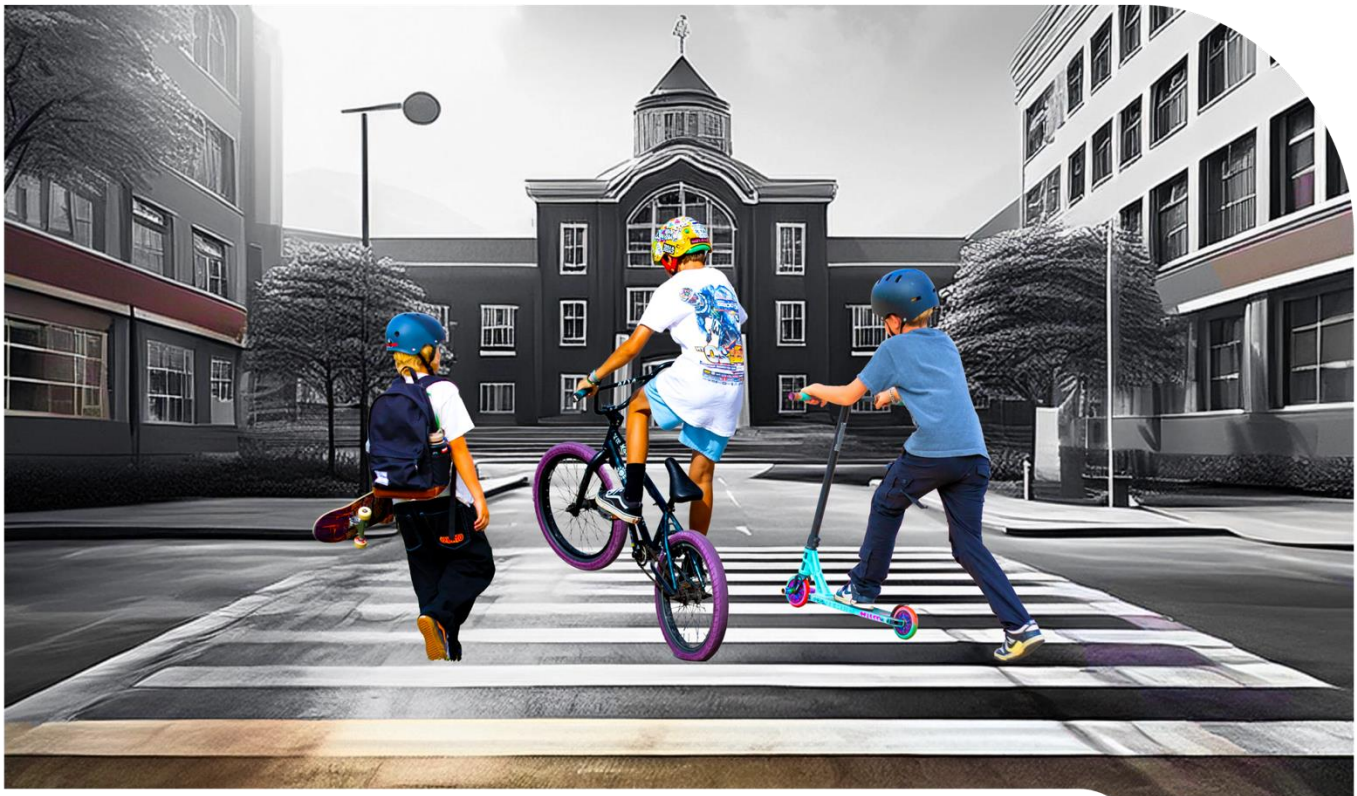
Colorado Safe Routes to School

Futures in motion



Core Subject Lesson Plans

Kindergarten through 8th Grade

COLORADO
Department of Transportation

Colorado Safe Routes to School
codot.gov/programs/bikeped/safe-routes

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Introduction

As recently as 1969 about half the school aged children in the United States walked or bicycled to school. Today 11% of school children walk or bike to school. Parents driving their children to school are responsible for 20- 30% of morning traffic. According to Children's Mercy Kansas City, "The 2024 U.S. Report Card on Physical Activity for Children and Youth reveals a continued low level of physical activity, with an overall grade of D- for children and youth. The 2024 United States Report Card on Physical Activity is the latest assessment of physical activity levels among children and youth in the U.S. It highlights significant concerns regarding the physical activity habits of young people, showing that only 20% to 28% of children aged 6 to 17 meet the recommended 60 minutes of daily physical activity." Most children living within a 1/2 mile of schools are driven in private vehicles. Obesity 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 United States, not to mention the lifestyles of our children. In response to these challenges and 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 include:

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

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

Relationship to Colorado State Academic Standards

Each lesson satisfies at least one Colorado Academic Standard content area; some satisfy more than one. In 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.

