DEPARTMENT OF TRANSPORTATION

Colorado Department of Transportation

Core Subject Lesson Plans: Kindergarten through 8th grade

SafeRoutes
Colorado Safe Routes to School

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Colorado Department of Transportation Safe Routes to School Core Subject Lesson Plans

As recently as 1969 about half the school aged children in the United States walked or bicycled to school. Today fewer than 15% of school children walk or bike to school and as much as 20-30% of morning traffic is generated by parents driving their children to school. Children are less active today and the majority of children living within a 1/2 mile of schools are driven in private vehicles. Obseity rates are on the rise and the cost of obesity and other health related challenges have significant impacts on the rising cost of health care in the Unites States, not to mention the lifestyles of our children.[1] In response to these challenges, in an effort to encourage healthy living, the Colorado Department of Transportation has developed a series of cross-curriculum bicycle and pedestrian lesson plans in support of the Colorado Safe Routes to School program.

Safe Routes to School initiatives have long been a focus of health and physical education in schools. The goal of this project is to develop lesson plans that integrate walking, bicycling and healthy living into additional subject areas such as history, science, math, language arts, geography and social studies. This will expand opportunities for children to develop healthy living and active transportation habits, while also providing teachers with lesson plans designed to effectively meet Colorado's education standards for kindergarten through eighth grade.

The purposes of these lessons are to do the following:

- Encourage walking and bicycling to school by developing a K-8 collection of lesson plans that will meet and exceed the state and national standards of learning;
- Fit easily into a teacher's lesson plan or unit;
- Promote pedestrian and bicycle safety; and
- Improve student wellness by applying aspects of walking and bicycling in different subject areas.

Each lesson was designed or included because it encourages students to think and live more actively. The goals of the project were to promote student safety and wellness. The lessons cover subjects from art to science and incorporate concepts that range from food energy to air pollution and use walking and bicycling as the means to explore the lesson.

How to use

These lessons are for educational purposes only and may not to be sold. They may be circulated, photocopied and shared and you are encouraged to do so.

Relationship to Colorado Academic Standards

Each lesson satisfies at least one Colorado Academic Standard content area; some satisfy more than one. In the cases where the lesson may be appropriate for multiple grades or content areas, the applicable grade range and standards are listed for each lesson. In some cases, the lessons may be age appropriate for multiple grades but the standard association is not as clear. In all cases, the lessons may be modified to meet additional standards, grade levels and circumstances as needed.

1 What is Safe Routes to School: Background and Statistics; Safe Routes to School National Partnership

Notes about Resources for the Lessons

The materials section of each lesson will list what is needed for each lesson. Books listed are frequently available at your local library or for purchase. Worksheets are available as part of the lesson or in the Resource section.

The internet is listed as a resource for a number of lessons. While every effort has been made to test the links and access the sites, the URLs may change. CDOT is not responsible for the effectiveness of these links. It is recommended that the resources included in the lessons be accessed before the lesson is taught.

Acknowledgements

This project could only have been possible with the input and feedback received from the following individuals and school districts and it is greatly appreciated. Projects are underway all over the state to incorporate Safe Routes to School initiatives and the interest and efforts made by these individuals and school districts (and more throughout Colorado) is making a huge difference in the quality of life of our school children.

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Table of Contents

Grade Level Expectation: K-2
Left Foot, Right Foot
Content Area: Reading, Writing and Communicating

Lesson time:
1 period

Materials:
1. Manila or white paper

2. Colored pencils, markers or crayons

3. The Foot Book by Dr. Seuss

Objective: This lesson is designed to help young children to learn more about their bodies as well as enjoy a classic book by Dr. Seuss. This lesson is adapted from a lesson idea on the Walk Across Texas website.

Kindergarten Standards:
1. Oral Expression and Listening
    1. Oral communication skills are built within a language-rich environment
3. Writing and Composition
    1. Text types and purposes, labels, and familiar words are used to communicate information and ideas.

1st Grade Standards:
1. Oral Expression and Listening
    1. Multiple strategies develop and expand oral vocabulary

2nd Grade Standards:
1. Oral Expression and Listening
    1. Discussions contribute and expand on the ideas of self and others

Activity:
1. Show students the cover and read the title of The Foot Book. Turn to the first page and explain that this is the title page. Show them the similarities between the cover and the title page.

2. Read the book aloud to students. Use the following questions for discussion:

- How many feet do you have?
- Show me your left foot
- Show me your right foot.
- Do you have front and back feet?
- Name an animal that has front and back feet.
- What does ‘rhyme’ mean?
- What are some words that rhyme with feet?
- What are some words that do not rhyme with feet?
- What are some words that rhyme with foot?
- What are some words that do not rhyme with foot?

3. Have students trace his or her own feet and label them ‘left foot’ and ‘right foot’ and compare to other’s drawings.

Evaluation: Evaluate based on students’ participation in discussion and question/answer sessions. Check drawings for accuracy.

Grade Level Expectation: K-2
My Dad Rides a Bicycle
Content Area: Reading, Writing and Communicating

Lesson Time:
1 period

Materials:
"My Dad Rides a Bike in His Bedroom" activity sheet by Melissa Knight (following pages)

Take home:
None

Note: Reference to children's game "Red Rover" on page 2 can be substituted with some other 'active' game if appropriate.

Objective: Students learn that exercising can be a fun way for families to spend time together. At the same time, they get to work on their listening and reading skills. This lesson is adapted from a lesson idea on the Walk Across Texas' website at http://walkacrosstexas.tamu.edu/.

Kindergarten Standards:
1.Oral Expression and Listening
1. Oral communication skills are built within a language-rich environment
3. Writing and Composition
1. Text types and purposes, labels, and familiar words are used to communicate information and ideas.

1st Grade Standards:
1. Oral Expression and Listening
1. Multiple strategies develop and expand oral vocabulary

2nd Grade Standards:
1. Oral Expression and Listening
1. Discussions contribute and expand on the ideas of self and others

Activity:
1. Read aloud or have volunteers read sections of the story.

- Who is telling the story?
  (A boy named Kevin)
- What is the story about?
  (The kinds of exercise that Kevin and his parents get)
- How does Kevin get his exercise?
  (Rides bike, races, plays tag, chases his dog, climbs up to his tree house)
- How does Kevin's dad get his exercise?
  (Rides an exercise bike, jogs, lifts weights)
- How does Kevin's mom get her exercise?
  (Does step aerobics, lifts weights)
- Can you name other ways that Kevin and his family can get exercise?
  (Mowing the grass, raking leaves)

2. Discuss the types of bikes Kevin and his father ride.
How are the two bikes alike and different?
(Both have pedals to push, but Kevin's is a real bike that actually moves. Kevin's dad's bike stays in one place.)

Why does Kevin's dad ride his bike?
(For exercise)

Why does Kevin ride his bike?
(For fun)

Kevin and his dad both run. How is his dad's jogging different from Kevin's races, games, and chases?
(Dad runs for exercise; Kevin runs when he plays.)

What lesson about exercising do Kevin's parents learn from Kevin?
(Exercise can and should be fun.)

3. At the end of the story, point out to the children that not only are Kevin and his parents getting regular exercise, they are also spending more time together. Ask children to name the activities that Kevin and his parents do together.
(Riding bikes, climbing, jogging)

Evaluation: Observe students for appropriate listening behavior and participation in the discussion.

Adapatation:

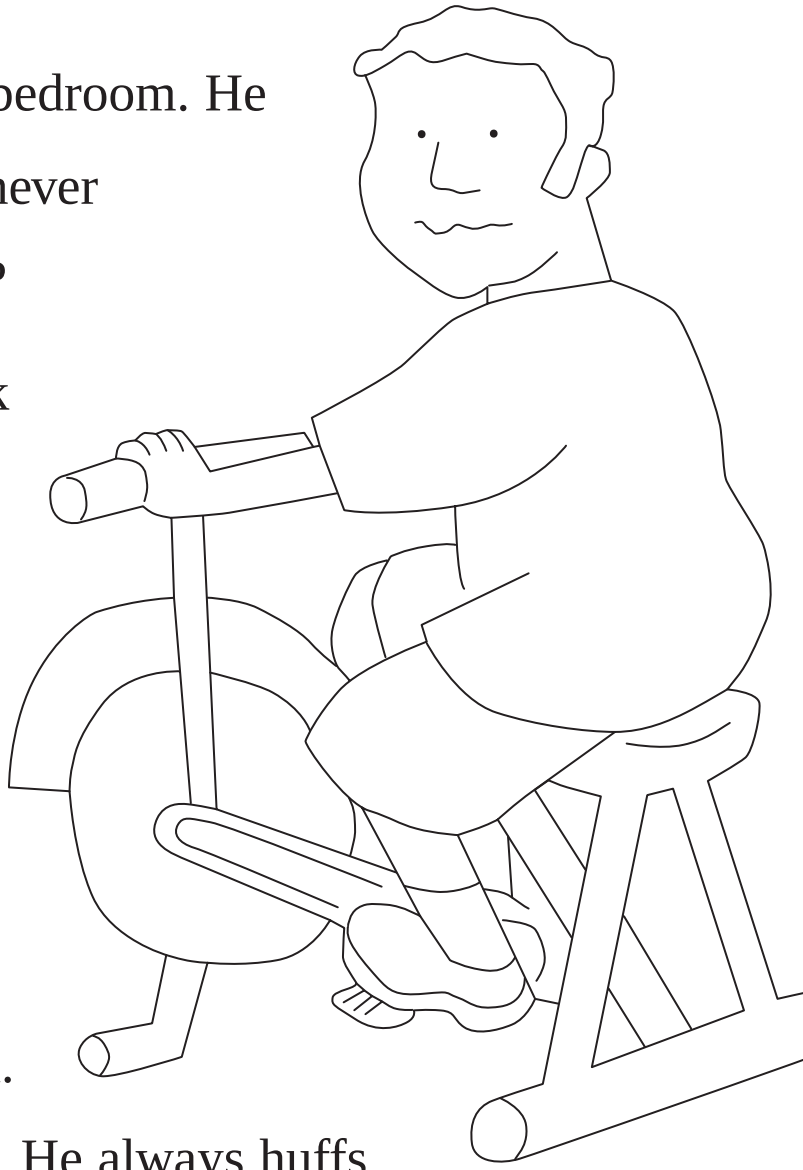
Because some students might be unfamiliar with the stationary bike or a stairmaster, they may not relate to this aspect of the lesson. If this is the case,

Ask students if their parents exercise and if so, how.

Ask how their forms of exercise differ from the students, stressing that the most important that thing is that they exercise, not so much they do it.

My Dad Rides a Bike in His Bedroom

by Melissa Knight



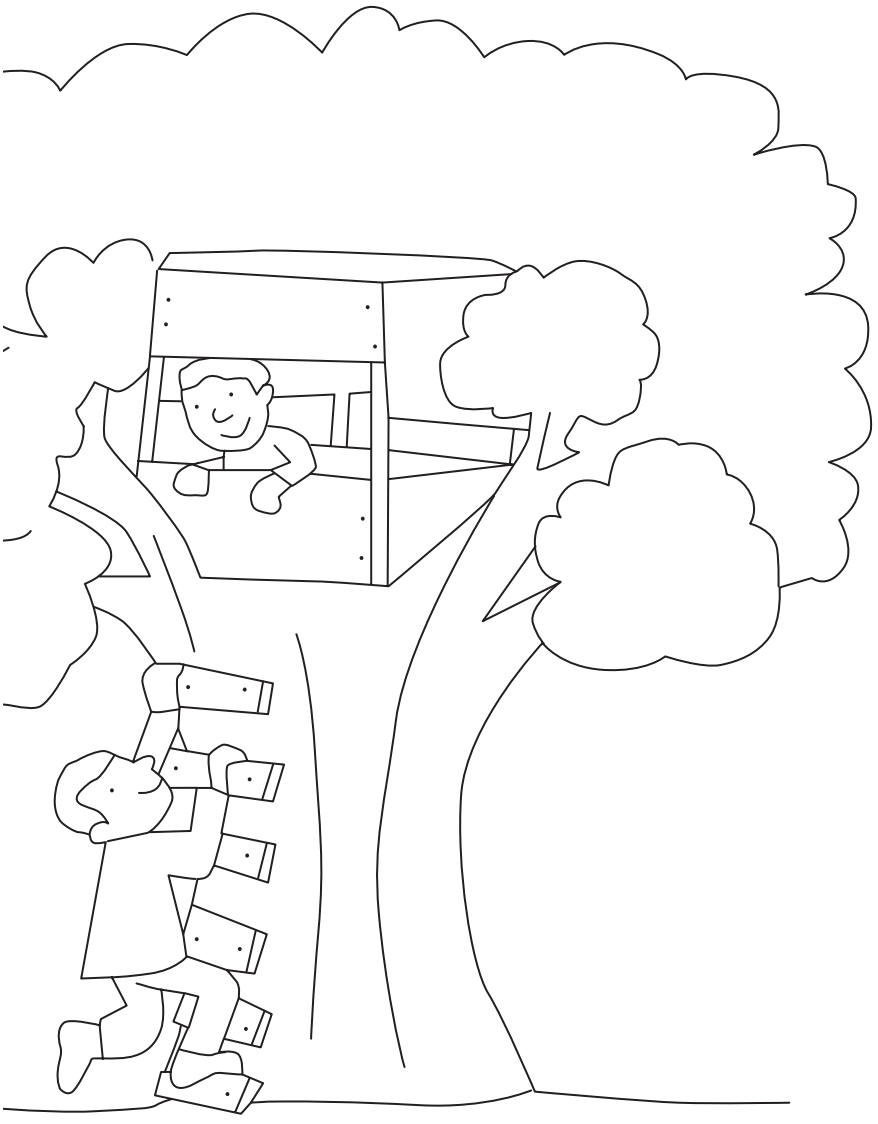
My dad rides a bike in his bedroom. He rides for a long, long time and never goes anywhere. Isn't that crazy?

When I ride my bike, I pick up Jordan at his house, and we go all the way to the park. We visit our friends' houses and sometimes ride in the field behind Jordan's house. We go everywhere.

My dad gets up at 6:00 a.m. to jog around the neighborhood. He always huffs and puffs and lies down on the kitchen floor when he gets back.

I run, too, but not like that. Jordan and I race each other from the corner to my house on the way home from school. We play tag and Red Rover. And when my dog, Hercules, gets out of the backyard, I have to chase him all over the neighborhood.

My mom has this step thing she bought the other day to get in shape. She steps on and off it about fifty times in a row. To me, it looks kind of boring!



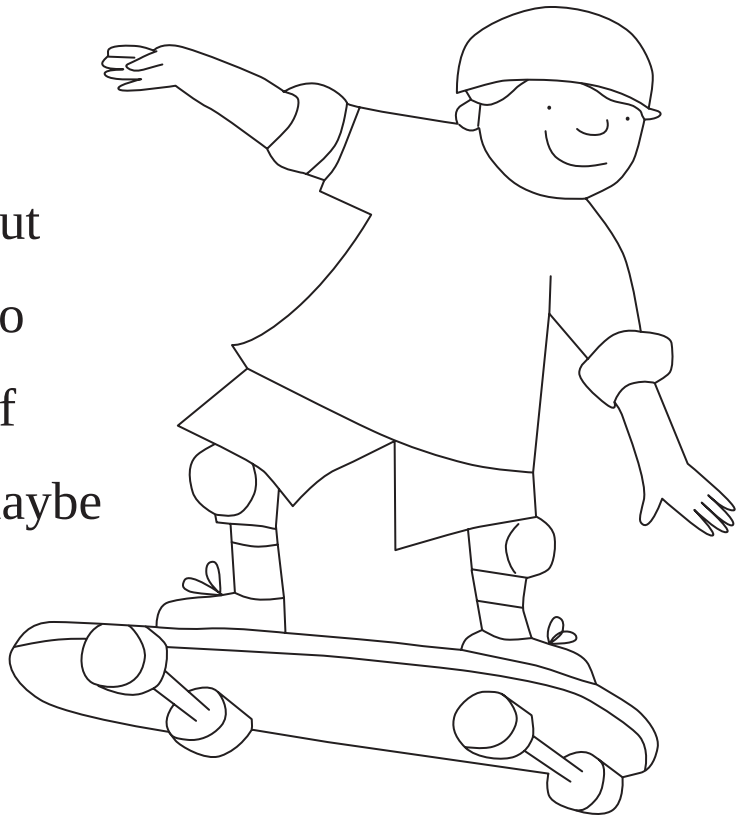
Jordan and I built this cool treehouse in my backyard last summer. We have to climb up the tree to get in it. We're always forgetting stuff we want to take with us, so we climb up and down it a lot. Once I tried to get Mom to

climb up there, but she said, “I’d better not—I’m out of shape.”

Mom and Dad belong to a health club. They take me along when they go there. They have to wear exercise clothes. They lift really heavy weights. They grunt and groan. It looks like they are in pain.

I don’t lift weights, but, like I said, I’m always carrying stuff up to the treehouse. I even tried to take Hercules up there once, but Mom caught me and wouldn’t let me. He *is* kind of heavy for a sheepdog.

Mom and Dad tell me all the time how important it is to keep my body in good shape. I like feeling strong and healthy, so I started thinking about it. I don’t lift weights or jog or do a step program or any of the stuff they do. I started thinking that maybe I ought to start an exercise program myself.



I asked them about it, and they just looked at each other and smiled. Then Dad got real serious and said, “Kevin, your whole day is like an exercise program. You get a lot of exercise. You don’t even think about it because you’re having fun. Maybe your mom and I can take a lesson from you.”

My dad still rides the bike in his bedroom. I even ride it sometimes. But now he also rides a lot more with Jordan and me. We don’t mind as long as he keeps up.

Mom climbs up to our treehouse every now and then. She always asks if it’s OK first, and we let her come if she brings a snack.

Dad gets up a little later now, and I get up a little earlier so we can jog together. He still lies down on the kitchen floor when we get home, but he is improving. And he says he has more fun with me along.

So I guess we all get a lot of exercise around here! There’s still one thing I’m not allowed to do, though. Mom still won’t let me carry Hercules up to the treehouse.

Grade Level Expectation: K-1
Blast Off with Healthty Eating
Content Area: Comprehensive Health and Physical Education

Lesson time:
30 minutes

Materials & Resources:
1. A book on variety for healthy eating. Suggested book: Eating the Alphabet: Fruits and Vegetables from A to Z by Lois Ehlert

2. Chart paper (1 piece)

3.Construction paper

4. Crayons or markers

5. String

6. Wire coat hangers (1 per student)

7. Old grocery flyers and food magazines

8. Glue Laminating paper (optional)

Objective:
To help students explore healthy eating habits and how eating well gives them energy, and helps them grow, learn and feel good. This lesson is adapted from Mission Nutrition, lesson 3; www.missionnutrution.ca.

Kindergarten Standard:
2. Physical and Personal Wellness in Health
   1. Identify the major food groups and the benefits of eating a variety of foods.

1st Grade Standard:
2. Physical and Personal Wellness in Health
   1. Eating a variety of foods from the different food groups is vital to promote good health.

Class Discussion:
The following questions can help students recognize that just as a space ship needs fuel to take off, their bodies need food for energy and nutrients to go, grow and glow. What would happen if a space ship tried to take off without any fuel?

