enhancing Behaviors

- **7.3.S:** Use appropriate protective gear and equipment.
- **7.4.S:** Follow safety rules and laws at home, at school, and in the community.

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National Health Education Standards for Grades Three to Five

Standard 7: Practicing Health-Enhancing Behaviors

- 7.5.1: Identify responsible personal health behaviors.
- 7.5.2: Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.
- 7.5.3: Demonstrate a variety of behaviors to avoid or reduce health risks.

MATERIALS NEEDED

- *What's the Cost of Bicycling?* worksheet (1 per student)
- *What's the Cost of Driving?* worksheet (1 per student)
- *Getting to School: What's the Cost?* worksheet (1 per student)
- Lined paper (1 piece per student)

PREPARATION ACTIVITIES

- Make copies of *What's the Cost of Bicycling?*, *What's the Cost of Driving?*, and *Getting to School: What's the Cost?* worksheets.

STEPS FOR CLASSROOM ACTIVITY

How Did You Get to School? (5 minutes)

- Have students turn to a partner and share how they got to school this morning. Ask students to share why they used the mode of transportation that they did.
- Call on students to share how they got to school. Briefly discuss the reasons why students used certain modes of transportation.

What's the Cost of Bicycling and Driving? (20 minutes)

- Tell students that there are different options for getting to school and each option has pros and cons. There are different costs for each option—monetary (money), environmental (pollution), safety, and practical (convenience) costs.
- Explain that students are going to help Traveling Tony evaluate the costs of using different modes of transportation to get to school. Traveling Tony goes to college every day. His school is two miles away from his house, which means it takes him four miles round trip to get to and from school. There is no public transportation in Traveling Tony's neighborhood and he does not have anyone to carpool with. Traveling Tony has three options for getting to school—walking, bicycling, and driving.
- Tell students that they will begin by calculating the monetary costs of each mode of transportation. Ask students how much it costs to walk (\$0). Tell students that they will calculate the monetary costs of bicycling and driving. To do this, students will figure out how much it costs per mile to bicycle or drive.
- Pass out the *What's the Cost of Bicycling?* and *What's the Cost of Driving?* worksheets. Have students complete each worksheet. Review the calculations as a class, using the answer keys to check your students' work.

PREPARATION TIME

10 minutes

ACTIVITY TIME

60 minutes

VOCABULARY

Environmental—Relating to the natural world and humans' impact on the natural world.

Fuel Efficiency—A measure of how much energy is produced by an engine in relationship to the amount of fuel it uses.

Insurance—Protection against a possible event or occurrence.

Maintenance—Keeping something in good condition.

Monetary—Having to do with money.

Practical—Concerned with actually doing something rather than just ideas.

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Getting to School: What's the Cost? (20 minutes)

- Now that students have calculated the costs of bicycling and driving per mile, ask them to think about what other costs Traveling Tony should consider.
- Tell students that they are going to help Traveling Tony calculate the cost that each mode of transportation has on the environment. Ask students if walking, bicycling, and/or driving causes air pollution. For driving, students will use the conversion 1 mile = 0.97 pounds of air pollution* (round to 1 mile = 1 pound of air pollution if students need a modification).
- Tell students that they will also consider the safety cost of each mode of transportation. Traveling Tony can help to make each mode of transportation safer by following certain precautions (crossing in the crosswalk while walking, wearing his helmet while bicycling, etc.)
- Have students fill out the *Getting to School: What's the Cost?* worksheet.
- When all students have finished, review and compare students' responses.
- Ask students if there is any other information Traveling Tony should consider when choosing which mode of transportation to use. If students do not bring it up, point out that Traveling Tony will also want to consider the practical cost of using each mode of transportation. For example, if Tony does not have much time in the morning, walking may not be practical because it would take Tony more time to get to school. However, Tony may wish to walk or bicycle to school even though it takes longer than driving because he cares about the environment and does not want to create pollution by driving.