How These Lessons Are Organized

These lessons are set up in increasing order by grade level. Please see the table below for a snapshot of grade levels and subjects covered in each.

Lesson Plans by Grade and Subject

Lesson	Grades	Subjects
Blast Off with Healthy Eating	K, 1	Reading, Writing and Communicating
Ways We Get to School	K, 1, 2, 3	Social Studies; Mathematics
Walking Treasure Hunt	K, 1, 2, 3	Social Studies
Students in Motion	K, 3, 4	Science
Getting Around Your Neighborhood	K, 1, 2, 3	Social Studies
Mapping my Route to School	K, 1, 2, 3	Social Studies
Take a Breath	4, 5	Science; Mathematics; Reading, Writing and Communicating
Walk Across the Country	3, 4, 5	Social Studies; Mathematics; Physical Education
The Footprints We Leave Behind	4, 5, 6	Science; Reading, Writing and Communicating
Walking Trail Adventure	4, 5, 6	Science; Social Studies; Visual Arts
Historical Perspectives: Women's Suffrage	4, 5, 6, 7, 8	Social Studies; Reading, Writing and Communicating
Recycled Materials as Art	4, 5, 6	Visual Arts
How Walkable or Bikeable Is Your Community?	4, 5, 6	Social Studies; Reading, Writing and Communicating

Lesson	Grades	Subjects
A Bicycling We Will Go	5, 6	Social Studies; Reading, Writing and Communicating
Historical Perspective on Racial Integration in Sports	5, 6	Social Studies; Reading, Writing and Communicating
Taming the Bicycle	6, 7	Reading, Writing, and Communicating
The Bicycle as a System	6, 7, 8	Reading, Writing and Communicating
The Bicycle as Art	8	Visual Arts
Transportation Efficiency	8	Science

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. The internet is also listed as a resource for a few lessons. In instances where specific sites and pages are linked, be aware that 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

These lesson plans represent an updated version of a project originally funded by the Colorado Department of Transportation and through a Safe Routes to School Grant. This project could only have been possible with the input and feedback received from over 24 individuals from school districts and organizations throughout Colorado as part of that initial development. Their dedicated efforts are greatly appreciated. Projects are underway all over the state to incorporate Safe Routes to School initiatives, and the interest and efforts made by all those invested in Colorado Safe Routes to School make a huge difference in the quality of life of our schoolchildren.

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Note: This curriculum is intended to promote safety and awareness for all students and may be modified for individual communities. Acknowledgement to CDOT's Colorado Safe Routes to School program is appreciated.

Blast Off with Healthy Eating

Grade Level Expectation: K-2
Content Area: Comprehensive Health and Physical Education

Objectives

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.

Kindergarten Standard

Comprehensive Health Standard

2-1. Identify healthy habits for personal wellness.

First Grade Standard

Comprehensive Health Standard

2-1. Identify a variety of foods from the different food groups that are vital to promote good health.

2nd Grade Standard

Comprehensive Health Standard

2-1. Identify eating and drinking behaviors that contribute to maintaining good health.

Preparation

Lesson Time

30 minutes

Materials

- A book on variety for healthy eating. Suggested book: Eating the Alphabet: Fruits and Vegetables from A to Z by Lois Ehlert
- Chart paper
- Post-it notes, pencils, or crayons

Optional Extensions:

- Visit the My Plate website for ideas.
- Consider downloading and printing the MyPlate Friends Profile cards for sorting activity

Note: The materials included on this website may not be accessible to all. Please reach out to myplate.gov if you need modifications

Procedures and Activities

Activate: 5-10 minutes

If desired, read a book about going on a trip such as:

Pete the Cat's Family Road Trip by James Dean and Kimberly Dean

Spot's Road Trip by Eric Hill

Ask students if they have ever been on a road trip. When you go on a trip you need to make sure your car has fuel and you need to bring a lot of things with you! What did the family in the story bring?