- Have you ever had to go without breakfast?
- How did your body feel later on in the morning when you started your day without fueling up with breakfast?
- What if you missed lunch, dinner or snacks?
- How would your body feel?
- How would you feel if you did not have anything to drink all day?
- How do you feel if you try to play games or ride your bike with your friends without eating lunch or a snack first?

Activities:
1. Enjoying a variety of foods gives us energy and nutrients to grow and learn. Read a book such as Eating the Alphabet to encourage students to enjoy a variety of foods. As you read, ask students to name some foods that begin with each letter.

2. Students can create their own “intergalactic healthy eating mobiles.” On chart paper, make a list of five healthy eating habits to guide students. Your list should include: eating a balanced breakfast, lunch and dinner, choosing nutritious snacks and drinking plenty of fluids.

Using construction paper, have each student cut out 5 various sized planets. Ask students to illustrate a different healthy eating habit on each planet. Their drawings should include a variety of foods for breakfast, lunch, dinner and snacks as well as fluids such as water, milk and juice. Use string to hang their healthy eating habit planets on a coat hanger.

Grade Level Expectation: 1-3
Ways We Get to School
Content Areas: Social Studies, Mathematics

Lesson Time:
1 class period

Materials:
1. This is the Way We Go to School by Edith Baer

2. Poster size paper

3. Graph paper or photocopies of the chart

4. Pencils or markers

Objective:
1. To introduce students to the concept that people in different environments use different modes of transportation.

2. To give students experience in collecting data and displaying data in graph form.

1st Grade Standards:
Content Area: Math
1: Number Sense, Properties and Operations
2. Number relationships can be used to solve addition and subtraction problems

3: Data Analysis, Statistics and Probability
1. Visual displays of information can be used to answer questions:

2nd Grade Standards:
Content Area: Math
1: Number Sense, Properties and Operations
2. Formulate, represent, and use strategies to add and subtract wtihin 100 with flexibility, accuracy, and efficiency

3rd Grade Standards:
Content area: Social Studies
2: Geography
1. Use various types of geographic tools to develop spatial thinking

Procedures/ Activities
1. Explain that people in different places use different methods of transportation.

2. Read the book This is the Way We Go to School.

3. Ask students, “How do you get to school?”

4. Instruct students to place a block on the poster sized chart under the heading that tells how they get to school.
(Labeled “Walk,” “Bike,” “Car”, “Bus,” and “Other”)

5. Count and write the total for each category.
(This can be done as a group or by calling on individual students for each category.) You may wish to ask any student who indicated “Other” to identify the mode of transportation used.

6. Ask students questions such as-
- How do the greatest number of children get to school?

- What way do the least number of children get to school?
- How many more children ride the bus than ride a bicycle?
- Why do you think some people take the bus and some people ride in a car?
- Why would someone prefer riding a bicycle to walking?
- When would you choose to ride or walk?

7. Pass out blank graphs. Have students transfer information from poster sized block graph to their individual blank graphs.

Extensions:
How do you think we/our school would change if these numbers were different?

Discuss pollution, health, grumpy parents in cars, etc.

***This lesson can be modified to meet the Standards and to accommodate the skills of students in lower or higher grade levels. For example, students in higher grade levels may conduct surveys of how people get to work. They could then represent this information as a bar graph or pie chart.

Example chart:

Walk	Bike	Car	Bus	Other

Consider using icons in pictographs- shoes, bikes, cars, bus, etc.

Grade Level Expectation: 1-3
Walking Treasure Hunt
Content Area: Social Studies

Lesson Time:
30 minutes
+ homework assignment

Materials:
1. White or chalkboard

2. Markers/chalk

Take home:
None

Objective: The Walking Treasure Hunt gives kids an opportunity to recognize all the great things they get to see when they walk. It also helps students become more familiar with their neighborhood and community. This lesson is adapted from Chicago Mayor Daley's Safe Routes Ambassadors Walking Treasure Hunt.

3 Grade Standard:
2: Geography
1. Use various types of geographic tools to develop spatial thinking

Procedure:
Design a one-page list of items and objects that children can look for on their way to school. You should include some street signs and traffic signals. It's also a good idea to include fun items, and ones that are specific to the neighborhood in which your students live, like a park, a playground, a brown dog, or a favorite restaurant The list can also ask questions like, "where is the bus or bus stop closest to your home?" If you don't live in the neighborhood yourself—or even if you do—you can ask your students to help you create the list.

- Distribute the list to the students and designate a completion date.

- Ask students to use the list as they walk to school or in their neighborhoods. They should identify each item and where they found it. They should try to keep track of street names. Alternatively, instead of when walking to school (if they bus to school, for example), students can use the list as they walk to a park or to other locations or around the school grounds.

- Have a discussion about what they learned from the treasure hunt. Talk about things students saw that weren't on the list (and maybe use them to make a new list for a new hunt).

- Ask students, "What is the difference between being driven to school and walking? When you're in the car, do you notice the same things as when you're walking?"

Extension: Have students draw the items they saw or write a story about their walk and the items they saw and where they saw them.

Sample List	**Item Location**
White fence	_____
Pink flamingo	_____
Crossing guard	_____
Bicycle	_____
Stoplight	_____
School bus	_____

Grade Level Expectation: 1-3
Colorado Bike History
Content Area: Social Studies, Reading, Writing and Communicating

Lesson Time:
1 class period

Materials:
1.Internet Connection

Take Home:
None

Objective: To expose young students to the range of historical reference materials available and help them make connections between their experiences and history.

1st Grade Standards:
Content Area: Reading, Writing and Composition
3. Writing and Composition
1. Exploring the writing process develops ideas for writing texts that carry meaning.

2nd Grade Standards:
Content Area: Social Studies
1: History
1. Identify historical sources and utilize the tools of a historian

Content Area: Reading, Writing and Composition
3. Writing and Composition
1. Exploring the writing process helps to plan and draft a variety of simple informational texts.

3. Writing and Composition
1. A writing process is used to plan, draft, and write a variety of informational texts.

Activities:
Use the information from agencies, such as the Douglas County Libraries History Research Center, to convey the history of the bicycle in transportation along the front range. Contact other libraries, historians or agencies in Colorado to gather information in other areas around Colorado. Note various clothing, gear carried, time to commute, stops along the way, obstacles, etc.

Other Support Materials:

- Documentary, Victorian Cycles, produced by Jim Kellett:
- http://www.youtube.com/playlist?list=PLBFE1BB47C915013C
-
- Denver-Palmer Lake Bicycle Path
- http://www.youtube.com/watch?v=S6ayCZAbw1g
-
- Denver-Palmer Lake Bicycle Path, part 2
- http://www.youtube.com/watch?v=szEGI4SXE30

Write a short story about how you use your bicycle. Draw a picture to illustrate it.

Grade Level Expectation: 2
Students In Motion
Content Area: Science

Lesson Time:
1 class period

Materials:
1.Pedometer

2. Stop watch

Objective: To understand the effects of changes in motion and speed. This lesson works best on a windy day when students can walk and run outside after these concepts have been discussed.

Standard:
1: Physical Science
1. Changes in speed or direction of motion are caused by forces such as pushes and pulls

Activity:
Explain the speed of the push, pull, or outside force in the following situations:

- What if a second grader was walking down the street on a sidewalk?
- What if a second grader had to travel up a steep hill?
- What if a second grader had to travel up a steep hill with the wind against the student's face?
- What if a second grader had to travel down a moderate hill with the wind blowing at the student's back?

Activity:
Use a speedometer/pedometer to measure steps and a stop watch to track the time while traveling against the wind and then the same distance with the wind. (Other variations: uphill, downhill, deep snow, sand, or anything with and without resistance.)

Evaluation:
At the end of this lesson, students should understand the effect of wind or grade on their walking or bicycling speed. Follow-up questions include “Do you go faster or slower when walking or bicycling downhill? What does it feel like to walk uphill, with wind blowing in your face?

Grade Level Expectation: 2-3
Getting Around Your Neighborhood
Content Area: Social Studies

Lesson Time:
1+ class period

Materials:
1. Tranparency of map of local area

2. Overhead projector and markers, if using map transparency or Smartboard

3. Pencils

4. Crayons or colored pencils

5. Dry Erase markers

6. Construction paper or large pieces of paper

Take Home: Maps

Objective:
Students will use maps to describe their neighborhoods and to map routes.

2nd Grade Standards:
2: Geography
1. Use geographic terms and tools to describe space and place

3rd Grade Standards:
2: Geography
1. Use various types of geographic tools to develop spatial thinking

Note: Prior to lesson, create transparancy of a neighborhood map, or use 3-D mapping software such as Google Earth.

Vocabulary: symbol, legend, key, compass rose

Activities
1. Put up overhead transparency, or map. Ask students to describe what they see.
- What are the human built features?
- What are the physical features?

Tell students that they will be creating neighborhood maps of their own, using the provided materials. Each student's neighborhood map should include houses, a school, and other buildings of the student's choice. Students should include a compass rose and label the key on their maps to show the symbols that they used. (Maps need not be representative of students' actual neighborhoods.)

2. Ask students to to create their maps.

3. After students have completed their maps, bring their attention back to the map transparency. Tell students that a child living in house A will be riding his bike to school.
- Ask students which route the child should take. Draw that route on the transparency.
- Ask students what things might be hazards to the child riding his bike? (examples: no crosswalk, intersections, busy roadway, broken sidewalk, lack of sidewalk, lots of driveways, etc.)
- Are there other routes that she might take? Repeat with routes from houses B and C.

4. Have students mark the best routes on their own maps, from each house to the school, using a different colored pencil or crayon to distinguish the different routes and explain to a buddy or class why they chose the route.

Grade Level Expectation: 2-3
Mapping My Route to School
Content Area: Social Studies

Lesson Time:
30-45 Minutes

Materials:
1. School area map (found at mapquest.com or Google Maps

2. Colored pens or pencils

Additional:
School area map overhead

(Overhead) projector

Colored overhead pens

Other maps for comparison

Objective: To create a map of each student's route to school (even if it includes multiple modes of transportation like walking to a bus stop then taking the bus route) and identify hazards along the way.

2nd Grade Standard:
2: Geography
1. Use geographic terms and tools to describe space and place

3rd Grade Standard:
2: Geography
1. Use various types of geographic tools to develop spatial thinking

Procedure:

- Instruct students to use the map provided to trace their route to school using a colored pen or pencil (a yellow highlighter works the best).
- Students will probably have more than one route because they rely on different modes of transportation. Many people drive some days and walk or ride other days. Use different colors for each route and create a key. For example: yellow= driving route red= biking route.
- Instruct students to label any hazardous street crossings with circles
- Demonstrate using the overhead map and different colored pens.
- Have students talk about their routes and discuss some of the reasons they chose the route they did.

Assessment: Were students able to trace a route or routes accurately and create a color key to indicate which mode of transportation they were using? Were they able to identify hazards?

Closing: Ask the class to share some of the reasons they can't walk or ride to school and brainstorm possible solutions. Discuss the hazards identified and how they can take precautions (stop, look, and listen before crossing, peek around parked cars, make sure drivers see you by making eye contact or waving).

Grade Level Expectation: 3-5

Climb a 14er

Content Area: Mathematics

Lesson time:
1 class period, then time each day for the assigned period

Materials:
1. Flat 14ers

2. Classroom Progress Log

3. Individual Progress Log

4. Flat 14ers Activity Conversion Chart

Take home:
Flat 14ers Individual
(to track individual steps to add to the Classroom chart)

Objective: To help students track their activity levels (and encourage more) using Colorado's 14ers tp chart progress.

3rd Grade Standards:
1. The whole number system describes place value relationships and forms the foundation for efficient algorithms.
2. Data Analysis, Statistics and Probability
   1. Visual displays are used to describe data

4th Grade Standards:
2. Data Analysis, Statistics and Probability
   1. Visual displays are used to represent data

5th Grade Standards:
2. Data Analysis, Statistics and Probability
   1. Visual displays are used to interpret data

Background:
The virtual trails are representations of Colorado's majestic peaks and reflect actual steps necessary to climb from the trailhead to the summit and back down to the trailhead. The student activity information can be charted on the Classroom forms or online and as they accumulate steps their progress captured in the "climbing of 14ers."

Flat 14ers Part 1 requires an average daily count of 10,940 steps over 42 days, totaling 459,500 steps or 229.75 miles. Part 1 covers 14ers in the Sawatch, Elk, Tenmile and Mosquito Ranges.

Flat 14ers Part 2 requires an average daily count of 14,321 steps over 42 days, totaling 601,500 steps or 300.75 miles. Part 2 covers 14ers in the San Juan, Sangre de Cristo and Front Ranges.

The Flat 14ers virtual trails are only available to registered America On the Move website users. Once you log in to the site, click the 'trail' tab on your user profile. You can select from either Part 1 or Part 2. Each time you log step or activities, you can see your progress on your trail tab and learn about the history and wildlife associated with each Colorado 14er.

For more inforamtion and to register, log on to:
https://aom3.americaonthemove.org/~/link.aspx?_id=06CE98903C674EE891F0F9B7D99C7F00&_z=z

America on the move
Steps to a Healthier Way of Life℠

Flat 14ers Individual Progress Log

Name: _____ Start Date: _____ Completion Date: _____

Peak:	Distance:	Elevation:	Steps:
1 Blanca Peak	15 miles	14,345 ft	30,000
2 Capitol Peak	17 miles	14,130 ft	34,000
3 Castle Peak / Conundrum Peak*	14 miles	14,265 ft / 14,060 ft	28,000
4 Challenger Point	12 miles	14,081 ft	24,000
5 Crestone Needle	8 miles	14,197 ft	16,000
6 Crestone Peak	6.25 miles	14,294 ft	12,500
7 Culebra Peak	7 miles	14,047 ft	14,000
8 Ellingood Point	15.5 miles	14,042 ft	31,000
9 Grays Peak	7.5 miles	14,270 ft	15,000
10 Handies Peak	5.5 miles	14,048 ft	11,000
11 Humbolt Peak	7.25 miles	14,064 ft	14,500
12 Huron Peak	5.5 miles	14,003 ft	11,000
13 Kit Carson Peak	11.5 miles	14,165 ft	23,000
14 La Plata Peak	9.5 miles	14,336 ft	19,000
15 Little Bear Peak	13 miles	14,037 ft	26,000
16 Longs Peak	14 miles	14,255 ft	28,000
17 Maroon Peak / North Maroon Peak*	12 miles	14,156 ft /14,014 ft	24,000
18 Missouri Mountain	10.5 miles	14,067 ft	21,000
19 Mt Antero	13.6 miles	14,269 ft	27,000
20 Mt Belford	11 miles	14,197 ft	22,000
21 Mt Bierstadt	7 miles	14,060 ft	14,000
22 Mt Bross	9 miles	14,172 ft	18,000
23 Mt Columbia	11.5 miles	14,073 ft	23,000
24 Mt Democrat	4 miles	14,148 ft	8,000
25 Mt Elbert	9 miles	14,433 ft	18,000

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Flat 14ers Individual Progress Log continued...

Peak:	Distance:	Elevation:	Steps:																	
26 Mt Eolus / North Eolus*	18 miles	14,083 ft / 14,039 ft	36,000																	
27 Mt Evans	14 miles	14,264 ft	28,000																	
28 Mt Harvard	13.5 miles	14,420 ft	27,000																	
29 Mt Lincoln / Mt Cameron*	5.5 miles	14,286 ft / 14,238 ft	11,000																	
30 Mt Lindsey	8.25 miles	14,042 ft	16,500																	
31 Mt Massive	13.75 miles	14,421 ft	27,500																	
32 Mt of the Holy Cross	11.5 miles	14,005 ft	23,000																	
33 Mt Princeton	13 miles	14,197 ft	26,000																	
34 Mt Shavano / Tabequache Peak	11.25 miles	14,229 ft	22,500																	
35 Mt Sherman	5.25 miles	14,036 ft	10,500																	
36 Mt Sneffels	6 miles	14,150 ft	12,000																	
37 Mt Wilson / El Diente Peak*	16 miles	14,246 ft / 14,159 ft	32,000																	
38 Mt Yale	8 miles	14,197 ft	16,000																	
39 Pikes Peak	11.5 miles	14,110 ft	23,000																	
40 Pyramid Peak	6.75 miles	14,018 ft	13,500																	
41 Quandary Peak	6.75 miles	14,264 ft	13,500																	
42 Redcloud Peak	9 miles	14,036 ft	18,000																	
43 San Luis Peak	13 miles	14,014 ft	26,000																	
44 Snowmass Mountain	8 miles	14,092 ft	16,000																	
45 Sunlight Peak	17 miles	14,059 ft	34,000																	
46 Sunshine Peak	12 miles	14,001 ft	24,000																	
47 Torreys Peak	7.5 miles	14,267 ft	15,000																	
48 Uncompahgre Peak	8 miles	14,309 ft	16,000																	
49 Wetterhorn Peak	7 miles	14,015 ft	14,000																	
50 Wilson Peak	16 miles	14,017 ft	32,000																	
51 Windom Peak	17 miles	14,082 ft	34,000																	

*Note: To be ranked, a peak must rise at least 300 feet above the saddle that connects it to the nearest 14er peak (if another exists nearby). This guideline has been in use in Colorado for some time. The peaks marked with an asterisk are not ranked because they do not fit this criterion, but they are on this 14er list because they are named and recognized on USGS maps.

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Flat 14ers Classroom Progress Log

School: _____ Teacher: _____ Grade: _____ Date: _____

Peak:	Steps:	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name
1 Blanca Peak	30,000																													
2 Capitol Peak	34,000																													
3 Castle Peak / Conundrum Peak*	28,000																													
4 Challenger Point	24,000																													
5 Crestone Needle	16,000																													
6 Crestone Peak	12,500																													
7 Culebra Peak	14,000																													
8 Ellingood Point	31,000																													
9 Grays Peak	15,000																													
10 Handies Peak	11,000																													
11 Humbolt Peak	14,500																													
12 Huron Peak	11,000																													
13 Kit Carson Peak	23,000																													
14 La Plata Peak	19,000																													
15 Little Bear Peak	26,000																													
16 Longs Peak	28,000																													
17 Maroon Peak / North Maroon Peak*	24,000																													
18 Missouri Mountain	21,000																													
19 Mt Antero	27,000																													
20 Mt Belford	22,000																													
21 Mt Bierstadt	14,000																													
22 Mt Bross	18,000																													
23 Mt Columbia	23,000																													
24 Mt Democrat	8,000																													
25 Mt Elbert	18,000																													

Flat 14ers Classroom Progress Log continued...