Reflection: Persuasive Letters (15 minutes)

- Ask students to make a recommendation for which mode of transportation Traveling Tony should use. Tell students that they will be writing a letter to Traveling Tony trying to convince him to use their recommended mode of transportation.
- In the persuasive letters, students should use information from their *What's the Cost?* worksheet to persuade Traveling Tony to change his mode of transportation. Remind students to use supporting details to convince Traveling Tony of their reasoning.

Ideas for Extending the Lesson

- After calculating the distances they travel to school, have students calculate the monetary and environmental costs of their trips to school.
- Have students make posters advertising the hidden costs of different modes of transportation. Encourage students to use the information they learned in this lesson to teach others about the impact of their transportation decisions.



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*<http://www.youcanbikethere.com/content/environmental-benefits-0>

Name: _____ Date: _____

It costs money to buy and maintain a bicycle. Help Traveling Tony calculate the cost of riding a bicycle per mile.

Starting Costs

Average cost of bicycle = \$150

Basic equipment (bicycle helmet, pump, spare tube, seat pack, front and rear lights, and water bottle) = \$100

1. How much money does it cost to buy a bicycle and basic equipment? Show your work.

Routine Maintenance Costs

Cost of routine maintenance = \$50/year

Replacement tires = \$30 for one set per year

Occasional upgrades (new bicycle helmet, seat, pedals, wheels) = \$60 per year

Average life of a bicycle = 10 years

2. Calculate how much money will be spent on maintenance over the life of a bicycle. Show your work.

Calculate Cost of Riding a Bicycle per Mile

Average miles ridden over the life of a bicycle = 10,000

3. Add the starting costs (question 1) and the maintenance costs (question 2).

Divide this answer by the total number of miles ridden over the life of a bicycle (10,000).

4. What is the cost of riding a bicycle per mile? (Round to the nearest hundredth) _____

Source: Maryland Pedestrian and Bicycle Safety Education Program,

<http://www.saferoutesinfo.org/program-tools/maryland-pedestrian-and-bicycle-safety-education-curriculum-k-5>

Name: _____ Date: _____

It costs money to buy and maintain a bicycle. Help Traveling Tony calculate the cost of riding a bicycle per mile.

Starting Costs

Average cost of bicycle = \$150

Basic equipment (bicycle helmet, pump, spare tube, seat pack, front and rear lights, and water bottle) = \$100

1. How much money does it cost to buy a bicycle and basic equipment? Show your work.

$$\mathbf{\$250 = (\$150 + \$100)}$$

Routine Maintenance Costs

Cost of routine maintenance = \$50/year

Replacement tires = \$30 for one set per year

Occasional upgrades (new bicycle helmet, seat, pedals, wheels) = \$60 per year

Average life of a bicycle = 10 years

2. Calculate how much money will be spent on maintenance over the life of a bicycle. Show your work.

$$\mathbf{\$1,400 = 10 \times (\$50 + \$30 + \$60)}$$

Calculate Cost of Riding a Bicycle per Mile

Average miles ridden over the life of a bicycle = 10,000

3. Add the starting costs (question 1) and the maintenance costs (question 2).
Divide this answer by the total number of miles ridden over the life of a bicycle (10,000). Show your work.

$$\mathbf{\$0.165 = (\$250 + \$1,400) \div 10,000 \text{ miles}}$$

4. What is the cost of riding a bicycle per mile? (Round to the nearest hundredth) _____

$$\mathbf{\$0.165/\text{mile}}$$

Student Worksheet

What's the Cost of Driving?

Name: _____ Date: _____

It costs money to buy, maintain, and drive a car. Help Traveling Tony calculate the cost of driving a car per mile.

Insurance

Average cost of Insurance = \$1,300 per year

Life of a Car = 15 years

1. How much money is spent on insurance over the life of a car? Show your work.

Cost of Gas

Average cost of gas in California = \$4.00 a gallon

Fuel Efficiency = 30 miles per gallon

2. Calculate how much it costs for gas per mile (round to nearest hundredth). Show your work.

The average number of miles driven over the life of a car = 150,000

3. Calculate how much money will be spent on gas over the life of a car. Show your work.

Maintenance Costs

Oil Change:	Tune-Ups	Tires
\$45 per oil change, performed twice per year	\$100 per tune-up, performed once per year	\$80 per tire, set of 4 tires replaced per year
Total yearly cost for oil changes: _____	Total yearly cost for tune-ups: _____	Total yearly cost for tires: _____