Tell students: "I want you to imagine that we are packing food for a big trip on a rocket ship! We will make sure that our rocket has plenty of fuel, and we also want to make sure we have good things to eat to keep our bodies and brains going all day. Think about what food you would most bring. When you know what you want to bring, raise your hand and I will give you a sticky note. Draw your idea on the sticky note and put it on the poster (chart paper)."

Discuss: 5 minutes

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

- Have you ever had to go without breakfast?
- How did your body feel later 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?

Instruct: 10 minutes

Ask students if they think the food we have packed will be good fuel for our bodies. How do we know? Invite them to get up and move while learning about the 5 food groups and how they help power us up!

Play Reach for the Sky, a music and movement video from the United States Department of Agriculture (USDA). A video with audio description and other resources is also available for students and teachers.

Read a book to encourage students to enjoy a variety of foods. Emphasize as you go how enjoying a variety of foods gives us energy and nutrients to grow and learn.

Eating the Alphabet by Lois Ehlert: As you read, ask students to name some foods that begin with each letter. Add a few choices on sticky notes to the collection.

Which Food Will You Choose by Claire Potter: In this story a family makes trips to the grocery store to explore different, colorful foods. Pause after each color and invite students to choose foods they would like to try. Add a few choices on sticky notes to the collection.

Activity: Fueling Up!

Tell students it's time to pack up for the trip! Do we have all the fuel we need? Divide chart paper into sections for fruit, veggies, grains, protein, and dairy, with an additional space for drinks (hydration is important). Sort the foods they drew at throughout the lesson into the groups. Ask them to think about what we might be missing. Notice which food groups we might need more of.

Closure

Gather students in a circle to review what they have learned about the 5 food groups. Pass a beanbag or other object around the circle as you play Reach for the Sky or another song, pausing the music at random times. When the music stops, the child holding the beanbag is asked to name a food from a specific food group.

Ways We Get to School

Grade Level Expectation: K -3
Content Areas: Social Studies, Mathematics

Objectives

1. To introduce students to the concept that people in different environments use different forms of transportation.
2. To give students the experience of collecting data and displaying data in graph form.

Kindergarten Standards:

Social Studies

2-2. Identify how the environment influences the way people live.

Math

3 K.MD.B. Measurement & Data: Classify objects and count the number of objects in each category.

1st Grade Standards:

Social Studies

2-2. Describe the characteristics of a community and how they are influenced by the environment.

Math:

3-1.MD.C. Measurement & Data: Represent and interpret data.

2nd Grade Standards:

Social Studies: Civics

4-1. Investigate ways in which ideas and actions can improve communities.

Math

3-2.MD.D. Measurement & Data: Represent and interpret data.

3rd Grade Standards:

Social Studies

2-2. Define the concept of region through an examination of similarities and differences in places and communities.

Math

3-3.MD.B. Measurement & Data: Represent and interpret data.

Preparation

Lesson Time:

30 minutes

Materials:

- Book about the ways students go to school such as This is the Way we Go to School by Edith Baer
- Poster size paper pre-labeled with modes of transportation (see procedures)
- Post it notes, one for each student
- Graph paper or photocopies of the included chart
- Pencils or markers

Procedures and Activities

Activate: 5 minutes

Tell students: transportation means traveling from one place to another. There are many kinds of transportation, in fact everyone in this room used some kind of transportation to get to school today! We're going to think and learn more about that.

Younger students may begin with a movement activity exploring different types of transportation such as The Transportation Song by Singing Walrus. Invite them to move to represent each type.

Older students may be invited to participate in a think-pair-share activity:

1. Think of a type of transportation you know or have used. Stand up or raise your hand when you have an idea.
2. Pair up (find a partner).
3. Share your idea with your partner and listen to their idea.
4. Repeat with a new partner. You may share your idea OR your partner's idea

Discuss: 5 minutes

Ask a few students to share a type of transportation they heard in the opening activity.