Peak:	Steps:	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name	Student Name
26 Mt Eolus / North Eolus*	36,000																													
27 Mt Evans	28,000																													
28 Mt Harvard	27,000																													
29 Mt Lincoln / Mt Cameron*	11,000																													
30 Mt Lindsey	16,500																													
31 Mt Massive	27,500																													
32 Mt of the Holy Cross	23,000																													
33 Mt Princeton	26,000																													
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America on the move
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Activity Conversion for Kids

ACTIVITY	STEPS PER MINUTE
Aerobics, moderate	231
Ballet	179
Baseball	186
Basketball	306
Cleaning your room	127
Climbing stairs, moderate	261
Dancing, moderate	205
DDR/Wii, active video games	160
Dodge ball	186
Dusting	157
Football	328
Four square	186
Frisbee, general	112
Frisbee, ultimate	298
Gardening	138
Golf	160
Gymnastics	149
Hacky-sack	149
Hide and seek	149
Hockey, field/ice	298
Hopscotch	220
Horseback riding	149
Ice skating	261
Indoor play	149
Jogging	287
Juggling	149
Jumping rope	310
Karate, martial arts, judo, kickboxing	373
Kayaking	186
Kickball	261
Lacrosse	239
Making the bed	127
Mini golf, putt putt	112
Mopping	134
Mowing lawn, push mower	205
Outdoor play	186
Ping pong	224
Playground equipment	186
Playing catch	97
Playing with animals	149
Pogo stick	325

ACTIVITY	STEPS PER MINUTE
Pulling weeds	138
Racquetball	261
Raking leaves	160
Riding a bicycle	231
Rock climbing	298
Rollerblading/skating	242
Rowing/canoeing	261
Rugby	328
Running	347
Sailing/boating	112
Scooter riding	242
Scrubbing floors	142
SCUBA diving	466
Setting the table	97
Shoveling/digging	160
Skateboarding	186
Skiing, cross country	298
Skiing, downhill	224
Snorkeling	186
Soccer	328
Softball	186
Speed skating	336
Stretching	93
Surfing	186
Sweeping the floor	134
Swimming laps	369
Swimming, playing in pool	149
Tai chi, yoga	93
Taking out the trash	93
Tap dancing	179
Tennis	261
Trampoline	325
Vacuuming	157
Volleyball	149
Walking carrying a load	157
Walking, hard	172
Walking, light	108
Walking, moderate	134
Washing the car	112
Washing the dog	93
Water skiing	224
Weight lifting	104

Grade Level Expectation: 4-5
What Color Is My Air Today?
Content Area: Mathematics, Science, Reading, Writing and Communicating

Lesson Time:
30 min, initial; additional class time as needed

Materials:
1. Internet access (black and white copies of the AQI Color Game and Answer Sheet are included at the end of this lesson for reference, but using the online color version is preferred)

2. Computer printer (preferably color, if not conducting activity online)

3. Pencils

Take Home: None

Objective:
Students will understand how breathing the air can affect people's bodies and health, be able to describe how colors and numbers can represent different classifications of something, such as levels of air quality and understand that air pollution, driving, and health are connected. Lesson courtesy of Walking for Health & the Environment Curriculum, WalkBoston.

Note:
Review the websites ahead of time. Use a smartboard to guide students if available.
http://www.airnow.gov/index.cfm?action=aqikids.index

4th Grade Standards:
Content Area: Mathematics
2: Patterns, Functions, and Algebraic Structures
1. Number patterns and relationships can be represented by symbols.

Content Area: Mathematics
3: Data Analysis, Statistics and Probability
1. Visual displays of classroom data can be use to summarize information across content areas.

Content Area: Reading, Writing and Communicating
4: Research and Reasoning
1. Comprehending new information for research is a process undertaken with discipline both alone and within groups.

Content Area: Science
2: Life Science
3. There is interaction and interdependence between and among living and nonliving components of ecosystems.

5thh Grade Standard:
Content Area: Mathematics
3: Data Analysis, Statistics and Probability
1. Visual displays are used to interpret data

Content Area: Reading, Writing and Communicating
4: Research and Reasoning
1. Identifying and evaluating concepts and ideas have implecations and consequences

Procedure:

1. Access the Air Quality Index Color Game online or distribute printed copies.

Have the class play the AQI Color Game online, or print out and hand out copies of the game (easy version) from the EPA AIRNow website URL: http://www.airnow.gov/index.cfm?action=aqikids.gamestxt.
(This lesson is based on the game version that can be printed out and completed found towards the bottom of the Internet page. You can also [or instead] play the animated online version.)

Note to Teachers: It may take a minute for the color chart to load onto your computer. Also, the AQI Game is available online at different levels: easy, medium, and hard. First have students play the "easy" game, which discusses AQI colors only. Then add a discussion of the AQI numbers, as discussed in the Steps below. The medium and hard versions of the game are appropriate for students in Grades 3-5.
If printing, also print out the answer key for the teacher. It is best if the student game can be printed in color.

2. Discuss the AQI colors and their meaning with students.
   Tell students that each day the AQI is one of these colors. The colors tell you how healthy the air is to breathe that day. The colors go from Green to Yellow to Orange to Red to Purple, with each color telling you that the air is less clean than the color before. (Note: Tell them that the last AQI color, Maroon, which represents the worst air quality, is usually not included with the other AQI colors because air quality in the U.S. has not been Maroon in many years. This is probably because people have been working hard to clean up the air.)

3. Tell students to look at their AQI Color Game sheet.
   Tell them to draw a line from the AQI words on the left side to the correct color on the right side. For younger students (e.g., kindergarten), the teacher can read the words and ask students which words go with which colors. For younger students (e.g., Grade 2), the teacher may need to assist students in reading and understanding some of the key words, as discussed in the table above.

4. Discuss the correct answers using the teacher answer sheet.

5. Add a discussion of the AQI numbering system.
   An index uses numbers to tell people how good or bad something is. For example, you might say your school lunch is a 1 (very good) or a 5 (yucky). The Air Quality Index uses numbers from 0 to 500. These numbers are used to decide the AQI color for a particular day. On days measuring less than 100, the air is clean. If the air is dirtier, the numbers get bigger. On days measuring more than 100, the air can be bad for you to breathe.

Here is how the AQI numbers match up with the AQI colors:

If Color is…	This Means…
Green	The air is good and healthy to breathe.
Yellow	The air is “moderate” - it’s fine for most people, including children like you. However, if you know you are extra sensitive to pollution, you might want to limit the time you spend playing outside when the AQI is yellow.
Orange	The air is unhealthy for sensitive groups. People with lung problems, such as asthma, and active kids and grown-ups should limit how long or how hard they play actively outside. If you don’t feel so great, take it a little easier when the AQI is orange.
Red	The air is unhealthy. People with lung problems, such as asthma, and active kids and grown-ups should not spend a long time playing actively outdoors. Everybody else should limit how long they are active outside.
Purple	The air is very unhealthy. People with lung problems, such as asthma, and active kids and grown-ups should not spend any time playing or being active outdoors. Everyone else should limit outdoor activities.

AQI Numbers	AQI Colors
0 to 50	Green
51 to 100	Yellow
101 to 150	Orange
151 to 200	Red
201 to 300	Purple

6. Have students view the AQI posters.
   Next, have students view the six AQI color posters online, or print out several sets of the posters and pass them around the class, available

from the EPA AIRNow website at: http: www.epa.gov/airnow//aqikids/pdffiles/posters.pdf
It is best if these posters can be printed out in color.

7. Discuss the six posters in sequence (from Green to Purple), which will reinforce the lesson thus far, including both AQI colors and numbers.

8. Remind students that to reduce air pollution, they and their families and friends can walk more, ride their bikes, carpool, and take the bus instead of driving in their cars.

For older students (Grades 3-5), play the Medium and/or Hard versions of the AQI Color Game. Add more in-depth discussion from the EPA website at: http: www.epa.gov/airnow//aqikids/pdffiles/aqirefer.pdf.

If using the Internet, go to http://www.airnow.gov and click on “Today’s Forecast” then click on a city located nearby. Ask students what the air quality is for today and expected to be tomorrow.

Have students try to find and cut out the Air Quality Index in the newspaper and bring it in to class to discuss; the AQI can often be found

AQI Color Game

En Español

Easy Game

To play this game, first print this page and then draw a line from the AQI word(s) on the left side to the correct color on the right.

1. Unhealthy
2. Moderate
3. Very Unhealthy
4. Good
5. Unhealthy for Sensitive Groups

Green
Yellow
Orange
Red
Purple

Click here to view the completed game.

Dictionary

AQI Game Home Page

EPA Home | OAR | AIRNow | Kid's AIR | AQI Kids | Comments

Grade Level Expectation: 4-5
Two Wheels and a Path
Content Area: Social Studies

Lesson Time:
1-2 class periods

Materials:
1.Internet connection

Take Home:
None

Objective: Students will explore local history and be able to make connections to today and their own experieces.

Note: Archivists at the Douglas County History Research Center are available to present this historical perspective and introduce students to this reference resource.

4th Grade Standards:
Content Area: Social Studies
1. History
   1. Organize a sequence of events to understand the concepts of chronology and cause and effect in the history of Colorado
2. Geography
   1. Connections within and across human and physical systems are developed

5th Grade Standards:
Content Area: Social Studies
1. History
   1. Analyze historical sources from mulitple points of view to develop an understanding of historical context.
2. Geography
   2. Causes and consequences of movement

Resources:
YouTube hosts a number of good video clips about the history of the bicycle and bicycling in the Denver region

Early Bicycle History in Denver
http://www.youtube.com/watch?v=WOaJw2XQzO8&feature=related

Denver-Palmer Lake Bicycle Path
http://www.youtube.com/watch?v=S6ayCZAbw1g&feature=related

Denver-Palmer Lake Bicycle Path, part 2
http://www.youtube.com/watch?v=szEGI4SXE30&feature=related

First Bike Ride Up Pikes Peak
http://www.youtube.com/watch?v=oUo36YYF39E

First Bicycle Crossing the United States
http://www.youtube.com/watch?v=WIRrWYf2i98&NR=1

The documentary, Victorian Cycles, produced by Jim Kellett is available on Amazon.com
http://www.amazon.com/Victorian-Cycles-Wheels-of-Change/dp/

Discussion:
How has bicycling changed since the 1800s?
How did the bicycle change society?
What role did the bicycle play in women's history?
What are some differences between the first bicycles and bicycles of today?

Activity:
Write a one to two page report about the history of the bicycle in Colorado. How is bicycing different now?

Research the various bicycle trails and routes in the area. Pick a destination 5-10 miles from your house. How would you get there?

If possible, cut and paste pictures from various web sites for your report.

Present report to the class.

Grade Level Expectation: 4-5
Walk Across the Country (or any Geographic area)
Content Area: Social Studies, Mathematics

Lesson Time:
30-50 minutes, initial lesson, then ongoing as progress is made across the chosen area

Materials:
1. US or Colorado State Map (local maps can be used also)

2. Pins/tacks

Objective:
Students get into shape by walking and chart how far they've gone by marking an equivalent distance on a map.

4th Grade Standards:
Content Area: Mathematics
3. Data, Analysis, Statistics, and Probability
   1. Visual displays are used to represent data

5th Grade Standards:
Content Area: Social Studies
2: Geography
   1. Use various geographic tools and sources to answer questions about the geography of the United States

Content Area: Mathematics
3. Data, Analysis, Statistics, and Probability
   1. Visual displays and summary statistics are used to describe and interpret data.

Procedure:
1. Students can walk or jog at school or chart the distance they walk to school, maybe on a specific day each week.

- City maps allow them to accurately chart how far they've gone. Each student picks a starting point on the map, then draws in each day the distance they've gone toward a destination.

- To expand the options or opportunites for learning, students can use state or country maps.

- Have parents help out by walking with their child. Having one parent along can double the distance; both parents can triple the distance. Stress the positives of exercising with child (time to connect, cut out the need for so many after school activities, good role model).

2. Students can pick their own imaginary starting and ending points, or the entire class can start from the same place and try for the same destination
.
- Your class could walk as a group across the country, adding the total distance traveled by your students to the map.

3. Post map in a prominent place in the classroom; extend thumbtacks/ yarn to show the daily progress across the Colorado or the United States. Advertise or celebrate each day as class 'reaches' a new city, town, or state.

Options/Variations:

- Become space travelers; each mile walked equals one light year.
- Walk through history by letting each mile equal one year, one century or one thousand years.
- Walk between battlefields during the Civil War era.
- As the class makes progress and reaches a new town or state, use this as an opportunity for students to do some research about the location.

Each 'landing' becomes an opportunity for additional research or a report

Grade Level Expectation: 4-6
Eco Points Score Card
Content Area: Social Studies, Reading, Writing and Communicating

Lesson Time:
1-2 sessions

Materials:
1. Question sheets

2. Scrap paper for keeping score

3.Answer key

4. Pens/pencils

Take Home:
Score Card

Overview: This is a game which assigns points to daily activities which require fossil fuel or electricity. Playing the game teaches students about the impact of their transportation choices and energy use on the environment. This is best done in teams. This lesson is adapted from Chicago Mayor Daley's Safe Routes Ambassadors Eco Points Score Card.

Objective: Each team must answer certain questions about how they use energy (transportation, appliances, etc.) for a cumulative team score. The higher your score the greater your team's impact on the environment. Teams can reduce their totals by answering questions about transportation alternatives and renewable vs. non-renewable energy sources and their effect on the environment.

6th Grade Standards:
Content Area: Social Studies
2. Geography
2. Human and physical systems vary and interact

Content Area: Reading, Writing and Communicating
1. Successful group discussion requires planning and communication

Discussion:
1.What does the term "ecological footprint" mean?
(Every living being uses resources from the ecosystem, defined as a community of plants and animals and the environment in which they live, to exist. We define the ecological footprint as the area of the planet that is required to annually supply these requirements. For humans, we can record our activities and use this data to determine the area of the earth that is required to support each of us. The average American uses 24 acres to support his or her current lifestyle. In comparison, the average Canadian lives on a footprint 30 percent smaller (17 acres), and the average Italian on a footprint 60 percent smaller (9 acres).

2.Have you (or your parents) ever changed the way you do something in order to "save the planet?"
(recycling, buying recycled products, car pooling, buying a hybrid car…)

3. Why do we need to "save the planet?" What's happening now that's never happened before?
(We're running out of natural resources, global warming, the holes in the ozone)

4. What natural resources are we running out of?
(water, fossil fuel, land for construction, agricultural land, forest products, plant and animal species…)

5. Can any of these things be replaced/restored once they are gone?

(land can be restored in some instances, otherwise once a plant or animal is extinct it is gone forever)

6. Won't science/technology invent a solution?
(In some areas better technology already exists; we must choose to to use it. One example would be the choice to buy a Hybrid vehicle instead of an SUV or build a home with a solar heating system. Many of our smaller purchases and practices concerning technology, particularly chemical technology, also matter, such as buying paper made from recycled products and not using pesticides in our gardens.)

7. What will life be like in the future if we continue to use and pollute the way we do?
(climate change, rising ocean levels resulting in the loss of islands and coastlines, sickness resulting from air and water quality, food and housing will become very expensive, we will loose our open spaces)

8. What kinds of things can we do to help the situation?
(See game questions)

Instruction
Relate a personal experience (commitment to human powered transportation, choosing to live close to work, buying locally grown and made food and goods to reduce the pollution generated by shipping…)

Explain that we will be playing a game where we answer questions about certain things we do everyday, probably without thinking much about them.

We will be assigning these activities point values based on their negative impact on the environment. The object is to have the lowest total.

We are playing in teams to demonstrate that even if some people are very careful about how they use energy what your neighbor does really matters; we are very much in this together. Some questions allow you to reduce your point total and you may also reduce the team's score by answering the bonus questions about energy sources and the environment.

Assessment:
- Were students able to calculate scores for their groups?
- Were students able to reduce their scores by answering questions about transportation, energy sources and the environment?

Closing:
- Have a discussion about decisions they are going to make as adults which will affect their environment.
- Have students brainstorm about ways they can help their families make changes today.

Eco Score Card

Choose the answer which best describes what you usually do.

1) Did you leave the water running while you brushed your teeth this morning?
Yes ___ 10 points No ___ 0 points

2) Many of our local trip destinations are within 2 miles, such as school, our friends houses, the store, the library, the park. The last time you went someplace about 2 miles away (about 5 minutes by car) did you:
ask for a ride in the car_____ 20 points walked or rode my bike _____ subtract 10 points

3) The last time you needed to ask for a ride in the car:
You considered whether it could wait until you were out for something else.
___subtract 3 points
You considered other errands you could run at the same time. ___ subtract 3 points
You asked other members of your family if they had any errands which could be done at the same time. ___subtract 3 points
I only thought about where I needed to go _____ 10 points

4) How did you get to school today?
Carpool (more than one family) ____ 2 points
Bus_____subtract 5 points
Walked, Rode a bike, scooter or other human powered vehicle____ subtract 10 points
Family car_____ 20 points

5) Does your classroom/school recycle?
Paper yes_____ 0 points no_____10 points
Containers yes_____ 0 points no_____10 Points
Batteries yes_____ 0 points no_____10 Points

6) Does your house recycle?
Paper Yes_____ 0 points no_____10 points
Containers Yes_____ 0 points no_____10 points
Batteries Yes_____ 0 points no_____10 points

7) In the last month have you taken a transit bus, train, bicycle or walked to get somewhere?
Yes _____ subtract 10 points no _____ 0 points

8) The last time you wanted something out of the refrigerator did you think about what you were getting first or did you stand around with the door open trying to figure out what you wanted?
Thought first _____ 0 points thought with the door open _____ 5 points

9) Have you eaten red meat more than twice this week?
Yes_____ 5 points no_____ 0 Points

10) Have you ever planted a tree?
Yes_____ subtract 7 points from your total no_____ 0 Points

Eco Score Card

11) The last time you got together with several friends did you each arrive separately?
_____ 10 points arrange to share rides _____ subtract 5 points

12) In the last week, at any time, did you ride a human powered vehicle (bike, scooter, skate-board) or walk to get someplace you wanted to go (store, school, friends' house)? yes_____ subtract 10 points no_____ 0 Points

13) When you put away leftover food what do you prefer to use:
Plastic wrap or aluminum foil _____ 5 points
Reusable containers _____ 0 Points

14) The last time I was cold in my house I:
Put on some warmer clothing ____0 points turned up the thermostat ____10 points

15) The last time I spilled something I cleaned it up with:
Paper towel _____ 5 points sponge or cloth towel or rag _____0 points

16) At home we unplug electronics with LEDs (light emitting diodes) like VCRs, digital clocks, and big screen TVs when they are not being used.
Yes_____ 0 points no_____5 points

Bonus Questions
1) Compact fluorescent bulbs use _____ of the energy of a regular bulb and last longer so even though they cost more they save money.
1/2 _____ 1/4____ 1/3_____

2) If you're sitting still with the car motor running for more than _____ you should turn the car off.
30 seconds_____ 60 seconds_____ 2 minutes_____

3) Styrofoam takes _____to break down; don't buy things in Styrofoam containers, choose cardboard instead (for example when buying eggs)
5 years _____ 50years_____ 500 years_____

4) Paper can be made from things other than trees.
True _____ False _____

5) The number one single cause of air pollution in the US today is:
Factories _____ power plants _____ automobiles _____

6) California gets more of its electricity from coal burning power plants in
Nevada, Arizona and Colorado_____
Solar power plants in the Mojave desert_____

Eco Score Card

7) Which causes less pollution:
Coal burning power plants_____ power plants which burn natural gas_____

8) Which of these energy sources is renewable? (place a check on the line or lines)
Coal_____ natural gas _____ nuclear power_____ fossil fuel_____
hydroelectric power_____ solar power_____ wind power_____ wood_____

9) You can't generate solar power when it's cloudy.
True _____ False _____

10) The typical American family generates averages an average of:
3_____ 5_____ 7_____
car trips per day, most of them:
under 2 miles _____ over 2 miles _____

Answer Key

1) If you leave the water running while you brush your teeth for two minutes that's nearly ten gallons of water. Think about all the ways we waste water: water running down the gutter from over watering the lawn, hosing off the sidewalk instead of sweeping it, letting the water run in the kitchen or bathroom sink when we aren't actually using it. Water is a diminishing resource we often take for granted.