4. How much money is spent on maintenance (oil changes + tune-ups + tires) per year? Show your work.
5. How much money is spent on maintenance over the life of a car (15 years)? Show your work.
(Hint: Use your answer above to help)

Calculate Cost of Driving per Mile

Average cost of a midsize car = \$15,000

6. Add cost of a midsize car (\$15,000), amount of money spent on insurance (question 1), amount of money spent on gas (question 3), and amount of money spent on maintenance (question 5). Show your work.

Divide this answer by the total number of miles driven over the life of a car (150,000). Show your work.

7. What is the cost of driving per mile? (Round to the nearest hundredth) _____

Source: Maryland Pedestrian and Bicycle Safety Education Program,

<http://www.saferoutesinfo.org/program-tools/maryland-pedestrian-and-bicycle-safety-education-curriculum-k-5>

Name: _____ Date: _____

It costs money to buy, maintain, and drive a car. Help Traveling Tony calculate the cost of driving a car per mile.

Insurance

Average cost of Insurance = \$1,300 per year

Life of a Car = 15 years

- How much money is spent on insurance over the life of a car? Show your work.

$$\mathbf{\$19,500 = (\$1,300 \times 15 \text{ years})}$$

Cost of Gas

Average cost of gas in California = \$4.00 a gallon

Fuel Efficiency = 30 miles per gallon

- Calculate how much it costs for gas per mile (round to nearest hundredth). Show your work.

$$\mathbf{\$0.13 = (\$4.00 \div 30 \text{ miles})}$$

The average number of miles driven over the life of a car = 150,000

- Calculate how much money will be spent on gas over the life of a car. Show your work.

$$\mathbf{\$19,500 = (\$0.13 \times 150,000 \text{ miles})}$$

Maintenance Costs

Oil Change: \$45 per oil change, performed twice per year Total yearly cost for oil changes: \$90	Tune-Ups \$100 per tune-up, performed once per year Total yearly cost for tune-ups: \$100	Tires \$80 per tire, set of 4 tires replaced per year Total yearly cost for tires: \$320
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- How much money is spent on maintenance (oil changes + tune-ups + tires) per year? Show your work.

$$\mathbf{\$510 = (\$90 + \$100 + \$320)}$$

- How much money is spent on maintenance over the life of a car (15 years)? Show your work.

(Hint: Use your answer above to help)

$$\mathbf{\$7,650 = (\$510 \times 15 \text{ years})}$$

Calculate Cost of Driving per Mile

Average cost of a Midsize Car = \$15,000

- Add cost of a midsize car (\$15,000), amount of money spent on insurance (question 1), amount of money spent on gas (question 3), and amount of money spent on maintenance (question 5). Show your work.

$$\mathbf{\$61,650 = (\$15,000 + \$19,500 + \$19,500 + \$7,650)}$$

Divide this answer by the total number of miles driven over the life of a car (150,000). Show your work.

$$\mathbf{\$0.41 = (\$61,650 \div 150,000 \text{ miles})}$$

- What is the cost of driving per mile? (Round to the nearest hundredth) _____

$$\mathbf{\$0.41/\text{mile}}$$

Student Worksheet

Getting to School: What's the Cost?

Name: _____ Date: _____

Help Traveling Tony weigh the costs of different modes of transportation. Traveling Tony's trip to school is 4 miles round trip.

To calculate the monetary cost, use the costs per mile that you calculated for bicycling and driving.

To calculate the environmental cost, use 1 mile = 0.97 pounds of air pollution.*

Mode of Transportation	Monetary Cost	Environmental Cost
Walking		
Bicycling		
Driving		

What's the safety cost?

Mode of Transportation	How safe do you think this mode is? Use a scale of 1-3 with 1 the most safe and 3 the least safe	How could Traveling Tony increase the safety of this mode?
Walking		
Bicycling		
Driving		

*<http://www.youcanbikethere.com/content/environmental-benefits-0>