We just heard about many different types of transportation, and people in different places use different methods of transportation.

Instruct: 5 minutes

Read the book *This is the Way We Go to School.* As you read, make connections to relevant Social Studies Standards.

After reading, ask a few students to recall modes of transportation from the book and ask if anyone in our class traveled to school that way. Label chart columns with relevant types of transportation (Walk, Bike, Car, Bus, and other labels as needed according to the class).

Activity: 10 minutes

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

Instruct students to place a block or a sticky note on the poster-sized chart under the heading that tells how they get to school.

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 invite any student who indicated “Other” to identify the mode of transportation used.

What can this chart/graph tell us?

Discuss the results, asking questions connecting to relevant math standards such as:

- How do the greatest number of children go to school?
- Which of these ways have you tried getting to or from school?
- Where are some places you might go using these modes of transportation?

Pass out blank graphs. Have students transfer information from the class chart to their individual blank graphs.

Closure: 5 minutes

Using an appropriate sentence frame or prompt, invite students to draw and/or write about how people go to school.

I go to school by _____.

In our class, the (greatest/least) number of people go to school by _____.

In _____ kids go to school by _____.

I would/ would not like to go to school by _____.

Prompt ideas:

What do you think is the best type of transportation?

Compare two different types of transportation. Which one do you prefer and why?

Note: The chart or graph created in this lesson will be useful in an upcoming lesson **Mapping My Route to School**

Optional extension: Utilize the website bikewalkroll.org to tally how students get to and from school.

Walking Treasure Hunt

Grade Level Expectation: K-3
Content Area: Social Studies

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.

Kindergarten Standards:

Social Studies

2-2. Identify how the environment influences the way people live.

First Grade Standards:

Social Studies

2-2. Describe the characteristics of a community and how they are influenced by the environment.

Second Grade Standards:

Social Studies

2. Describe how people of various cultures influence neighborhoods and communities over time.

3rd Grade Standards:

Social Studies

2-1. Use geographic tools to develop spatial thinking skills.

2-2. Define the concept of region through an examination of similarities and differences in places and communities.

Preparation

Lesson Time

30 minutes plus homework assignment (optional)

Materials:

- Whiteboard or chalkboard
- Markers/chalk

Setup

Design a one-page list or table of items and objects that children can look for on their way to school. Include some street signs and traffic signals as well as some 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.

Procedures and Activities

Activate: 5-10 minutes

Engage students in a game of I Spy to activate visual awareness of people or objects in the classroom. Give descriptive prompts such as “I Spy something red …something round…someone blonde…someone tall…something sharp…a trapezoid…” etc. Students look around and point to something in the room that fits the category

Discuss: 5 minutes

Ask students, “Did everyone point to the same things in the room every time? Why did we sometimes choose different things?”

When we are being observant or aware of our surroundings, we each may notice different things.

A great time to be observant is when you are walking to school, in your neighborhood or around our community. Listen to this story about a kid like you going for a walk, and think about the things they see.

Instruct: 10-15 minutes

Read aloud a book about going for a walk in a neighborhood or community. Some suggestions are:

I Went Walking by Sue Williams

On the Town: A Community Adventure by Judith Caseley

Neighborhood Walk: City by Peggy Pancella

Activity: Walking Treasure Hunt

Ask students to remember some of the things the characters in the books see as they are walking. Connect with students’ experiences with questions such as

> Would you see _____ walking in your neighborhood?
>
> Would you see _____ if you were in a car instead of walking?
>
> What do you see when you walk to school or go for a walk around your neighborhood?

Distribute the list or table the students and designate a completion date.

Signs	Animals or People	Plants	Buildings	Other

Ask students to use the list as they walk to school or in their neighborhoods. They should draw and label each item and note where they found it. They could try to keep track of street names. Alternatively, instead of 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.

Activity: Reflection/Closure 10-15 minutes (upon completion of homework assignment)

1. Discuss what they learned from the treasure hunt. Talk about what and where students saw the things on their tables.
2. 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: Students might write a story about their walk incorporating items they saw and where they saw them or compare their walk to the character in the book.

Students in Motion

Grade Level Expectation: Kindergarten, Third Grade, Fourth Grade
Content Area: Science

Objective

To understand that force is related to motion and speed.