2/3/4) Our choice of transportation is the most important decision we make about our environment.

5/6) Landfill is taking up a lot of space so recycling helps conserve land. When trash is burned it pollutes the air so recycling reduces pollution. Paper is made from trees so recycling paper and cardboard or using it for scratch preserves our forests.

7) Our choice of transportation is the most important decision we make about our environment.

8) Refrigerators waste energy in many ways; leaving the door open, setting the temperature too low, letting ice build up in the freezer or having an older fridge which isn't well insulated are big wastes of energy.

9) Cattle production in many parts of the world has led to the destruction of much of the rain forests.

10) Planting a tree will help keep the air clean, provide a habitat for wildlife, provide shade and make our communities more attractive.

11/12) Our choice of transportation is the most important decision we make about our environment.

13) Aluminum production is a highly toxic process. Both plastic wrap and aluminum foil do not break down but become permanent land fill. Using reusable containers instead of dishes covered by foil or plastic solves the problem.

14) Artificially heating and cooling our environments is something we do without first considering other ways to stay warm or cool off.

15) Many paper products can be replaced by reusable cloth products such as canvas shopping bags instead of paper or plastic and cloth napkins.

16) The little lights on the VCR and the stereo don't use a lot of electricity but they are constantly left on and they sure do add up.

Bonus Answers, Values and Discussion Points

1) Compact fluorescent bulbs use _____ of the energy of a regular bulb and last longer so even though they cost more they save money.
1/2 _____ 1/4__X__ 1/3_____ (-2 points)

2) If you're sitting still with the car motor running for more than _____ you should turn the car off.
30 seconds__X___ 60 seconds_____ 2 minutes_____ (-2 points)
(sitting in the car with the motor running is a big waste of fuel and cause of pollution.)

3) Styrofoam takes _____to break down; don't buy things in Styrofoam containers, choose cardboard instead (for example when buying eggs)

5 years _____ 50years_____ 500 years___X__ (-2 points)
(Don't buy things in Styrofoam containers, choose cardboard instead, for example when buying eggs)

4) Paper can be made from things other than trees.
True ___X__ False _____ (-2 points)
(Paper can be made without trees by using such fibers as hemp. When buying paper made from trees, choose recycled.)

5) The number one single cause of air pollution in the US today is:
factories _____ power plants _____ automobiles __X___ (-4 points)

6) California gets more of it's electricity from coal burning power plants in Nevada, Arizona and Colorado__X___
solar power plants in the Mojave desert_____(-5 points)

7) Which causes less pollution:
coal burning power plants_____ power plants which burn natural gas__X___(-2 points)
(Burning coal for fuel causes serious air pollution. Natural gas burns cleaner but is much more expensive. Both are nonrenewable sources of energy.)

8) Which of these energy sources is renewable? (place a check on the line)
Coal_____ natural gas _____ nuclear power_____ fossil fuel_____ hydroelectric power__X___ solar power__X___ wind power__X___ wood___X__
(-2 points for each correct answer)

9) You can't generate solar power when it's cloudy.
True _____ False ___X__ (-2 points)

10) The typical American family generates averages an average of 3_____ 5_____ 7__X___ car trips per day, most of them under 2 miles __X___ over 2 miles _____
(-2 points for each correct answer)
(Coal, natural gas, nuclear power and fossil fuel are nonrenewable sources of energy which means we will eventually run out. Hydroelectric power, solar power, and wind powerare renewable sources of energy. Wood is renewable; in many parts of the world people still use wood for heating and cooking but are cutting down the forests faster than they can grow back. Burning anything causes air pollution.)

Grade Level Expectation: 4-6
Walking Trail Adventure
Content Area: Social Studies, Visual Arts

Lesson Time:
1-3 class periods depending on the level of detail of the sketch and the model

Materials:
1. Art supplies, Household supplies

Objective:
Create a plan for a neighborhood walking trail or other public facility to improve recreational opportunities for people and habitats for animals in your community. Working in groups helps develop collaboration skills. Adapted from: Create a Trail http://www.crayola.com/educators/lesson_plans/printer.cfm?id=1111.

4th Grade Standards:
Content Area: Social Studies
2. Geography
   2. Connections within and across human and physical systems are developed

Content Area: Visual Arts
3. Invent and Discover to Create
   1. Use media to express and communicate ideas about an issue of personal interest

Activity:
1. Work with a small group of classmates to design a recreational area in your community—either real or imaginary. Think about what facilities it might it include: Walking trail? Fish pond? Climbing Rock? Sunflower patch to attract birds? Basketball court? Boat launch? Stage? Skateboard park? Ask classmates, family members, and others in your community to make suggestions.

2. Sketch ideas. Determine how much space your trail and play areas will need. Recommend where it could be installed. Then prepare a replica of your plan.

3. Start with a flat base of stiff cardboard. Use colored paper for clay or differnt parts of your park such as the trail, play areas, etc. For example, press blue clay into a lake shape or cut out a lake 'shape' from blue construction paper. Make fish or a boat out of construction paper. Cut out a shape that represents a skate park, build a model of a swing set or play ground. Cut out pictures from magazines.

4. Label areas with paper signs. Attach signs to toothpicks with glue. Compare and contrast your group's plan with others. Consider presenting the most feasible plan to decision makers in your community.

Adaptations. Ask local recreation experts to discuss ideas with the class. What is the planning process for this type of facility? Who is responsible?

Write an article about the need for your facility and submit it to the local

paper.

Draw a life-size trail design on a safe, large paved area with sidewalk chalk.

Assessment: Evaluate how thoroughly children researched the need for recreational spaces. Did they apply what they learned in their model? Is the plan realistic? How well did students work together? Was the choice for a plan to present well reasoned?

Benefits:
Children identify local needs for recreational spaces by interviewing diverse classmates, families, and community members.

Students work in small groups to consider space needs and a possible place for installation. They sketch, make a model of their planned area, and label their replicas.

Students compare and contrast their plans to select one for presentation to decision makers for action.

Grade Level Expectation: 4-6
Historical Perspectives: Women's Sufferage (Susan B. Anthony)
Content Area: Social Studies

Lesson time:
30 minutes; homework assignment

Materials:
1. Internet connection

Objective:
This lesson give students the opportunity to analyze a historical source for accuracy.

5th Grade Standards:
1. History
   1. Analyze historical sources from multiple points of view to develop an understanding of historical context

6th Grade Standards:
1. History
   1. Analyze and interpret historical sources to ask and research historical questions.

Background:
Susan B. Anthony, women's suffrage pioneer, once said, "Let me tell you what I think of bicycling. I think it has done more to emancipate women than anything else in the world. It gives women a feeling of freedom and self-reliance. I stand and rejoice every time I see a woman ride by on a wheel… the picture of free, untrammeled womanhood."

"With a bike, a woman could travel solo. She could travel without waiting for a man to hitch horse and carriage…Bicycles also forced dress reform. On a horse a woman could ride sidesaddle in a long skirt. But a bike required a divided skirt or bloomers, and the action of pedaling started the slow movement to shed waist-pinching corsets."

Source: http://cyclingsisters.org/taxonomy_menu/2/23

The Quotable Cyclist, Compiled by Bill Strickland, Breakaway Books, 1997.

Vocabulary: emancipate, suffrage

Procedure:
1. Introduce Susan B. Anthony to the students.
2. Discuss the impact bicycles had on women's independence.

Activity:

Ask the students to write a short essay supporting (or taking a contrary position) the statement by Susan B. Anthony with at least three supporting points.

Ask students to research major historical figures in the evolution of bicycling, identifying the individuals role in history.

Grade Level Expectation: 4-6
Recycled Materials as Art
Content Area: Visual Arts

Lesson Time:
2 class periods

Materials:
1. Pictures of art made from recycled bicycles

Take home:
Art project

Objective:
To identify artists who use recycled materials in their art. To learn why artists would use recycled materials.

Background: Mark Grieve and Ilana Spector create artwork from discarded bicycle parts. Their "Bicycle Arch" was created to provide an entryway into a bicycle parking area.

Carolina Fontoura Alzaga is another artist who used bicycle parts in her work. "Connect" is a series of chandeliers made from old bike parts, mostly chains. "Brake Lotus" is a sculpture made from the brake levers of bicycles. She describes her work as "repurposing castoff materials."

The bicycle, because of its perception as an eco-friendly object, is particularly suited for art with an ecology theme.

4th Grade Standard
Content Area: Visual Arts
3. Invent and Discover to Create
   2. Use media to express and communicate ideas about an issue of personal interest

5th Grade Standard
Content Area: Visual Arts
1. Observe and Learn to Comprehend
   2. Visual arts communicate the human experience

6th Grade Standard
Content Area: Visual Arts
4: Relate and Connect to Transfer
   3. Eco-art is a contemporary response to environmental issues.

Procedure:
Discuss with the students what motivates artists to use recycled or reclaimed items in their art.

Discuss what other items they have seen at home or in their neighborhoods that could be used in art projects.

Discuss where they have seen recycled materials used in artwork.

Discuss how artists recycle materials to make their artwork and why they choose the materials they use.

Activity 1:

Grade Level Expectation: 4-6
Recycled Materials as Art
Content Area: Visual Arts

Have students create a work of art from reclaimed or recycled materials. This could be either a sculpture or materials pasted to a canvas. Students should be encouraged to use materials that represent their specific interests. For example, an equestrian could use an old tack and harness; someone who likes video games could use old game cartridges or controllers.

For this activity restrictions will need to be placed on the types of materials used in the art projects, for example no knives, weapons, drug paraphernalia, alcohol related or tobacco related objects should be used. If it is impractical for the art project to be transported to the school, a series of photos documenting the construction process and the final work could be presented in a poster format instead.

Alternative Activity:
Have students create and draw a concept for a work of art made from recycled bicycle parts.

Grade Level Expectation: 4-6
How Walkable or Bikable is your Community?
Content Area: Social studies; Reading, Writing and Communicating

Lesson time:
1-2 class periods homework assignment

Materials:
1. Walkability Checklist (following this lesson)

2. Bikeability Checklist (following this lesson)

Take home:
None

Objective:
To help students understand their community in a different way, by having them explore how safe and comfortable it is to walk or bicycle.

Background:
This type of review is a common planning practice. You may be able to engage an agency planner or engineer to visit your class and speak to students about this type of analysis.

4th Grade Standards:
Content Area: Social Studies
2. Geography
   2. Connections within and across human and physical systems are developed

6th Grade Standards:
Content Area: Social Studies
2. Geography
   2. Human and physical systems vary and interact

Content Area: Reading, Writing and Communicating
1. Successful group discussion requires planning and communication

Activity:
Class Period 1:
1. Ask students if they walk or bicycle to school. If they don't, this excercise can be done in their neighborhoods and the results shared wtih the class.

2. Ask if they have ever noticed barriers or problems as they walk or bicycle in their neighborhoods or to school. Note these for review later.

3. Review the Walkability or Bikeability Checklist with students.

Class Period 2:
4. Review student findings. Ask what they noticed and and what challenges they identified. Ask how the identified challenges affect their walking or bicycling experience. Ask how fixing the challenges would change their experiences.

Extensions:
Have students write letters to their planning agency discussing the challenges and asking for corrections to the problems.

Walkability Checklist

How walkable is your community?

Take a walk with a child and decide for yourselves.

Everyone benefits from walking. These benefits include: improved fitness, cleaner air, reduced risks of certain health problems, and a greater sense of community. But walking needs to be safe and easy. Take a walk with your child and use this checklist to decide if your neighborhood is a friendly place to walk. Take heart if you find problems, there are ways you can make things better.

Getting started:

First, you'll need to pick a place to walk, like the route to school, a friend's house or just somewhere fun to go. The second step involves the checklist. Read over the checklist before you go, and as you walk, note the locations of things you would like to change. At the end of your walk, give each question a rating. Then add up the numbers to see how you rated your walk overall.After you've rated your walk and identified any problem areas, the next step is to figure out what you can do to improve your community's score. You'll find both immediate answers and long-term solutions under "Improving Your Community's Score..." on the third page.

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
National Highway Traffic Safety Administration

United States Environmental Protection Agency

SafeRoutes
National Center for Safe Routes to School

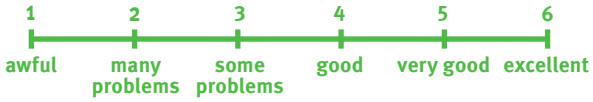
Pedestrian and Bicycle Information Center

Take a walk and use this checklist to rate your neighborhood's walkability.

How walkable is your community?

Location of walk

Rating Scale:



1. Did you have room to walk?

- ☐ Yes
- ☐ Some problems:
  - ☐ Sidewalks or paths started and stopped
  - ☐ Sidewalks were broken or cracked
  - ☐ Sidewalks were blocked with poles, signs,shrubbery, dumpsters, etc.
  - ☐ No sidewalks, paths, or shoulders
  - ☐ Too much traffic
  - ☐ Something else _____

Rating: (circle one)
1 2 3 4 5 6

Locations of problems:
_____

2. Was it easy to cross streets?

- ☐ Yes
- ☐ Some problems:
  - ☐ Road was too wide
  - ☐ Traffic signals made us wait too long or did not give us enough time to cross
  - ☐ Needed striped crosswalks or traffic signals
  - ☐ Parked cars blocked our view of traffic
  - ☐ Trees or plants blocked our view of traffic
  - ☐ Needed curb ramps or ramps needed repair

  Something else _____

Rating: (circle one)
1 2 3 4 5 6

Locations of problems:
_____

3. Did drivers behave well?

- ☐ Yes
- ☐ Some problems: Drivers ...
  - ☐ Backed out of driveways without looking
  - ☐ Did not yield to people crossing the street
  - ☐ Turned into people crossing the street
  - ☐ Drove too fastp
  - ☐ Sped up to make it through traffic lights or drove through traffic lights?
  - ☐ Something else _____

Rating: (circle one)
1 2 3 4 5 6

Locations of problems:
_____

4. Was it easy to follow safety rules? Could you and your child...

- ☐ Yes ☐ No Cross at crosswalks or where you could see and be seen by drivers?
- ☐ Yes ☐ No Stop and look left, right and then left again before crossing streets?
- ☐ Yes ☐ No Walk on sidewalks or shoulders facing traffic where there were no sidewalks?
- ☐ Yes ☐ No Cross with the light?

Rating: (circle one)
1 2 3 4 5 6

Locations of problems:
_____

5. Was your walk pleasant?

- ☐ Yes
- ☐ Some problems:
  - ☐ Needed more grass, flowers, or trees
  - ☐ Scary dogs
  - ☐ Scary people
  - ☐ Not well lighted
  - ☐ Dirty, lots of litter or trash
  - ☐ Dirty air due to automobile exhaust
  - ☐ Something else _____

Rating: (circle one)
1 2 3 4 5 6

Locations of problems:
_____

How does your neighborhood stack up? Add up your ratings and decide.

1. _____
2. _____
3. _____
4. _____
5. _____

Total: _____

26–30	Celebrate! You have a great neighborhood for walking.
21–25	Celebrate a little. Your neighborhood is pretty good.
16–20	Okay, but it needs work.
11–15	It needs lots of work. You deserve better than that.
5–10	It's a disaster for walking!

Now that you've identified the problems, go to the next page to find out how to fix them.

Now that you know the problems, you can find the answers.

Improving your community's score

1. Did you have room to walk?

Sidewalks or paths started and stopped
Sidewalks broken or cracked
Sidewalks blocked
No sidewalks, paths or shoulders
Too much traffic

What you and your child can do immediately

- pick another route for now
- tell local traffic engineering or public works department about specific problems and provide a copy of the checklist

What you and your community can do with more time

- speak up at board meetings
- write or petition city for walkways and gather neighborhood signatures
- make media aware of problem
- work with a local transportation engineer to develop a plan for a safe walking route

2. Was it easy to cross streets?

Road too wide
Traffic signals made us wait too long or did not give us enough time to cross
Crosswalks/traffic signals needed
View of traffic blocked by parked cars, trees, or plants
Needed curb ramps or ramps needed repair

- pick another route for now
- share problems and checklist with local traffic engineering or public works department
- trim your trees or bushes that block the street and ask your neighbors to do the same
- leave nice notes on problem cars asking owners not to park there

- push for crosswalks/signals/ parking changes/curb ramps at city meetings
- report to traffic engineer where parked cars are safety hazards
- report illegally parked cars to the police
- request that the public works department trim trees or plants
- make media aware of problem

3. Did drivers behave well?

Backed without looking
Did not yield
Turned into walkers
Drove too fast
Sped up to make traffic lights or drove through red lights

- pick another route for now
- set an example: slow down and be considerate of others
- encourage your neighbors to do the same
- report unsafe driving to the police

- petition for more enforcement
- request protected turns
- ask city planners and traffic engineers for traffic calming ideas
- ask schools about getting crossing guards at key locations
- organize a neighborhood speed watch program

4. Could you follow safety rules?

Cross at crosswalks or where you could see and be seen
Stop and look left, right, left before crossing
Walk on sidewalks or shoulders facing traffic
Cross with the light

- educate yourself and your child about safe walking
- organize parents in your neighborhood to walk children to school

- encourage schools to teach walking safely
- help schools start safe walking programs
- encourage corporate support for flex schedules so parents can walk children to school

5. Was your walk pleasant?

Needs grass, flowers, trees
Scary dogs
Scary people
Not well lit
Dirty, litter
Lots of traffic

- point out areas to avoid to your child; agree on safe routes
- ask neighbors to keep dogs leashed or fenced
- report scary dogs to the animal control department
- report scary people to the police
- report lighting needs to the police or appropriate public works department
- take a walk wih a trash bag
- plant trees, flowers in your yard
- select alternative route with less traffic

- request increased police enforcement
- start a crime watch program in your neighborhood
- organize a community clean-up day
- sponsor a neighborhood beautification or tree-planting day
- begin an adopt-a-street program
- initiate support to provide routes with less traffic to schools in your community (reduced traffic during am and pm school commute times)

A Quick Health Check

Could not go as far or as fast as we wanted
Were tired, short of breath or had sore feet or muscles
Was the sun really hot?
Was it hot and hazy?

- start with short walks and work up to 30 minutes of walking most days
- invite a friend or child along
- walk along shaded routes where possible
- use sunscreen of SPF 15 or higher, wear a hat and sunglasses
- try not to walk during the hottest time of day

- get media to do a story about the health benefits of walking
- call parks and recreation department about community walks
- encourage corporate support for employee walking programs
- plant shade trees along routes
- have a sun safety seminar for kids
- have kids learn about unhealthy ozone days and the Air Quality Index (AQI)

Need some guidance? These resources might help...

Great Resources

WALKING INFORMATION

Pedestrian and Bicycle Information Center (PBIC)
UNC Highway Safety Research Center
Chapel Hill, NC
www.pedbikeinfo.org
www.walkinginfo.org

National Center for Safe Routes to School
Chapel Hill, NC
www.saferoutesinfo.org

For More Information about Who Can Help Address Community Problems
www.walkinginfo.org/problems/help.cfm

State Bicycle & Pedestrian Coordinators
http://www.walkinginfo.org/assistance/contacts.cfm

FEDERAL POLICY, GUIDANCE AND FUNDING SOURCES FOR WALKING FACILITIES

Federal Highway Administration
Bicycle and Pedestrian Program
Office of Natural and Human Environment
Washington, DC
www.fhwa.dot.gov/environment/bikeped/index.htm

PEDESTRIAN SAFETY

Federal Highway Administration
Pedestrian and Bicycle Safety Team
Office Of Safety
Washington, DC
http://safety.fhwa.dot.gov/ped_bike/

National Highway Traffic Safety Administration
Traffic Safety Programs
Washington, DC
www.nhtsa.dot.gov/people/injury/pedbimot/pedSAFE

SIDEWALK ACCESSIBILITY INFORMATION

US Access Board
Washington, DC
Phone: (800) 872-2253;
(800) 993-2822 (TTY)
www.access-board.gov

U.S. Department of Transportation Federal Highway Administration

U.S. Department of Transportation National Highway Traffic Safety Administration

SafeRoutes National Center for Safe Routes to School

Pedestrian and Bicycle Information Center

Bikeability Checklist

How bikeable is your community?

Riding a bike is fun!

Bicycling is a great way to get around and to get your daily dose of physical activity. It's good for the environment, and it can save you money. No wonder many communities are encouraging people to ride their bikes more often!

Can you get to where you want to go by bike?

Some communities are more bikeable than others: how does yours rate? Read over the questions in this checklist and then take a ride in your community, perhaps to the local shops, to visit a friend, or even to work. See if you can get where you want to go by bicycle, even if you are just riding around the neighborhood to get some exercise.

At the end of your ride, answer each question and, based on your opinion, circle an overall rating for each question. You can also note any problems you encountered by checking the appropriate box(es). Be sure to make a careful note of any specific locations that need improvement.

Add up the numbers to see how you rated your ride. Then, turn to the pages that show you how to begin to improve those areas where you gave your community a low score. Before you ride, make sure your bike is in good working order, put on a helmet, and be sure you can manage the ride

U.S. Department of Transportation
National Highway Traffic Safety Administration

Pedestrian and Bicycle Information Center

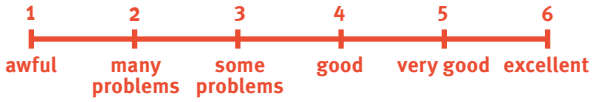
U.S. Department of Transportation
Federal Highway Administration

Go for a ride and use this checklist to rate your neighborhood's bikeability.

How bikeable is your community?

Location of bike ride (be specific):

Rating Scale:



1. Did you have a place to bicycle safely?

a) On the road, sharing the road with motor vehicles?

☐ Yes ☐ Some problems (please note locations):

- ☐ No space for bicyclists to ride
- ☐ Bicycle lane or paved shoulder disappeared
- ☐ Heavy and/or fast-moving traffic
- ☐ Too many trucks or buses
- ☐ No space for bicyclists on bridges or in tunnels
- ☐ Poorly lighted roadways

Other problems:

_____

_____

b) On an off-road path or trail, where motor vehicles were not allowed?

☐ Yes ☐ Some problems:

- ☐ Path ended abruptly
- ☐ Path didn't go where I wanted to go
- ☐ Path intersected with roads that were difficult to cross
- ☐ Path was crowded
- ☐ Path was unsafe because of sharp turns or dangerous downhills
- ☐ Path was uncomfortable because of too many hills
- ☐ Path was poorly lighted

Other problems:

_____

_____

Overall "Safe Place To Ride" Rating: (circle one)

1 2 3 4 5 6

2. How was the surface that you rode on?

☐ Good ☐ Some problems, the road or path had:

- ☐ Potholes
- ☐ Cracked or broken pavement
- ☐ Debris (e.g. broken glass, sand, gravel, etc.)
- ☐ Dangerous drain grates, utility covers, or metal plates
- ☐ Uneven surface or gaps
- ☐ Slippery surfaces when wet (e.g. bridge decks, construction plates, road markings)
- ☐ Bumpy or angled railroad tracks
- ☐ Rumble strips

Other problems:

_____

_____

Overall Surface Rating: (circle one)

1 2 3 4 5 6

3. How were the intersections you rode through?

☐ Good ☐ Some problems:

- ☐ Had to wait too long to cross intersection
- ☐ Couldn't see crossing traffic
- ☐ Signal didn't give me enough time to cross the road
- ☐ Signal didn't change for a bicycle
- ☐ Unsure where or how to ride through intersection

Other problems:

_____

_____

Overall Intersection Rating: (circle one)

1 2 3 4 5 6

Continue the checklist on the next page...

4. Did drivers behave well?

☐ Good ☐ Some problems, drivers:

- ☐ Drove too fast
- ☐ Passed me too close
- ☐ Did not signal
- ☐ Harassed me
- ☐ Cut me off
- ☐ Ran red lights or stop sign

Other problems:

_____

_____

Overall Driver Rating: (circle one)

1 2 3 4 5 6

5. Was it easy for you to use your bike?

☐ Good ☐ Some problems:

- ☐ No maps, signs, or road markings to help me find my way
- ☐ No safe or secure place to leave my bicycle at my destination
- ☐ No way to take my bicycle with me on the bus or train
- ☐ Scary dogs
- ☐ Hard to find a direct route I liked
- ☐ Route was too hilly

Other problems:

_____

_____

Overall Intersection Rating: (circle one)

1 2 3 4 5 6

6. What did you do to make your ride safer?

Your behavior contributes to the bikeability of your community. Check all that apply:

- ☐ Wore a bicycle helmet
- ☐ Obeyed traffic signal and signs
- ☐ Rode in a straight line (didn't weave)
- ☐ Signaled my turns
- ☐ Rode with (not against) traffic
- ☐ Used lights, if riding at night
- ☐ Wore reflective and/or retroreflective materials and bright clothing
- ☐ Was courteous to other travelers (motorist, skaters, pedestrians, etc.)

7. Tell us a little about yourself.

In good weather months, about how many days a month do you ride your bike?

- ☐ Never
- ☐ Occasionally (one or two)
- ☐ Frequently (5-10)
- ☐ Most (more than 15)
- ☐ Every day

Which of these phrases best describes you?

- ☐ An advanced, confident rider who is comfortable riding in most traffic situations
- ☐ An intermediate rider who is not really comfortable riding in most traffic situations
- ☐ A beginner rider who prefers to stick to the bike path or trail

How does your community rate?

Add up your ratings and decide.

(Questions 6 and 7 do not contribute to your community's score)

1. _____	**26–30**	Celebrate! You live in a bicycle-friendly community.
2. _____	**21–25**	Your community is pretty good, but there's always room for improvement.
3. _____	**16–20**	Conditions for riding are okay, but not ideal. Plenty of opportunity for improvements.
4. _____	**11–15**	Conditions are poor and you deserve better than this! Call the mayor and the newspaper right away.
5. _____	**5–10**	Oh dear. Consider wearing body armor and Christmas tree lights before venturing out again.

Total: _____

Did you find something that needs to be changed?

On the next page, you'll find suggestions for improving the bikeability of your community based on the problems you identified. Take a look at both the short- and long-term solutions and commit to seeing at least one of each through to the end. If you don't, then who will?

During your bike ride, how did you feel physically? Could you go as far or as fast as you wanted to? Were you short of breath, tired, or were your muscles sore? The next page also has some suggestions to improve the enjoyment of your ride.

Bicycling, whether for transportation or recreation, is a great way to get 30 minutes of physical activity into your day. Riding, just like any other activity, should be something you enjoy doing. The more you enjoy it, the more likely you'll stick with it. Choose routes that match your skill level and physical activities. If a route is too long or hilly, find a new one. Start slowly and work up to your potential.

Now that you know the problems, you can find the answers.

Improving your community's score

1. Did you have a place to bicycle safely?

a) On the road?

	What you and your child can do immediately	What you and your community can do with more time
No space for bicyclists to ride (e.g. no bike lane or shoulder; narrow lanes) Bicycle lane or paved shoulder disappeared Heavy and/or fast-moving traffic Too many trucks or buses No space for bicyclists on bridges or in tunnels Poorly lighted roadways	• pick another route for now • tell local transportation engineers or public works department about specific problems; provide a copy of your checklist • find a class to boost your confidence about riding in traffic	• participate in local planning meetings • encourage your community to adopt a plan to improve conditions, including a network of bike lanes on major roads • ask your public works department to consider "Share the Road" signs at specific locations • ask your state department of transportation to include paved shoulders on all their rural highways • establish or join a local bicycle advocacy group

b) On an off-road path or trail?

Path ended abruptly Path didn't go where I wanted to go Path intersected with roads that were difficult to cross Path was crowded Path was unsafe because of sharp turns or dangerous downhills Path was uncomfortable because of too many hills Path was poorly lighted	• slow down and take care when using the path • find an on-street route • use the path at less crowded times • tell the trail manager or agency about specific problems	• ask the trail manager or agency to improve directional and warning signs • petition your local transportation agency to improve path/roadway crossings • ask for more trails in your community • establish or join a "Friends of the Trail" advocacy group

2. How was the surface you rode on?

Potholes Cracked or broken pavement Debris (e.g. broken glass, sand, gravel, etc.) Dangerous drain grates, utility covers, or metal plates Uneven surface or gaps Slippery surfaces when wet (e.g. bridge decks, construction plates, road markings) Bumpy or angled railroad tracks Rumble strips	• report problems immediately to public works department or appropriate agency • keep your eye on the road/path • pick another route until the problem is fixed (and check to see that the problems are fixed) • organize a community effort to clean up the path	• participate in local planning meetings • encourage your community to adopt a plan to improve conditions, including a network of bike lanes on major roads • ask your public works department to consider "Share the Road" signs at specific locations • ask your state department of transportation to include paved shoulders on all their rural highways • establish or join a local bicycle advocacy group

3. How were the intersections you rode through?

Had to wait too long to cross intersection Couldn't see crossing traffic Signal didn't give me enough time to cross the road The signal didn't change for a bicycle Unsure where or how to ride through intersection	• pick another route for now • tell local transportation engineers or public works department about specific problems • take a class to improve your riding confidence and skills	• ask the public works department to look at the timing of the specific traffic signals • ask the public works department to install loop-detectors that detect bicyclists • suggest improvements to sightlines that include cutting back vegetation; building out the path crossing; and moving parked cars that obstruct your view • organize community-wide, on-bike training on how to safely ride through intersections

Improving your community's score (continued)

4. Did drivers behave well?

Drivers:

Drove too fast

Passed me too close

Did not signal

Harassed me

Cut me off

Ran red lights or stop signs

What you and your child can do immediately

- report unsafe drivers to the police
- set an example by riding responsibly; obey traffic laws; don't antagonize drivers
- always expect the unexpected
- work with your community to raise awareness to share the road

What you and your community can do with more time

- ask the police department to enforce speed limits and safe driving
- encourage your department of motor vehicles to include "Share the Road" messages in driver tests and correspondence with drivers
- ask city planners and traffic engineers for traffic calming ideas
- encourage your community to use cameras to catch speeders and red light runners

5. Was it easy for you to use your bike?

No maps, signs, or road markings to help me find my way

No safe or secure place to leave my bicycle at my destination

No way to take my bicycle with me on the bus or train

Scary dogs

Hard to find a direct route I liked

Route was too hilly

- plan your route ahead of time
- find somewhere close by to lock your bike; never leave it unlocked
- report scary dogs to the animal control department
- learn to use all of your gears!

- ask your community to publish a local bike map
- ask your public works department to install bike parking racks at key destinations; work with them to identify locations
- petition your transit agency to install bike racks on all their buses
- plan your local route network to minimize the impact of steep hills
- establish or join a bicycle user group (BUG) at your workplace

6. What did you do to make your ride safer?

Wore a bicycle helmet

Obeyed traffic signals and signs

Rode in a straight line (didn't weave)

Signaled my turns

Rode with (not against) traffic

Used lights, if riding at night

Wore reflective materials and bright clothing

Was courteous to other travelers (motorists, skaters, pedestrians, etc.)

- go to your local bike shop and buy a helmet; get lights and reflectors if you are expecting to ride at night
- always follow the rules of the road and set a good example
- take a class to improve your riding skills and knowledge

- ask the police to enforce bicycle laws
- encourage your school or youth agencies to teach bicycle safety (on-bike)
- start or join a local bicycle club
- become a bicycle safety instructor

Need some guidance? These resources might help...

Great Resources

BICYCLING INFORMATION

Pedestrian and Bicycle Information Center (PBIC)
UNC Highway Safety Research Center
Chapel Hill, NC
http://www.pedbikeinfo.org
http:// www.bikinginfo.org

National Center for Safe Routes to School (NCSRTS)
UNC Highway Safety Research Center
Chapel Hill, NC
http:// www.saferoutesinfo.org

STREET DESIGN AND BICYCLE FACILITIES

American Association of State Highway and Transportation Officials (AASHTO)
Washington, D.C.
http://www.aashto.org

Institute of Transportation Engineers (ITE)
Washington, D.C.
http:// www.ite.org

Association of Pedestrian and Bicycle Professionals (APBP)
Cedarburg, WI
http:// www.apbp.org

Federal Highway Administration (FHWA)
Bicycle and Pedestrian Program
Office of Natural and Human Environment
Washington, DC
http:// www.fhwa.dot.gov/environment/bikeped/index.htm

PATHS AND TRAILS

Rails to Trails Conservancy
Washington, DC
http:// www.railtrails.org

National Park Service (NPS)
Washington, DC
http://www.nps.gov/index.htm

EDUCATION AND SAFETY

National Highway Traffic Safety Administration (NHTSA)
Bicycle Safety Program, Office of Safety Programs
Washington, DC
http://www.nhtsa.gov/portal/site/nhtsa/menuitem.810acaee50c651189ca8e410dba046a0/

Federal Highway Administration (FHWA)
Pedestrian and Bicycle Safety Team, Office of Safety
Washington, DC
http://safety.fhwa.dot.gov/ped_bike/

SafeKids World-wide
Washington, D.C.
http://www.safekids.org

HEALTH

Centers for Disease Control and Prevention (CDC)
Division of Nutrition and Physical Activity
Atlanta, GA
http://www.dcd.gov/nccdphp/dnpa

Centers for Disease Control and Prevention (CDC)
Childhood Injury Prevention
Atlanta, GA
http:// www.dcd.gov/ncipc

ADVOCACY GROUPS

Alliance for Biking and Walking
http://www.peoplepoweredmovaement.org

League of American Bicyclists (LAB)
http://www.bikeleague.org

National Center for Bicycling and Walking (NCBW)
http://www.bikewalk.org

FUNDING SOURCES

Transportation Enhancement Activities:
http://www.fhwa.dot.gov/environment/te/

Safe Routes to School Program:
http://safety.fhwa.dot.gov/saferoutes/

Recreational Trails Program:
http://www.fhwa.dot.gov/environment/rectrails/

National Scenic Byways Program:
http://www.bywaysonline.org/

Federal Lands Highway Program:
http://flh.fhwa.dot.gov/

Pedestrian and Bicycle Information Center

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
National Highway Traffic Safety Administration

Grade Level Expectation: 5-6
A Bicylcing We Will Go
Content Area: Social Studies, Reading, Writing, and Communicating

Lesson time:
2 class periods

Materials:
1. Print resources

2. Encyclopedias

3. Internet connection

4. Science journal

Objective: To discover how the design of bicycles has changed over time as technology has developed.

Adapted from: A bicycling we will go at: http://scifiles.larc.nasa.gov.

Background:
Nobody knows exactly when the first bike was invented, but in the late 1700s there was a "hobbyhorse" that had wooden wheels, but no pedals. Their riders had to ride it by pushing it with their feet, and if they wanted to get off, they had to drag their feet until it stopped. Needless to say, only really strong people were able to ride a "hobbyhorse." Through the years as technology became better, the bicycle began to change. Today there are many styles and kinds of bicycles to choose from. Bicycles are not only used for riding pleasure, but have also been adapted to do various jobs, such as a street sweeper and ice cream cart. You may even use yours for a paper route.

Standards:
5th Grade Social Studies
1. History
   1. Analyze historical sources from multiple view points to develop an understanding of historical context.

1. Reading for All Purposes
   2. Ideas found in a variety of informational texts need to be compared and understood
4. Research and Reasoning
   1. High quality research required information that is organized and presented with documentation

6th Grade Social Studies
1. History
   1. Analyze and interpret historical sources to ask and research historical questions

6th Grade Reading, Writing and Communication
3. Writing and Composition
   2. Writing informational and persuasive genres for intended audiences and purpose requires ideas, organization and voice development

4. Research and Reasoning
   1. Individual and group research projects require obtaining information on a topic from a variety or sources, organizing it for presentation

Web resources:

Japanese Bicycle History Research Club
Explore the history of bicycling in Japan. Includes photo galleries, articles and more.
http://www.eva.hi-ho.ne.jp/ordinary/

National Bicycle History of America Association (NBHAA)
Web site dedicated to the identification, cataloging, and restoration of American bikes from 1920-1965.
http://www.nbhaa.com/

Bicycles, History, Beauty, Fantasy
This web site has great pictures and historical accounts of bicycles from 1863 to 1901.
http://antiquesandthearts.com/archive/bicycle.htm

Activity:

Use the various print and internet resources to trace the history of the bicycle.

Write a one to two page report showing how technology changed the way the bicycle looks and works. Describe how the features of the various designs of the bicycle help to accomplish its purpose.

If possible, cut and paste pictures from various web sites for the report.

Present the report to the class.

Grade Level Expectation:5-6
Traffic Tally
Content Area: Mathematics

Lesson time:
2-3 class periods

Materials:
1. Pencils and erasers

2. Watches with minute/ second hands, stopwatches, or clicker counters

3. Clipboards (if available)

4. Additional staff support (classroom assistants or parent volunteers)

5. Signed parental consent forms (if taking students off of school premises

6. Student Worksheets (following the lesson)

7. Photographs for further exploration can be at: www.swt.org/share/bguard.html

Objective:
Students will understand the connection between vehicle traffic, air pollution, and health by designing and conducting a traffic survey to explore traffic volumes on familiar roadways. This lesson is adapted from the Walking for Health & the Environment Curriculum, Walk Boston.

Summary:
This activity is a mini-field trip that provides students with hands-on experience in conducting a traffic survey in their own community, analyzing their data, and presenting it in a graphic form that shows traffic volumes.

Standards:
5th Grade
1. Patterns, Functions and Algebraic Structures
    1. Number patterns and relationships can be described using a variety of tools
    3. Quantities can be expressed and compared using ratios and rates
3. Data, Analysis, Statistics and Probability
    1. Visual displays and summary statistics are used to describe and interpret data

6th Grade
1. Patterns, Functions and Algebraic Structures
    1. Patterns can be described using words, tables and graphs
3. Data, Analysis, Statistics and Probability
    1. Questions can be answered by collecting and analysing data and data displays

Discussion:
Do you think there is too much traffic along the main roads in your community? If so, how many vehicles do you think travel along these roads during morning rush-hour traffic? How many people do you think are typically in each vehicle?