Kindergarten Standard

Science

1-1. Pushes and pulls can have different strengths and directions and can change the speed or direction of an object's motion or start or stop it.

Third Grade Standard

Science

1-2. Objects in contact exert forces on each other; electric and magnetic forces between a pair of objects do not require contact.

Fourth Grade Standard

Science

1-1. The faster an object moves the more energy it has.

Preparation

Lesson Time

30 minutes

Materials

- Video:
    - Push and Pull (https://www.youtube.com/watch?v=2X_V2ZsCZKE)
- Optional video extension for older grades:
    - TedEd Newton's 3 Laws, with a bicycle

(Note: The videos included in the websites may not be accessible to all. Please reach out to video creators if you need modifications

- Bicycle with hand brakes for demonstration

Procedures and Activities

Activate:

Start with a game of freeze dance, asking students to follow you in moving when they hear music play and then stop or freeze when the music stops. Include a variety of movements such as jump, march, walk, jog, and slow-motion walking as you play.

Discuss:

Ask students to share what they notice about different types of movements. Are some more tiring than others? Why? Possibly create a list of the movements from least to most tiring.

Instruct:

Watch and listen to the video Push and Pull

Summarize: The idea here is that for a body or a bicycle to move, ***force*** is required. Whether jumping or marching or bicycling, our muscles generate the force which is translated into motion. Every force is a push or a pull, and every force is either balanced or unbalanced.

Discuss different movements from the freeze dance game: are these pushes or pulls? (All are pushes). If you want to move faster or jump higher or move against another force (uphill or against the wind) what will you need? More force.

Activity:

Elevate the back of the bicycle so that the pedals may turn without moving the bicycle. Ensure that the bicycle is secure. Always ensure the safety of students. Demonstrate, or have a student demonstrate, how applying force (pedaling) translates into motion of the wheel. If the student turns the pedals faster, the bike will move faster.

Finally, ask the student to pedal while the teacher or another student presses on the hand brakes. How does this change the speed of the bike? (The bike would slow down because the friction of the brakes is an opposing force).

Reflection/Closure:

What are other opposing forces that might affect you if you are walking or biking? (traveling uphill or against the wind)

Possible extension: Ask students to draw and/or write to explain why it is more difficult (requires more force from your muscles) to walk or bike uphill or into the wind.

Getting Around Your Neighborhood

This lesson may be split into 2 sessions.

Grade Level Expectation: K-3
Content Area: Social Studies

Objective

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

Kindergarten Standards

Social Studies

2-1. Recognize that geographic tools represent places and spaces.

First Grade Standards

Social Studies

2-1. Use geographic terms and tools to describe places and spaces.

2nd Grade Standards

Social Studies

2-1. Use geographic terms and tools to locate and describe spatial patterns and places.

2-2. Explain how people in communities manage, modify, and depend on their environment.

3rd Grade Standards

Social Studies

2-1. Use geographic tools to develop spatial thinking skills.

Preparation

Lesson Time

45 minutes to 1 hour

Materials

- Digital maps of local area that can be projected, or online mapping tool such as Google Maps
  Note: Maps may not be accessible to all. Please reach out to Google Maps if you need modifications.
- Whiteboard
- Dry erase markers

- Chart paper and markers
- Pencils
- Crayons or colored pencils
- Construction paper, graph paper, or large pieces of paper

Vocabulary

symbol, key, compass rose

Procedures and Activities

Activate: 5-10 minutes

Begin by entering the school address into Google Maps and project or display on the white board. Slowly zoom out and ask students to describe what they see (in satellite view it is possible to see details such as sidewalks and crosswalks). Note the features of the map and record their observations on a class chart with columns for human-built features and natural physical features.

Discussion: 5 minutes

What is the purpose of the human-built features we noticed? In a neighborhood, buildings, roads, parking lots and even parks and playgrounds are built by humans to make it a better, safer place to live. Explore how we might use some of these features, such as roads and sidewalks, in everyday life, such as when traveling to school.

Instruction: 15 minutes

On the map identify the school and 2-3 different houses and circle them on the map using dry erase markers.