How might the amount of traffic be reduced?
(Possible answers: More people walking, bicycling, carpooling, and taking subways, trains, and buses)

How might the amount of air pollution from this traffic be reduced?
(Possible answers: Having fewer motor vehicles on the road; driving smaller or hybrid cars; more people walking, bicycling, carpooling, and taking light rail, trains, and buses)

What might be some of the benefits of reducing traffic and air pollution from vehicles?
(Possible answers: Fewer traffic jams; safer

streets to walk and bike on; fewer health problems from air pollution, such as breathing problems [e.g., asthma], and heart disease; and possibly healthier people because more people might be walking and getting exercise)

What things might affect the accuracy of a traffic survey's results? (Possible answers: Bad weather; if the day was a holiday; if different groups started counting traffic at different times; if some people missed counting some vehicles; if some people put some vehicles into the wrong categories; if some people "double-counted" some vehicles)

What vehicles produce the most pollution per person? (Possible answer: Trucks with just one person in them.)

What vehicles produce the least pollution per person? (Possible answer: Bicycles)

Preparation:
Make important arrangements, such as obtaining parental permission slips to go to off-school locations, and getting commitments from adult classroom assistants and/or parent volunteers to accompany the class groups. (Note: If going offsite is problematic, you can instead conduct the traffic survey on school premises, near the driveway to the school.)

Choose the roads on which the class will survey traffic volume and vehicle types.

Choose a minimum of two roads for comparison purposes.

Choose roads that are within easy walking distance of the school and are busy 2-lane (one travel lane each direction) roadways.

Select a time of day when the roads have moderately busy traffic, such as morning rush hour. The number of roads chosen will depend on how many groups you want to divide the class into (which in turn will depend in part on how many adult assistants/volunteers you have, and the size of your class).

(Note: The class will not be surveying major 4-lane or larger highways; the purpose is to determine local/community traffic impacts.)

Give students an overview of the traffic survey. Inform students that the class will conduct a traffic survey to explore traffic volumes on key local roads, and the connection between vehicle traffic and air pollution. Discuss the "Key Questions" above with the class. Tell the class that they will divide up into groups of at least 6 students per group, stand safely by the sides of different busy roads, and count the number of vehicles driving by for a

fifteen-minute period (e.g., during morning rush hour). They will also identify the type of each vehicle (e.g., car, truck, etc.) and the number of people in each vehicle.

1. Explain a tally chart.
Tell students that to conduct the survey, they will make tally charts that keep track of the number and types of vehicles and the number of people in each vehicle, and that the class is first going to practice making these charts. On the chalkboard, illustrate tally marks.

2. Practice a traffic tally in class. Tell students to use the back of their Student Worksheets to practice recording the number and types of vehicles that you will list for them.

3. Explain roles.
Explain to students that they will conduct the survey in four pairs:

1st Pair: One person will call out loud to his or her partner each time a vehicle passes in one direction (one side of the street) the type of the vehicle (e.g., “car,” “truck”), while the other partner will record the data on the Tally Student Worksheet #1.

2nd Pair: One person will call out vehicles passing in the other direction (on the other side of the street), while the other partner records the data.

3rd Pair: One person will call out the number of people in each vehicle in one direction, while the other partner will record the number of persons per vehicle. For buses, have the students determine an estimate of the number of people they will use (e.g., average of 15 people per bus) and make sure all students are using the same number.

4th Pair: One person will call out the number of people in each vehicle in the other direction, while the other partner will record the number of persons per vehicle. For buses, use the same estimated average number of people as discussed in “3rd Pair” above, and make sure all students are using the same number.

4. Explain methodology
Also explain to the class that in order for the survey to be accurate, it is important that each group and each pair of students do things exactly the same way. For example, each group must start the survey at the same time, and each group must conduct the survey for exactly 15 minutes – not longer and not shorter.

5. Assign roles
Assign the students to survey groups and assign an adult assistant to each group. Have students in each group divide up into pairs; help them decide

who will be an “announcer” (calling out the type of each vehicle that passes, or the number of people in each vehicle) and who will be the “recorder” in each pair. Assign one person (perhaps the adult assistant) to be the timekeeper, who will tell students when to begin and end the survey and will record the exact starting and ending times.

6. Conduct the traffic survey.
Conduct the traffic survey at the designated locations, using Student Worksheet #1. If possible, don’t have students cross any streets. Be sure to remind students to practice safety: stand back from the roadway; if crossing a street is necessary, do so carefully when the adult assistant says it is safe to do so, make sure students are standing in a way that allows other pedestrian to pass easily, and that they are polite to people.

7. Discuss and analyze survey results in class.
Calculate totals. Back in the classroom (on the same day or another day), have each group add up the totals for their group, including the total number of vehicles, and the total number of each type of vehicle, using Student Worksheet #2. Also have each group add up the total number of people traveling in these vehicles. Ask a spokesperson from each group to read aloud the totals for their group, write these on the chalkboard, and add up the totals for the entire class.

Discuss results. Compare and contrast the different categories for each group. Which roadway had the most traffic? Why does the class think this is so?

Calculate different vehicle types. Of the total traffic, have the class calculate the portion of each vehicle type (e.g., cars, trucks, buses, bicycles). For younger students, this might be calculated as fractions. For older students, this might be calculated as fractions and percentages.

Discuss the accuracy of the methodology and results. Identify any potential problems regarding the data collection methods: Did one group collect data for 20 minutes instead of 15? Did some people miss counting some vehicles (e.g., because they weren’t paying attention, because they sneezed, etc.)? Did some people “double count” one or more vehicles? Could students really see the number of passengers inside vehicles? Did some people put certain types of vehicles in the wrong categories? Did one group start earlier or later than another group? Did the weather suddenly change during the tally? Inform the class that any of these or other factors can affect the accuracy of the survey results. Ask the class if they have any ideas about how the survey could have been done more accurately.

8. Discuss the relationship between traffic volume, number of people in vehicles, and air pollution.

Ask: If the number of vehicles on the road were reduced, might this reduce air pollution? (Correct answer: Yes).

Why? (Correct answer: Because gasoline-powered vehicles emit air pollutants, and fewer vehicles would mean less pollution.)

What are some benefits from reducing air pollution? (Correct answer: Fewer breathing problems, like asthma, less heart disease, and more people might get exercise by walking or bicycling instead of driving. Healthier trees and plants. Also reducing some sources [vehicles] of global warming). Also discuss how fewer vehicles, ones that have higher miles-per-gallon, carpooling, and using public transportation would use less gasoline and thus produce less pollution.

9. Have students present the survey results.
Either during the same session or on another day, tell the class that they will now prepare a presentation of the traffic survey data. Depending on time available, either assign how the class should present the data, or, if more time is available, have the class discuss different ways of presenting the data and determine the best way to present the information (e.g., line graph, pie chart, pictogram, and/or bar graph). If time permits, you may want to have different groups present their data results in different ways.

Building on prior classroom experience with the different presentation formats, explain to the class how to develop the type of presentation format you choose. Decide what units, scales, colors, symbols, spacing, etc. to use, as appropriate. If computers are available, consider having students check the Internet or use relevant software to create charts or graphs.

10. Tell students that tranportation agencies perform traffy tally studies. Ask the students how they think agencies would use this data. Consider calling your local plannig agency. Local planners (City, region, DOT) may be willing to come talk to the class about how this information is used.

11. Class display.
Have the students create a class display of the survey results.

12. Discuss presentation methods.
Discuss which type(s) of chart or graph conveys the information most effectively and why.

Adaptations
For Grades K-2, conduct the traffic survey as a whole class instead of dividing up into groups (with enough adult classroom assistants). Have the teacher and adult assistants, rather than the students, count the

number of cars and people in the cars. Back in class, the teacher can call out the totals for the students to record. For presentation purposes, help the students develop pictograms and/or pie charts (instead of more complex bar graphs, etc.).

Further exploration

Have students explore the mean and range of the different groups' data sets and of the grand totals. Have students develop a database, computerized if possible, of the data collected.

If your school is near a busy business district where there is a lot of foot traffic, students can tally the numbers of pedestrians (in addition to vehicles) along a road. This exercise, and the accompanying four photographs at the end of this lesson, can show students how much less space is taken up by people on foot or bicycles than by people in cars. It can also prompt a discussion about polluting versus non-polluting modes of travel. Perform this pedestrian traffic tally at a time of day that's busy for shops and stores, such as lunchtime. Assign a fifth pair of students to count pedestrians – one student for each sidewalk along the road.

Resources

UK Department for Transport Primary School Teaching Resource – Numeracy: Local Traffic Survey. URL:http://primarylinks.co.uk/category/links/geography/page/3/

The Beacon School Interactive Website – Geography Department. URL:http://www.bbc.co.uk/schools/gcsebitesize/geography/

The Tampa Tribune – "Packing Pavement," 7/18/99, by Jim Beamguard, writer, and Phil Sheffield, photographer. Photos used with permission. Complete article can be viewed online at URL: http://www.swt.org/share/bguard.html

Tally Sheet for Traffic Survey

Location (name of road, and main intersection, if appropriate):

_____

Fill out while coducting the traffic survey:

Number of Each Vehicle Type

	Tally	Totals
Cars		
Trucks		
Buses		
Bicycles		
Pedestrians		

Number of people in each vehicle

Survey Analysis and Presentation

Location (name of road, and main intersection if appropriate):

_____

Fill out in classroom after conducing the survey:

Total number of cars: _____ Total number of people in cars:_____
Total number of trucks: _____ Total number of pople in trucks: _____
Total number of buses: _____ Total number of pople in buses: _____
Total number of bicycles: _____ Total number of pople on bicycles: _____
Total number of pedestrians: _____

Total number of all types of vehicles: _____ Total number of people, all vehicle types: _____

Present your results (as a line graph, pie chart, bar graph and/or pictogram).

Grade Level Expectation: 5-6
Historical Perspectives: African American on an Integrated Sports Team
Content Area: Social Studies

Lesson Time:
1 class period

Materials:
1. Internet access

Take Home:
None

Objective:
This lesson give students the opportunity to identify how we record our history and critique information to determine if it is sufficient to answer historical questions.

5th Grade Standard:
1. History
   1. Analyse histroical sources from multiple points of view to develop an understanding of historical context

6th Grade Standard:
1: History
   1. Analyze and interpret historical sources to ask and reserch historical questions.

Background:
In a brief search internet search for African-American athletes finding the name Marshall Taylor would be a surprise. This is not because he does not deserve to be noted in any list of all-time great athletes. He was the first African-American on an integrated professional sports team, the first to have a commercial sponsorship, the first to establish world records (he held seven at once), he was the second to hold a world championship, and was an American champion. He was a bicycle racer. He was nationally known in his day and the venues where he raced would be filled to capacity. The Major Taylor Association website provides a comprehensive look at his accomplishments. So while Marshall Taylor was certainly an exceptional and notable athlete, he is not very well known.

Internet Resources: http://www.biography.com/blackhistory/people/athletes.jsp

BleacherReport website, http://bleacherreport.com/articles/340194-black-history-month-top-10-greatest-black-athletes

ARNet http://www.americansc.org.uk/Online/walters.html

Major Taylor Association, http://www.majortaylorassociation.org/who.htm,

David B. Perry, Bike Cult, Four Walls Eight Windows, 1995.

Procedure:
   1. Ask students to name some famous African-American athletes. Ask them to name the sport each played and why the athlete is famous.

   2. Ask the students if they have ever heard of Marshall Taylor, or Major Taylor.

3. Have students resarch Marshall Taylor and as group discuss Marshall Taylor's accomplishments.

4. Discuss why, despite all he accomplished, he is not better known.

5. Ask the students "How do we decide which historic figures are taught in school and which are not?" "Do we believe this applies to other areas of history?"

Grade Level Expectation: 5-6
Transportation: A view into the future with a look at the past
Content Area: Social studies, Reading, Writing and Communicating

Lesson time:
2-3 class periods

Materials:
1. Internet connection

Objective:

A. Students will study historical modes of transportation and issues surrounding their use found in Colorado's newspapers using the Colorado Historic Newspaper Collection (CHNC). Students will study contemporary ideas and issues on transportation using the electronic versions of the Denver Post and Rocky Mountain News.

B. Students will analyze transportation issues through readings about bicycles, flying machines,and railroads in historical newspapers. Students will be able to relate benefits, problems, and other issues seen through history.

C. Students will analyze current modes of transportation and the issues surrounding their use. How have issues such as the environment, pollution, land use, quality of life, growth, etc. been addressed over the years? How will these issues impact the future of transportation?

D. Students will create a Plan for Colorado's Transportation Future 2025 based on current transportation articles and issues.

This lesson is adapted from: Transportation: A View into the Future with a look at the past from the Denver Post Educational Service.

5th Grade Standards:
Content Area: Social Studies
1. History
1. Analyze historical sources from multiple points of view to develop an understanding of historical context

Content Area: Reading, Writing and Communicating
2. Reading for All Purposes
2. Ideas found in a variety of informational texts need to be compared and inderstood

6th Grade Standards:
Content Area: Social Studies
1. History
1. Analyze and interpret historical sources to ask and research historical questions
2. Geography
2. Human and physical systems vary and interact

Content Area: Reading, Writing and Communicating
1. Oral Expression and Listening
1. Successful group discussions require planning and participation by all
4. Research and Reasoning
1. Individual and group research projects require obtaining information on

a topic from a variety of sources and organizing it for presentation.

Background Information Needed for Teachers and Students:
• Working knowledge of the electronic edition of the Denver Post (www.denverpost.com)

• Working knowledge of Colorado's Historic Newspaper Collection (CHNC) www.ColoradoHistoricNewspapers.org

This unit is organized on different levels which can help you differentiate instruction:
Level I – Bicycles (historical articles provided are short, easily read)

Level II – Flying Machines (historical articles provided are longer in length, more difficult)

Level III - Railroads (one historical article provided, students research other historical articles themselves)

Level IV – Transportation Now (students search for contemporary articles on one particular issue to analyze and compare/contrast with historical articles)

Have students research and answer the following questions.

Level I - Bicycles

Type in http://www.ColoradoHistoricNewspapers.org. On the horizontal Tab Bar, click on Featured Topics, then General Interest Topics. Click on bicycles. Read at least four articles and write your observations.

1. What did you learn from your reading in the historic newspapers?

2. List the advantages/hopes/benefits of the bicycle.

3. List the difficulties/concerns/disadvantages of the bicycle.

4. How did this bicycle differ from today's models?

Level II – Flying Machines
Type in http://www.ColoradoHistoricNewspapers.org. On the horizontal Tab Bar, click on Featured Topics, then General Interest Topics. Click on flying machines. Of the thirteen articles listed, read at least four and write your observations.

1. What did you learn from your reading on flying machines?

2. List the advantages/hopes/benefits of flying.

3. List the difficulties/concerns/disadvantages of flying.

4. How do these flying machines differ from today's methods of flying?

Level III - Railroads
Type in http://www.ColoradoHistoricNewspapers.org. Click on Browse. Scroll to Rocky Mountain News. Click on June 22, 1870. On the front page, find the article titled "The Denver Pacific Finished". Use this as your first article to study. In the Search For: box enter "Railroads" or "Railroads" <NEAR> Your City, then click on Search Region. Search the articles for items of interest, and choose at least three more for this assignment. Then respond to the following questions.

1. List the articles you read for this assignment:
E.g:

Newspaper	Date	Title of Article
Rocky Mountain News	6/22/1870	The Denver Pacific Finished

2. What did you learn from your reading on railroads?

3. List the advantages/hopes/promises of trains.

4. List the difficulties/discouragements/disadvantages of trains.

5. How do these trains differ from today's railroads?

6. What else do you wish to note that was important, interesting, or puzzling?

Level IV – Transportation Now
Type in http://www.denverpost.com for access to the electronic edition of The Denver Post. Click on search, type in "transportation", and search in articles for the whole month. Look for articles printed on the front page, state, national, or world, rather than ads listed on marketplace, autos, etc. You are looking for news rather than purchasing a car. After browsing through these articles, choose four articles that all address a similar issue such as paying for roads, light rail, DIA, gasoline prices, air quality, etc. Choose four articles (you may want to access both papers online) to read and respond to with the following form.

Circle the Paper: Denver Post Rocky Mountain News

Title of Article _____
Date_____

Type of Transportation/
Issue_____

1. What is the transportation issue making news? What are the main ideas of this article?

2. What problems/concerns were covered? Are any of these similar to problems of the past?

3. What solutions/benefits are covered? Are any of these similar to solutions of the past?

4. What are the issues facing Colorado and the nation in the future?

Assignment:
Write an essay

Create a Plan for Colorado's Transportation Future 2025.
How can Colorado address the environment, pollution, land use, growth, quality of life issues, etc. through transportation in the future? What would your plan favor? (Can be done individually or in groups)

Grade Level Expectation: 5-7
Bike Around Colorado
Content Areas: Social Studies, Mathematics, Reading, Writing and Communicating

Lesson Time: 6-7 lessons

Materials:
1. Bicycle Route Maps for students to write on.

2. Other appropriate maps of Colorado and informational literature from sites around the region.

3. Internet access

4. Worksheet - "What Supplies does your group need to bring?"

5. Worksheet – "Track your Trip"

6. Hyperlinks to hotel chain websites or travel websites such as Expedia.com

7. Markers, colored pencils

8. Paper or notebook

9. Rubric (in Reference section

Objective:
Students will plan a multi-day trip around some part of Colorado. They will be responsible for calculating the daily mileage, determining where to stop for the night, evaluating the necessary supplies to take, and reporting on physical characteristics of the towns and land that they will visit on their trip. (This lesson can be adapted to include a smaller or larger area of Colorado to meet the needs of your lesson or grade level.)

1. Students will calculate the distance on a map using a map scale.
2. Students will generate a list of supplies needed for a bicycle trip.
3. Students will evaluate the importance of supplies needed to survive a multi—day trip when space and weight load is limited.
4. Students will create a report on the physical features of the land they will travel and the towns they will visit.

Adapted from Planning a multi-day trip in the Northwest Region of Illinois, Greg Noack, http://iga.illinoisstate.edu/2005%20SI%20Illinois%20Studies/05GN.pdf.

Standards:
5th Grade Standards:
Content Area: Social Studies
2. Geography
Use various geographic tools and sources to answer questions about the geography of the United States.

Content Area: Mathematics:
1: Number Sense, properties and operations
4. The concepts of multiplication and division can be applied to multiply and divide fractions.

Content Area: Reading, Writing and Communicating
1. Oral Expression and Listening
1. Effective communication requires speakers to express an opinion, provide information, describe a process, and persuade an audience.

4: Research and Reasoning
3. Quality reasoning requires asking questions and analyzing and evaluating viewpoints.

Procedure:
Day One: Set Purpose for Learning, Build Background Knowledge, Model Learning
1. Tell students that they will be planning a multi-day bicycle trip around Colorado during the next week. They will be placed into groups and asked to plan the trip. If possible have a guest speaker visit who has done a multi-day bicycle trip to talk about their experiences or visit an online diary of someone's experience.

2. Tell students they will be expected to do the following:
   - Choose places of interest and explain why they chose them
   - Calculate distances between points of interest correctly
   - They will have to determine how far they want to travel each day,
   - Figure the cost of supplies after they have chosen what to take, and
   - Keep track of money spent, supplies needed, and sites they plan to visit.

3. Explain Evaluation/Assessment

4. Share rubric for grading written work and oral presentation. (See Resource section.)

5. Give steps of assignment: 1. become familiar with the map, 2. research places of interest, 3. plan the trip, 4. present to class

6. If time permits let students explore the map on their own, or play a game, "Who can find?" With various parts of the map, (Teacher asks students to quickly find a feature on the map. Make sure everyone has found it before going on).

Day Two: Map Skills, becoming familiar with the map.
1. Review learning from the day before, especially the requirements of the lesson and the rubric.

2. Pass out maps, go over features of map. Practice going over the legend features with the students; locate north/south, find scale, look for different features of the map. Have students measure the distance between two sites and calculate the time to bicycle that distance travelling 10 miles per hour. Discuss the different types of roads and which would be the best to travel on and which they would want to avoid.

3. If time permits, groups make a preliminary decision as to where they want to bike.
Students must visit at least five sites, but they can visit more.

4. Remind them that they are going to do research the next two days to determine where they want to go.

5. Collect students' maps and itineraries to spot check that they have realistic goals and have at least five sites to visit. Make suggestions if appropriate.

Day Three: Internet Literature Search
Students use the internet and any literature the teacher can find to research what they would expect to see on their trip. You may have a list of places that they must include or leave it up to them to identify the locations.

Day Four: Plan the Trip
Students measure the mileage of the trip they have planned and break the trip up into days. Students must account for time spent site-seeing or overnight layovers at parks. Students should base their mileage on travelling about 10 mph, travelling six to eight hours a day. They may stay at campgrounds, with friends or relatives, or at hotels. Students use markers or colored pencils to mark on the map their route, layovers, and places of interest.

Day Five and Six: Finish Planning/Packing it up
Students should have their trip divided up into days; they now need to plan where they are going to stay each night and what supplies are needed. If they are going to stay in a hotel they must look up the cost of that expense. Pass out the handout of supplies. This is a mock grocery/dry goods sheet that list supplies they might need and their costs. Students must decide what they are going to take with them and how much it costs. You as the teacher can decide if funds are limited or not, however weight is limited. Students should at least keep track of money that is spent to connect to math.

Day Seven: Present to Class
Groups present to the class their trip itinerary and their supplies list. Students should explain to the class their trip, the sites they plan to visit and why they chose those sites, the mileage that they took, and the supplies they plan to take with them.

Adaptations:
Special Needs Students: Students with special needs would benefit from being placed in a group that will work well together. Large print maps or a map that has been enlarged on the photocopier might be appropriate. A classroom aide should be available if necessary to sit with students.

Gifted/Accelerated Learners: Gifted students or students who finish early could be asked to extend the project according to their interests. They might look for pictures on the internet of sites they want to visit, write a fictional log of their trip, or research animals or plants they might find on the trip.

ESL students: ESL students would need maps and literature in their language if possible, as well as having the handouts translated into their language.

Extensions:
Using topographical maps from the State Geological Survey, students could find the highest and lowest elevation on their trip, find the steepest grade they will climb or descend on their trip. This could be modelled by finding the highest and lowest point in the neighborhood around the school and then walking outside to explore the elevations.

Use Bikely or Map my Ride to obtain roadway profiles- elevations and grades of the proposed routes. How would this impact speed and distance?

Potential problems and Successes:
Students may have trouble calculating the mileage and determining how far it is realistic to travel in a day. They may also have trouble understanding the limits of what they could take with them on the trip. Successes might have students extending the problem to visiting relatives and friends they have in the area, planning long trips to encompass a long period of time, or incorporating many cities in to their trip.

What Supplies Does Your Group Need to Bring?

Use the chart below to select what you will want to take with you on your trip. Each of you may only carry 20 lbs on your bicycle rack. You must bring food, equipment to camp with if you are planning on camping, emergency supplies, personal items, and other items to help you with your trip.

Calculate the amount of weight your group can take.

Number of Bikers X 20 lbs = total weight you may take:

_____ X 20 lbs = _____

Item	Weight	Number Needed	Total Weight
Tent to sleep two (must take if you are camping)	10 lbs		
Sleeping Bag (must take if you are camp-ing	3lbs		
2 changes of clothes	3lbs		
First Aid Kit	1lb		
Water bottle filled	2lbs		
Maps	1/2lbs		
Compass	1/5lbs		
Flashlight	1/2lbs		
Personal Items	1lb		
Rain Gear	2lbs		
Emergency Supplies for 1 bicycle	1lb		
Change of shoes	1 1/2lbs		
Book to read	1/5lbs		
Bicycle helmet	1lb		
		total weight =	

Track your trip

Record your plans for your trip on this worksheet. Make sure to include full names, correct spelling, and the correct units for any numbers.

Traveling or Site Visit	Name of Site or Route Taken	Distance Traveled	Time Estimate Spent at Site or Traveling
Example: Site Visit	*Red Rocks Amphitheatre*	*Starting Point- N/A*	*2 hours*
Example: Traveling		*6 miles*	*1 hour*

Grade Level Expectation: 6-7
Short Story Lesson Plan: "Taming the Bicycle"
Content Area: Reading, Writing and Communicating

Lesson Time:
3 class periods (1 to read/discuss the story, 1 to work on writing and editing, 1 for presentations)

Materials:
None

Take Home:
None

Objective: To review Mark Twain's experience learning to ride a bicycle and write and present student's own 'how to' project. This lesson is adapted from a Short Story Lesson Plan: "Taming the Bicycle" by Marcia Fohey (http://www.marktwainmuseum.org/media/Taming%20the%20Bicycle%20Lesson%20Plan.pdf)

Background: In May of 1884, Sam Clemens (Mark Twain) and his good friend, Joe Twichell, tried to learn how to ride a bicycle. The bicycle was a new invention, and it became more difficult a task for Clemens than riding a horse, which he didn't like either. According to Clemens, it was a painful and short-lived experience. This essay was 3,400 words long, and he was not happy with it, so it was not published until after his death.

6th Grade Standards:
1. Oral Expression and listening
   1. Successful group discussions require planning and participation by all
2. Reading for All Purposes
   1. Understanding the meaning within different types of literature depends on properly analysing literary components
   3. Word meanings are determined by how they are designed and they are used in context
3. Writing and Composition
   1. Writing literary genres for intended audiences and purposes requires ideas, organization, and voice
   3. Specific editing for grammar, usage, mechanics, and clarity gives writing its precision and legitimacy.

7th Grade Standard:
2. Reading for All Purposes
   1. Literary elements, characteristics, and ideas are interrelated and guide the comprehension of literary and fictional texts.

Web resource:
http://www.bicyclinglife.com/HowTo/TamingTheBicycle.htm

Introduction:
What is the hardest thing you have learned how to do? Facilitate discussion about what is hard for some people may be easy for others, etc.

Explain background of the story. Discuss how the bicycle was a new invention and that Twain was always very interested in anything new. Show pictures of Twain and Twichell, early bicycles, etc. Discuss how early bicycles were not as easy to ride as today's. Ask students if they remember learning how to ride a bike. Ask students what they have tried to master (e.g., X-Box, iPod, etc.). Ask if they would be able to write instructions for

one of these inventions so that someone else could learn successfully.

Read the story aloud. Students can follow along with their own copy or simply listen. Invite them to sketch an image of an event from the story as they listen.

Question/discussion:

- What is the point of view?
- What are the behaviors and motives of characters in the story?
- How did Twain compare the German language to riding a bicycle? (Teachers: Here would be a good place to discuss the challengesTwain often described in learning a foreign language.)
- What is Pond's Extract? What was its use in the story?
- How does the bicycle today differ from the bicycle of Twain's day?
- What does the author mean when he says that what was required was "against nature?"
- Why does Twain feel that you cannot learn to ride without a teacher?
- Do you prefer having someone teach you a new skill or would you rather figure it out for yourself?
- Have you ever had someone make fun of you because you could not learn something right away? How did you feel?
- Was this story funny or serious? Could it be both? Why or why not?
- How does this story resemble Twain's lifelong struggles? (Teachers: You may need to provide more background here.)
- Was the "Expert" really an expert on bicycles?
- How does the main character feel throughout the story? Give three evidences.
- Where was the author being ironic?

Listen and respond

- Did you identify with any of the characters? Which one, and why?
- Have you ever tried to teach someone a skill and they just couldn't "get it?" How did you feel?

- How is the word "taming" used in the title? Have you ever "tamed" anything besides an animal?

- How did you feel about the ending?

Read the following quote from Helen Hayes, First Lady of American Theater. She was asked prior to her death at age 92 if she had any regrets. Her answer was, "I regret that I never rode a bicycle. I wish I had. That's all." Ask students if there is one thing they would most like to learn at some point in their lives. If there is time, ask them how they feel about learning to drive a car, which will occur in their near future.

Review photos of Twain, Twichell, and an old bicycle. Compare to photos of Lance Armstrong, motorcycles, etc.

Closure: Have students do a quick summarization of the story. Discuss content objectives and assessment options. Assign homework (students will select an option from the list below, write a draft, and bring it in the next day for peer review and editing).

Options for student essays:

- Write an essay or story describing the hardest (or funniest) thing you ever learned.

- Rewrite Twain's essay from another character's perspective (the dog's, for instance).

- Rewrite Twain's essay from the bicycle's perspective.

- Create a cartoon/comic strip depicting Mark Twain and his bicycle experience.

- Write an essay or story describing how hard it is to teach someone something.

- Create a visual story (e.g., PowerPoint, poster, Sunday-style comic, etc.) that depicts the humorous challenges of learning something new.

- Create a news-broadcast about an unlikely character learning an unlikely skill (e.g., Rosalyn Carter learning to ride a Harley-Davidson, Arnold Schwarzenegger learning ballet, etc.).

- Compile a scrapbook (include captions) depicting the hardest or funniest thing you ever learned.

- Write a song or rap describing the hardest (or funniest) thing you ever

learned.

- Students can suggest an appropriate project.
  Other related activities:
- Create a scrapbook of bicycle advertisements from the past as well as today.
- Take a virtual tour of the Bicycle Museum at http://www.bicyclemuseum.com or do a Google search for other bicycle museums.
- Write a "how to" paper on a topic and include criteria.
- Research the history of the bicycle.
- Research the history of motorcycles.
- Research other inventions that were introduced during Twain's life (e.g., telephone, linotype, etc.).
- Field trip to related sites (e.g., Twain exhibits, bicycle manufacturer, etc.).
- Organize a class bike ride to support a worthy cause (e.g., Lance Armstrong "Live Strong" program, make bracelets, etc.).
- Locate and read other stories involving bicycles.
- Examine Leonardo da Vinci's bicycle sketches.

Grade Level Expectation: 6-8
The Bicycle as a System
Content Area: Science; Reading, Writing and Communicating

Lesson Time:
1-2 class periods

Materials:
1.Internet access. Cycle of Heroes article on the Franklin Institute website http://www.fi.edu/learn/sci-tech/bicycle-heroes/bicycle-heroes.php?cts=recreation

2. *The Science of Cycling* http://www.exploratorium.edu/cycling/index.html

3..The Bicycle as a System - student sheet (at end of lesson)

4. A Bicycle (or picure of a bicycle) - so students can point to the various subsystems and parts when describing its properties

Objective:
To explore the nature of systems by examining the systems that make a bicycle work. Students will begin to understand how the different systems of a bicycle relate to each other and be able to identify the properties of each part or subsystem. This lesson is adapted from "The Bicycle as a System" from the American Association for the Advancement of Science.

7th Grade Standards:
Content Area:Reading, Writing and Communicating
1. Oral Expression and Listening
   1. Small and large group discussions rely on actuve listening and the effective contributions of all participants.

Background:
This lesson gives students an opportunity to examine the nature of systems in the context of an object with which they are very familiar - the bicycle. While this lesson is intended for grades 6-8, it presents concepts that are more appropriate for 7th and 8th grade students.

The main goal of having students learn about systems is not to have them talk about systems in abstract terms, but to enhance their ability (and inclination) to identify the various aspects of systems in attempting to understand the whole system. Examining systems is really a way of thinking that will supplement thinking about theories or making discoveries.

Students will identify the properties of the various subsystems of a bicycle and examine how they relate to the whole. According to research: "Children tend to think of the properties of a system as belonging to individual parts of it rather than as arising from the interaction of the parts. A system property that arises from interaction of parts is therefore a difficult idea." (Benchmarks for Science Literacy, p. 26211.)

Students should already know that if something consists of many parts, the parts usually influence one another. Also they should be aware that something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected. It is important to establish the boundary of the system to include enough parts so that their relationship to one another makes sense. Drawing the boundary of a system well can make the difference between understanding and not understanding what is going on. Thinking of everything within some boundary as being a system suggests the need to look for certain kinds of influence and behavior. For example, students should consider a system's inputs and outputs - the outputs of some parts being inputs for others.

Systems are not mutually exclusive. Systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the other. Any part of a system may itself be considered

as a system-a subsystem - with its own internal parts and interactions. Any system is likely to be part of a larger system that it influences and that influences it. The idea of a system should be expanded to include connections among systems.
Students will also learn about the choices and constraints that go into the design of a bicycle system. Depending on whether the bicycle is intended for racing, mountain roads, or touring, influences its design and such choices as the type of tires, frame and materials, and drives and gears. In addition, accommodating one constraint can often lead to conflict with others. For example, the lightest material may not be the strongest, or the most efficient shape may not be the safest or the most aesthetically pleasing. Therefore, every design problem lends itself to many alternative solutions, depending on what values people place on the various constraints.

Procedure:
Before reading the article Cycle of Heroes, on the Franklin Institute website, discuss with students their personal experience and knowledge of bicycles.

Ask students:
- Describe the qualities of your own bicycle.
- What do you like about your bicycle?
- Describe how a bicycle works.
- Has your bicycle ever broken? What part broke? Were you able to repair it?

Distribute the article *Bicycle Heroes* or have students read it online.
URL: http://www.fi.edu/learn/sci-tech/bicycle-heroes/bicycle-heroes.php?cts=recreation

The article describes one of the earliest bicycles, how it worked, and the design changes that improved its use. It also discusses the early bicycle clubs, as well as the first bicycle racers who became stars and who helped to popularize the sport. In addition, the article has several photographs of these early bicycles.

After reviewing the article, ask students:
- How do the early bicycles differ from bicycles made today?
- What accounted for the popularity of bicycles when they were first invented in the late 1800s?
- What accounts for the popularity of bicycles today?
- Identify the various parts of the bicycle.
- What does each part do? Describe some of the properties of these parts.

What is the purpose of a bicycle system?

Finally, ask students:

- In your opinion, list in order of importance the following bicycle characteristics: speed, safety, comfort, durability. Explain your choice.
- How might a bicycle's design differ depending on which characteristic is more important?
- Is it possible to accommodate all four characteristics in designing a bicycle?

Procedure:

Divide students into six groups. Explain to the groups that they will conduct an Internet exploration to understand more about the parts of a bicycle and how bicycle systems work. Have students review *Science of Cycling* on The Exploratorium website (http://www.exploratorium.edu/cycling/index.html). Ask each group to select one subsystem to explore. The groups of students should review their section and describe the subsystem and the parts that make a bicycle work.

The subsystems are:

- The Wheel
- Drivers & Gears
- Frames & Materials
- Brakes & Steering
- Aerodynamics
- Human Power

Note: The Introduction section discusses the people who were interviewed and provided information for the website. It is not necessary for students to read the Introduction to understand the lesson.

Distribute the student sheet entitled The Bicycle as a System13. As students read about each subsystem, they should use their worksheet to list the parts of the subsystem, define the properties it has on its own, and how it works with the whole system. To answer the questions, students may need to use their knowledge about the other bicycle subsystems that are described on the site. Ask the students to present their findings to the class. At appropriate times during the presentations, lead the discussion to help the rest of the class process the information.

Ask such questions as:
What is the boundary of the bicycle system? (For the purpose of this lesson, it includes all the bicycle's subsystems, as well as the person riding the bicycle.)

How is the bicycle system related to other larger systems? (It can be related to road, air currents, and weather systems.)

The seat is one part of the bicycle. Use three different words or phrases that describe the seat.

Do any of these words or phrases also describe the whole bicycle? (Possible answers include: soft, hard, smooth, narrow, uncomfortable. These could also describe the bicycle as a whole.)

What parts of the bicycle must work together if you want to ride around a corner? (Wheels, frame, steering, and human power all work together to ride the bicycle around a corner.)

How would the functioning of the bicycle change if one part or subsystem wears out? (The bicycle would be more difficult or impossible to ride.)

What about riding the bicycle- How are you part of the system?

Assessment

Assess students' understanding based on how well they have answered the questions about the bicycle as a system. Students should demonstrate an understanding that all the subsystems need to work together for the bicycle to function.

Students should be able to identify approximately six parts for each subsystem they explored, including each part's function, as well as the input and output for the subsystem. Students should acknowledge that all bicycles have similar subsystems and it is possible to place the same part from one bicycle in another bicycle. Variations to the bicycle, in terms of materials or the arrangement of parts, may affect the bicycle's speed, safety, comfort, or durability. It is even possible that the variations would cause the bicycle not to function.

The Bicycle as a System
Student Sheet

Name:_____ Date:_____

Review the information from the **The Science of Cycling** http://www.exploratorium.edu/cycling/, on The Exploratorium website. Apply your knowledge of systems to answer the questions below and then be prepared to present your answers to the class.

Also, use this worksheet to take notes as the other groups present their answers.

1. Describe the subsystem that your group researched. What is its function within the bicycle system?

2. Complete the table to indicate how the subsystem affects the bicycle's speed, safety, comfort, and durability.

	Speed	Safety	Comfort	Durability
The Wheel				
Drivers and Gears				
Frames & Materials				
Brakes & Steering				
Aerodynamics				
Human Power				

3. Complete the table below to identify the following:
    - Name the parts of the bicycle's subsystem. If you don't know the name of a part, make up a name.
    - Tell what function each part has and how it contributes to the subsystem.
    - For the bicycle subsystem to work, what input must it receive?
    - What, if any output does the subsystem produce?

	Parts	Function	Input	Output
The Wheel				
Drivers and Gears				
Frames & Materials				
Brakes & Steering				
Aerodynamics				
Human Power				

4. Could any part of this bicycle be made of a different material and still help the bicycle carry out its function?

5. Can any one part of the bicycle carry out the job of the whole bicycle? Explain your answer.

6. Can you take a part from another bicycle and use it to replace a part in this bicycle and still have the bicycle carry out its function?

7. Could some parts of the bicycle be arranged differently so that the system will still carry out its function? Explain your answer.

8. Does the bicycle require symmetry among any of its parts? If so, describe the symmetry.

9. What will happen to the bicycle if one part, such as a spoke, breaks? What if all the spokes on a wheel break?

10. Is it useful to think of a bicycle as a system? Justify your answer.

The Bicycle as a System
Student Sheet

Name:_____ Date:_____

Review the information from the **The Science of Cycling** http://www.exploratorium.edu/cycling/, on The Exploratorium website. Apply your knowledge of systems to answer the questions below and then be prepared to present your answers to the class.

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10. Is it useful to think of a bicycle as a system? Justify your answer.

Grade Level Expectation: 5-8
Gears and Proportions
Content Area: Mathematics

Lesson time:
1 hour

Materials:
1. Gearing Up handout (at end of this lesson)

2. Assessment: Level A (at end of this lesson)

3. Assessment: Level B (at end of this lesson)

4. Answer Key (at end of this lesson)

Video resource:
Bianca gets in gear
http://www.teachersdomain.org/resource/vtl07.math.number.rat.