1. Tell students that a child living in house A will be riding their bike to school. Work together to find which route the child should take and draw that route on the board.
2. Discuss potential hazards to the child riding their bike? (examples: no crosswalk, intersections, busy roadway, broken sidewalk, lack of sidewalk, lots of driveways, etc.)

   Are there other routes that she might take?
3. As time allows, repeat with routes from houses B and C, possibly choosing for student B to travel to a park or grocery store visible on the projected map.

Activity: Making Maps (20 minutes)

Begin by reviewing or introducing the concept of a map key and compass rose as elements that help us to use the map for planning travel.

Distribute paper of choice and other materials (colored pencils, crayons) and have students begin by drawing a compass rose and work together creating a key to reflect the colors seen on the map for different features (black for roads, grey for sidewalks, blue for rivers, green for open space and parks etc.).

Students will be creating neighborhood maps of their own, using the materials provided. For younger students (K,1) this activity may be more appropriate as a whole group activity, co-creating a neighborhood map on a bulletin board, chart paper, etc.

In addition to the compass rose and key on their maps to show the symbols that they used, each student's neighborhood map should include houses, a school, and other buildings or locations of the student's choice. Maps need not be representative of students' actual neighborhoods; they may design a new neighborhood or one they would like to live in.

Ask students to create their maps.

Closure: 10 minutes

Students should be invited to share and discuss the maps they created using a procedure that promotes discussion such as a pair share.

Consider using sentence starters such as

My neighborhood includes _____.

The people who live in my neighborhood can go to the **(location)** by (mode of transportation) .

It's possible to get to my neighborhood by (mode of transportation) or by (mode of transportation).

Mapping My Route to School

Grade Level Expectation: K-3
Content Area: Social Studies

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.

Kindergarten Standards

Social Studies

2-1. Recognize that geographic tools represent places and spaces.

First Grade Standards

Social Studies

2-1. Recognize that geographic tools represent places and spaces.

2nd Grade Standards

Social Studies

2-1. Use geographic terms and tools to locate and describe spatial patterns and places.

2-2. Explain how people in communities manage, modify, and depend on their environment.

3rd Grade Standards

Social Studies

2-1. Use geographic tools to develop spatial thinking skills.

Preparation

Lesson Time

30-45 minutes

Materials

- School area map, such as one found on Google Maps, ensuring that all students' home addresses can be located (1 copy per student)
- Student addresses
- Highlighters or colored pens or pencils for each student

- Setup for projecting Google Maps onto a whiteboard or similar (Note: Maps may not be accessible to all. Please reach out to Google Maps if you need modifications.)
- Chart or Graph from the **Ways We Get to School** lesson, if available

Procedures and Activities

Activate: 5- 10 minutes

Begin by entering the school address into Google Maps and project or display on the white board. Slowly zoom in and out and ask students to describe what they see (in satellite view it is possible to see details such as sidewalks and crosswalks). Identify the schools and any key areas. Review marking a route from any chosen location to the school using the projected map.

Discuss: 5 minutes

Ask students to observe key areas on this route where they will want to be especially aware of traffic, such as intersections. Also note safety features along the route such as stop signs, crosswalks, and bike paths. How would these considerations be different if traveling on foot, by bike or by car.

Instruction: 5 minutes

Remind students of the learning in **Ways We Get to School** lesson or discuss that there are many types of transportation that students and teachers may use to get to school. Refer to the graph from that lesson or create a list of ways students in the class come to school. The goal today will be for each student to map 2 personal routes to school. It is good to have more than one route because at times they may need to rely on different modes of transportation (What if the car breaks down, or the chain is off your bicycle). Having more than one route can help us to be prepared.

Activity: Mapping Personal Routes

For younger students, this may be more appropriate as a whole group activity.

Begin by reviewing or introducing the concept of a map key and compass rose as elements that help us to use the map for planning travel. As students add symbols and colors to their maps they should add them to their key.

Distribute copies of school area maps and assist students in locating their home address on the map. Instruct students to use the map provided to trace their most common route to school using a colored pen, pencil, or highlighter. Using a different color, each student will then find the best route to school using another mode of transportation. As they complete each route, ask students to label any hazardous street crossings with circles and add this symbol to the key.