Objective: To teach students how bicycle gears work and the relationships between the sizes of front and rear gears, gear ratios and relative speeds of the bicycle wheels. Students later list gear combinations and ratios for bicycles of different speeds. Adapted from Teachers' Domain: Gears and Proportions.

5th Grade Standard:
1. Patterns, Functions, and Algebraic Structures
   3. Number patterns are based on operations and relationships

6th Grade Standard:
1. Number, Sense, Properties and Operations
   3. Quantities can be expressed and compared using ratios and rates

Part I: Learning Activity
1. Read the following to your students: "Have you ever ridden a bicycle with multiple gears? In this activity, you will consider how mathematics can help us understand how gears work. In a Cyberchase video segment, Bianca buys a fast new bicycle to keep up with her friend Kelly when they go riding in the park."

2. Ask if any of the students can explain what happens when they change gears during a bike ride. Ask them to discuss whether a geared bike is easier to ride than a bike with no gears.

3. Play the *Bianca Gets in Gear* QuickTime Video. Tell students to watch as Bianca visits the bike shop and to pay attention to the shop owner's explanation of gears.

4. Distribute the Gearing Up handout.

5. Ask the students to complete the handout. (Note: This activity will be enhanced if your students can examine a geared bicycle directly. We suggest that the class go out to the bike rack and look at a geared bike. If any of the students has a bicycle at school, perhaps a student could bring a bicycle into the classroom so students can examine the gears, gearshifters and derailleurs, and how they work.)

6. Discuss with students the relationships between the front and rear gears and how mathematics is involved in the motion of the bicycle gears.

Part II: Assessment
From a set of gear combinations and gear ratios, ask students to identify high and low gear ratio valuesa and to determine what it means to compare gear ratios. Alternatively aks students to list gear combinations for a 12-speed bike and to rank the gear ratios in terms of relative speeds per pedal turn.

vital
video in teaching and learning

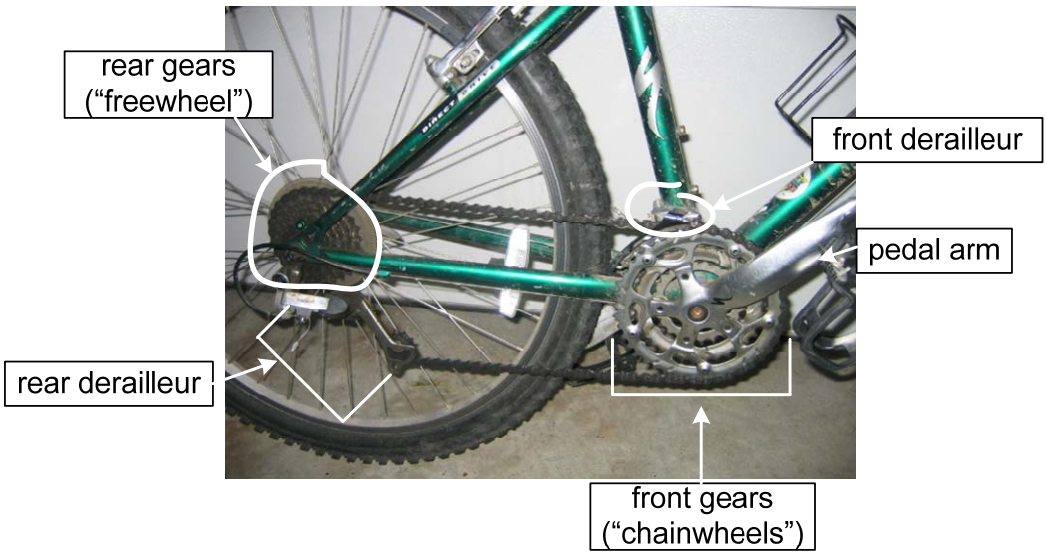
Name: _____
Date: _____

"Gearing Up" Handout

Bicycles have a bewildering assortment of gears on them. But what are all those gears for? Let's explore how the gears on a bike work.

Part 1

The pictures below show you some of the basic parts of a bicycle. There are two places on a bike where gears can be found. The front gears (also called the "chainwheels") are attached to the pedal arms (which hold the pedals out at their ends). Then there are gears attached to the rear wheel's hub. All the rear gears are contained in a cluster of gears on a "freewheel," which only turns the rear wheel when you pedal forward. It is "free" of the wheel if you pedal backwards. The two sets of gears are connected by the bicycle's chain. All the gear teeth are the same size. Why must this be the case?



The gear shifts on bikes can be on the handlebars, or mounted on the bicycle frame:

Left gear shift, for front gears. Note that on this bike, there are three marked positions (3 front gears)

Right gear shift, for rear gears Note that on this bike there are 7 marked positions (7 rear gears)

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The left shifter controls the front derailleur, for the front gears, or chainwheels. The right shifter controls the rear derailleur, for the rear gears, or freewheel.

The derailleurs, as their name suggest, "de-rail" the chain from one gear to the next, by pushing the chain to the left or the right.

From your own experience, and the pictures, answer the following questions.

1. Each time a pedal goes all the way around, which gearset--the front or the rear--goes around once?

2. When the rear wheel goes around once, which gear set--the front or the rear--goes around once?

3. If a bicycle has 2 gears in the front, and 5 in the rear, how many different combinations of gears are possible? Justify your answer.

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For each of the remaining problems, assume that the bicycle has 2 gears in the front, one of which has 30 teeth and the other 24. The bicycle also has 5 gears in the back, with 8, 12, 16, 20, and 24 teeth.

4. Now list all the pairs of possible combinations of gears in the following format: (# teeth on the front gear, # teeth on the rear gear). For instance, one combination would be (30,12), indicating the 30-tooth front gear connected by the chain to the 12-tooth rear gear. Enter the values in the table below. The first example is entered already.

Number of teeth in front gear	Number of teeth in rear gear	Gear combination
30	12	(30,12)

Now that we have all the combinations of gears on our bicycle, we will learn how to interpret how the ratio of the gears affects the action of the bicycle.

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5. If a front gear had 24 teeth, and a rear gear has 12 teeth:

    a. Each time the pedal goes around once, how many times does the rear gear (and wheel) go around?

    b. If the pedal goes around twice, how many times will the rear wheel go around?

    c. If the pedal goes around 4 times, how many times will the rear wheel go around?

We say that the ratio of the number of teeth in the front gear, to the number of teeth in the rear gear, is equal to 24:12. When we put this ratio in simplest terms, we call it the "gear ratio." Therefore, this 24:12 ratio represents a gear ratio of 2:1.

When the bike shop owner told Bianca about a speed gear, he was referring to gear ratios that cause the wheel to go around more times per pedal revolution. High performance bikes can have chainwheel-freewheel combinations that include gear ratios of up to 5 or more.

6. If the chain is on the 24 tooth front gear, and on the 8-tooth rear gear:

    a. What is the gear ratio?

    b. How many times does the rear wheel go around when the pedal goes around once?

    c. Will this combination result in a higher speed than the 2:1 gear ratio? Justify your answer.

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7. Complete the table below with the gear combinations for the bicycle that has two gears in the front, one of which has 30 teeth and the other 24. And five gears in the back have 8, 12, 16, 20, and 24 teeth.

# teeth in front gear	# teeth in rear gear	ratio of # front teeth: # rear teeth	(gear ratio)	# turns of wheel for each turn of pedal
24	8	24:8	3:1	3
24	12	24:12	2:1	2
24				
24				
24				
30				
30				
30				
30				
30				

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"Gears and Proportions"
Assessment Level B

A manufacturer has created a new trail bike with 2 front gears (56 and 42 teeth), and rear gears of 14, 21, 28, 35, 42, and 56 teeth.

1. How many gear combinations are possible for this new bicycle? Justify your answer.

2. Complete the first four columns of the table below for all the possible gear combinations.

# Teeth in Front Gear	# Teeth in Rear Gear	Ratio of # Front teeth to # Rear teeth	Gear Ratio	Speed Ranking (use 1 for lowest speed)

3. Identify gear combinations that have the same gear ratio.

4. Now, in the final column on the right, rank the gear combinations, with 1 being the **lowest** speed gear combination. The higher the rank number, the higher the speed. Gear ratios that tie should get the same rank.

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"Gears and Proportions"
Assessment Level A

The table below represents all the possible combinations of front and rear gears for the 10-speed bike from Handout 1.

# teeth in front gear	# teeth in rear gear	ratio of # front teeth: # rear teeth	(gear ratio)	# turns of wheel for each turn of pedal
24	24	24:24	1:1	1
24	20	24:20	6:5	1.2
24	16	24:16	3:2	1.5
24	12	24:12	2:1	2
24	8	24:8	3:1	3
30	24	30:24	5:4	1.2
30	20	30:20	3:2	1.5
30	16	30:16	15:8	1.875
30	12	30:12	5:2	2.5
30	8	30:8	15:4	3.75

1. What is the highest gear ratio in the table?

2. What is the lowest gear ratio in the table?

3. Identify two gear combinations that have the same gear ratio.

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"Gears and Proportions"
Assessment Level A, page 2

4. What does it mean for a gear ratio to be 1:1, in terms of the turns of pedal and turns of the wheels?

5. What does it mean for one gear ratio to be "higher" than another, in terms of the turns of the pedal and turns of the wheels?

6. What does it mean for one gear ratio to be "higher" than another, in terms of the effort you must expend or the speed you can go?

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"Gears and Proportions"
Answer Key

Handout 1: "Gearing Up"

1. The front gearset goes around once.

2. The rear gearset.

3. There are 10 gear combinations. The first gear in front can go with the 5 gears in the back for 5 plus the second gear in front can go with the 5 gears in the back for an additional five. Students may also use a tree diagram to justify their answer.

4.

Number of teeth in front gear	Number of teeth in rear gear	Gear combination
30	12	(30,12)
30	8	(30, 8)
30	16	(30, 16)
30	20	(30, 20)
30	24	(30, 24)
24	8	(24, 8)
24	12	(24, 12)
24	16	(24, 16)
24	20	(24, 20)
24	24	(24, 24)

5. (a) 2 times.

   (b) 4 times

   (c) 8 times

6. (a) 24:8 = 3:1

   (b) 3 times

(c) It is more of a speed ratio because on a 2:1 gear ratio the rear wheel only goes around twice when the pedal goes around once.

7.

# teeth in front gear	# teeth in rear gear	ratio of # front teeth: # rear teeth	(gear ratio)	# turns of wheel for each turn of pedal
24	8	24:8	3:1	3
24	12	24:12	2:1	2
24	16	24:16	3:2	1.5 (3/2)
24	20	24:20	6:5	1.2 (6/5)
24	24	24:24	1:1	1
30	8	30:8	15:4	3.75 (15/4)
30	12	30:12	5:2	2.5 (5/2)
30	16	30:16	15:8	1.875 (15/8)
30	20	30:20	3:2	1.5 (3/2)
30	24	30:24	5:4	1.25 (5/4)

Assessment Level A

1. 15:4

2. 1.1

3. 6:5 ratio exists when there are 24 front teeth and 20 rear teeth and also when there are 30 front teeth and 24 rear teeth.

   And 3:2, with 24:16 and 30:20 tooth combinations

4. Every time the pedal goes around once, the rear wheel goes around once.

5. The rear wheel turns more times per pedal stroke when the gear ratio is higher.

6. You must expend more effort when the gear ratio is higher but you travel much faster because the rear wheel is turning more times per pedal stroke. You would use a higher gear ratio on flat land, or going downhill where you want to race and where the pedaling is easier. You would not want to use a higher gear ratio when biking uphill because that would expend too much energy.

Assessment Level B

1. There are 12 gear combinations. The first front gear can match with the 6 rear gears for 6 combinations and the second front gear can match with the 6 rear gears for another 6 combinations for a total of 12 combinations. Students may also use a tree diagram to justify their answer.
2.

# teeth in front gear	# teeth in rear gear	Ratio of Front teeth to Rear teeth	Gear Ratio	Speed rank (1 is lowest)
56	14	56:14	4:1	10
56	21	56:21	8:3	8
56	28	56:28	2:1	7 (tie)
56	35	56:35	8:5	6
56	42	56:42	4:3	4
56	56	56:56	1:1	2 (tie)
42	14	42:14	3:1	9
42	21	42:21	2:1	7 (tie)
42	28	42:28	3:2	5
42	35	42:35	6:5	3
42	42	42:42	1:1	2 (tie)
42	56	42:56	3:4	1

3. 56:28 and 42:21 (2:1)
   56:56 and 42:42 (1:1)

4. See table above. Remember that the ratios are ranked from lowest to highest, (1 to 10, with two ties).

Grade Level Expectation: 6-8
The Bicycle as Art
Content Area: Visual Arts

Lesson Time:
1 class period

Materials:
1. Pictures of Picasso's "Head of a Bull" and Duchamp's "Bicycle Wheel"

Take home:
None

Objectives:
To have students analyze two famous works of art which were later copied by the original artist.

6th Grade Standards:
1: Observe and Learn to Comprehend
3. Specific art vocabulary is used to describe, analyze, and interpret works of art

7th Grade Standards:
1: Observe and Learn to Comprehend
2. Understanding works of art involves knowledge of historical and cultural styles, genre, and artists over time.
3. Knowledge of art vocabulary is important when critically analyzing works of art

2: Envision and Critique to Reflect
2. Concepts, issues, and themes in the visual arts can be used to communicate ideas in various other disciplines

8th Grade
1: Observe and Learn to Comprehend
1. Conceptual art theories explain how works of art are created

Background:
Picasso's "Head of a Bull" (1942) sculpture is one of his most recognizable works. In it, he took two found objects, the handlebars and the saddle from a bicycle, and created a striking and memorable sculpture. Picasso later had this work cast in bronze (1943).

Marcel Duchamp is another artist who used bicycle parts to create a sculpture. In 1913 Duchamp took the fork and front wheel of a bicycle and mounted them upside down on top of a kitchen stool. Duchamp did not originally construct "Bicycle Wheel" as a work of art. Rather it was just a distraction for his workshop and he claimed he never intended to show it as a piece of art. In fact the original was lost, and the first "Bicycle Wheel" shown in a gallery was a replica.

Objective: Discuss the concepts of symmetry, balance, scale, proportion and rhythm with respect to these two works of art.

Each of these works was later copied in some form by the original artist. In addition, "Bicycle Wheel" was not originally created as a work of art by Duchamp. Discuss the concepts of integrity, authenticity, and originality with respect to these works.

Vocabulary: symmetry, balance, rhythm, scale, proportion, integrity, authenticity

Setup
Display photos of the Picasso's "Head of a Bull" and Duchamp's "Bicycle Wheel"

Procedure:
Discuss with the students the original creation and subsequent creation of replicas or recasting of the original works. In the case of "Bicycle Wheel" it should be noted that the artist did not intend it as a work to be displayed but rather a distraction for his studio; he considered watching the turning wheel to be much like watching a fireplace.

How can art be a distraction - a positive one for you?
When/how do you feel in balance?

Activity 1: Ask the students to discuss the vocabulary terms with respect to the original "Head of Bull" and "Bicycle Wheel."

How does the fact that "Bicycle Wheel" was originally created as a mere distraction impact the students' perception of its authenticity or integrity?

What impact does the recasting of "Head of Bull" in bronze, and the creation and showing of the replica "Bicycle Wheel," have on students' perceptions of their authenticity or integrity?

Activity 2: Have students draw examples of other creations that could be made from bicycle parts, for example a carnival Ferris wheel, a pizza, etc.

Alternative Activity: Writing Assignment

The above questions could be posed to the students for them to answer in a writing assignment.

Grade Level Expectation: 8
Transportation Efficiency
Content Area: Science

Lesson Time:
1 class period plus homework

Materials:
1. Internet access

Take home: None

Objectives:
This lesson gives students a chance to compare the energy used to get from home to school using a car, bus, bike, or by walking. It also discusses how energy is changed from one form to another.

8th Grade Standards:
2. Physical Science
   1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion.
   2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved.

Background:
- A 130 pound person burns approximately 35 calories per mile when bicycling at a moderate or light pace (12 -14 mph).
- A 130 pound person burns approximately 75 calories per mile when walking a moderately brisk pace (4 mph).
- A 130 pound person burns approximately 75 calories per hour while traveling on a bus (assumed to take 20% more calories than reading).
- A 130 pound person burns approximately 125 calories per hour while driving a car.
- A gallon of gas contains about 31,000 calories.
- A gallon of diesel fuel contains about 35,000 calories.
- Cars and light trucks average a fuel efficiency of 20.8 mpg.
- School busses have an average fuel efficiency of 7 mpg.
- The average car weighs approximately 3,500 pounds.

Internet resources:
http://www.healthstatus.com/calories_burned.html
http://www.americanschoolbuscouncil.org/index.php?page=fuel-calculator
http://www.convertunits.com/from/kilogram+calorie/to/gallon+%5BU.S.%5D+of+diesel+oil
http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm

When one compares the energy consumed moving a certain distance as a function of body weight for a variety of animals and machines, one finds that an unaided walker and does fairly well (consuming about .75 calorie per gram per kilometer), but he is not as efficient as a horse, salmon, or jet transport. With the aid of a bicycle, however, the man's energy consumption for a given distance is reduced to about a fifth (roughly .15 calorie per gram per kilometer). Therefore, apart from increasing his unaided speed by a factor of three or four, the cyclists improves his efficiency rating to No. 1 among moving creatures and machines.
- Stuart S. Wilson, Scientific American (1973)

Vocabulary: energy, calorie, Kilocalorie

Procedure:
1. Discuss the calorie as a unit of measure, the amount of energy required to raise 1 gram of water 1 degree Celsius. Note that the calories listed on food containers are actually Kilocalories (as is the value for gasoline and diesel above).

2. Ask the students how far they travel to school.

3. Have the students calculate how many calories it would take to get to school by walking, biking, taking a bus, or driving in a car. Alternatively, if a significant number of students ride bikes or walk to school, each student could calculate how many calories it takes him or her to get to school.

4. Have them adjust the number of calories based upon how many people are being transported to school. For instance if two students are being transported in a single car, each would require half the calories required for the complete trip. If a parent drops off the students and then goes home, the number of miles traveled to school should be doubled to account for the total car trip. They will need to estimate or count the number of students using a school bus.

5. Have the students determine the calories per pound needed to travel one mile by each of the modes.

6. Discuss why the calories needed to transport students varies by mode. Ask how the students feel the forces acting upon the transportation mode impact the number of calories required to travel one mile.

7. Discuss the forces that are acting on each mode. How are they different for motorists as opposed to bicyclists or pedestrians? Such forces include gravity, friction within the mechanical workings of the bike or motor vehicle, and wind resistance due to the frontal area of the person or vehicle.

8. Discuss what sorts of fuels are needed to power each mode of transportation. What sort of energy is contained in the food? What sort of conversion does it undergo to provide energy to the mode of transport? What impacts how much of the food energy is translated directly into transport energy? Where does the rest of the energy go?

Activity: Graphing Assignment

Several presentation projects could be used to supplement this project. Some examples include the following:

- Prepare a chart showing the distance that could be traveled using different travel modes with the calories provided from various common foods.
- Prepare a chart showing the relative efficiency (energy used per mile traveled) for each mode.

- Prepare a chart showing how much time one would have to spend travelling to use the calories in a common fast food product: number of minutes would someone have to walk, bike, drive, or ride a bus.