Have students talk about their routes and discuss some of the reasons they chose the route they did.

Evaluation

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?

Closure

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).

Take a Breath

Grade Level Expectation: 4-5
Content Areas: Mathematics, Science, Reading, Writing and Communication

Objectives

Students will understand how air quality can affect their ability to perform certain tasks as well as their overall health. Students will be able to describe how air quality can be represented using a color and numerically based categorical system. Students will understand that factors such as driving and use of gasoline-powered equipment can impact air quality and subsequently their health.

Fourth Grade Learning Standards

Mathematics

3-4.MD.B. Measurement & Data: Represent and interpret data.

Reading, Writing and Communication

1-2. Create a plan to effectively present information both informally and formally.

3-2. Write informative/explanatory texts using text structures appropriate for the purpose and developed through facts, definitions, concrete details, precise language, and domain-specific vocabulary.

Science

3-4. Energy and fuels that humans use are derived from natural sources and their use affects the environment in multiple ways.

Fifth Grade Learning Standards

Mathematics

5.MD.B. Measurement & Data: Represent and interpret data.

Science

3-5. Societal activities have had major effects on land, ocean, atmosphere, and even outer space

Reading, Writing and Communication

1-2. Present to express an opinion, persuade, or explain/provide information.

3-1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information, for a variety of purposes and audiences.

4-1. Research to locate, summarize, synthesize, and document information from print and digital sources, and communicate findings appropriately.

Preparation

Lesson Time

1-2 class periods for activities with short periods daily for data-gathering

Materials

- Guide for Particle Pollution | AirNow.gov Note: This resource may not be accessible to all. Please reach out to AirNow.gov if you need modifications.
- Guide for Schools | AirNow.gov Note: This resource may not be accessible to all. Please reach out to AirNow.gov if you need modifications.
- Air Pollution Reading Comprehension Worksheet from https://readingduck.com. Note: This free resource may not be accessible to all. Please reach out to readingduck.com if you need modifications.

Setup

Students must have had an introduction to certain concepts in prior learning experiences. These concepts include:

- What is Air Pollution
- What are the major causes of air pollution
- How does air pollution affect our health

Procedures and Activities

Activity 1 (Used if students lack necessary background knowledge)

- Students are provided with the article *Air Pollution Reading Comprehension,* sticky notes, and chart paper. They could work in small groups (3-4 students) and read the article. They then could create sticky notes with Causes/Effects of Air pollution and create a visual summary on the chart paper. The sticky notes could include both words and pictures. Encourage students to be creative in the ways they share what they learned from the reading. Charts could be posted around the room as students continue with other activities. Students could also do a ‘museum walk’ and see each other's work.

Activity 2 (Local Air Quality)

Introduce students to the concept of air quality. Review how air quality is represented. Use the Guide for Particle Pollution from AirNow.gov and the Guide for Schools from AirNow.gov to introduce students to how both colors and numbers are used to communicate Air Quality.

Using AirNow.gov students could look up Air Quality in their local community. They could track how the Air Quality changes from day to day. It is important to check Air Quality at the same time of day each day. Students can create a line graph plotting daily Air Quality. The classroom could discuss what trends they see in their graphs and what might influence these trends.

Students could also choose 2-3 different locations and compare their Air Quality in a bar graph. Discussions could revolve about what factors in the different locations might contribute to the differences observed and how those changes could impact health and the ability to enjoy the outdoors.

Activity 3 (Writing)

Tell students that they are journalists writing for their local news source. Have them write a persuasive article in which they inform readers about local Air Quality. Students should use the data they collected in Activity 2 in their writing to inform readers. If community action is required, students should pose solutions and persuade readers of their needs based upon how air quality could be affecting health.

Walk Across the Country

Grade Level Expectation: 4-5
Content Areas: Social Studies, Mathematics

Objectives

Students learn how to chart how far they've walked by marking an equivalent distance on a map while increasing their personal fitness.

4th Grade Standards

Mathematics

4.MD.B. Measurement & Data: Represent and interpret data.

Physical Education

2-2. Analyze opportunities for participating in physical activity and actively engage in teacher-directed and independent activities.

5th Grade Standards

Social Studies

2-1. Use geographic tools and sources to research and answer questions about United States geography.

Mathematics

5.MD.B. Measurement & Data: Represent and interpret data.

Preparation

Lesson Time

Initial lesson and setup could take 30-50 minutes. The tracking of distance could be an ongoing activity throughout the year.

Materials

- US, Colorado (fp_COMAP 1.pdf), or local map, printed for classroom display
- Access to https://www.google.com/maps Note: Maps may not be accessible to all. Please reach out to Google Maps if you need modifications.

- Pins, tacks, or small colored stickers
- Meter/yard Sticks

Setup

Beforehand, choose what area and scale to have students chart based on map parameters.

Procedures and Activities

Introduction

Introduce maps to students, explaining how maps allow them to accurately chart progress on routes. Students can work as a class to create a map of their classroom that is true to scale (for example one foot of classroom length may be represented by one inch on the map). The teacher and students can have activating discussions as to why this is necessary and how this can be achieved. It is important to discuss the importance of units of measurement at this point. Once a method is established, all students can be involved in measuring and creating the map.

Activity: Work towards walking goal

Students can pick their own imaginary starting and ending points on the state or country map, or the entire class can start from the same place and try to reach the same destination.

Following the mapping activity, discuss how students can chart the distance they walk to school each day. This could be accomplished by using a fitness tracker or Google maps to look up the distance of their route. If students do not walk to school, they could be asked to walk/jog for a short set time each day or track their steps around the school building and that distance could be used. The distance will be used to chart progress daily in reaching a pre-selected destination on a map or simply to explore.

Have each student pick a starting point on the map, then draw in each day the distance they've progressed towards that destination.

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

A class could choose to attempt to walk as a group across the country, adding the total distance traveled by each student to the map.

Charting Progress of a Class Goal:

Post the group map in a prominent place in the classroom; extend thumbtacks/ yarn to show the daily progress across the local area, Colorado, or the United States.

Advertise or celebrate each day as the class ‘reaches’ a new city, town, or state.

Variations and Extensions

- Choose a content-relevant path or distance (Transcontinental Railroad, Oregon Trail, etc.) as the walking goal.
- Walk through history by letting each mile equal one year, one century or one thousand years.
- 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.

The Footprints We Leave Behind

Grade Level Expectation: 5-6
Content Areas: Science, Reading, Writing and Communicating

Objective

Students will discover what is meant by the term ecological footprint/carbon footprint and learn about how their actions affect them.

5th Grade Standards

Science

3-5. Societal activities have had major effects on land, ocean, atmosphere, and even outer space

Reading, Writing, and Communicating

1-1. Collaborate in discussions that serve various purposes and address various situations.

1-2. Present to express an opinion, persuade, or explain/provide information.

6th Grade Standards

Science

2-5. Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with non-living factors.

3-10. Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things.

3-11. Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.

Reading, Writing, and Communicating
4-1. Successful group discussion requires planning and communication

.

Preparation

Lesson Time

1 - 2 sessions

Materials

- Computer and internet access

Procedures and Activities

Discussion

Use the questions below to guide a discussion that encourages students to think about the environmental impacts of our activities.

What does the term “ecological footprint” mean?

Every living being uses resources from the ecosystem. An ecosystem is defined as a community of organisms and the environment in which they live. We define the ecological footprint as the area of the planet that is required annually to supply these requirements. 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).

The video below could also be used to support this concept:

The Carbon Footprint of a Sandwich Note: this video may not be accessible to all. Please reach out to the creator if you need modifications.

What are some things that you or your parents have changed or could change to reduce your footprints?

Answers may include recycling, buying recycled products, carpooling, buying a hybrid car, etc.…

Consider creating a class list or idea bank, using sticky notes. Students will return to this list to add ideas after the lesson before they write speeches later in the lesson.

Why do we need to “save the planet?”

Answers may include: availability of resources decreasing; climate change;loss of habitats; loss of species.

Natural resource availability decreases when they are consumed faster than ecosystems can restore them. What natural resources are currently being depleted?

Water, fossil fuels, land available for construction and agriculture, forest products, plants, and animal species.

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

Land can be restored in some instances. Likewise, water can also be restored in some cases. However, once a plant or animal is extinct, it is gone forever.

Won't science/advances in technology create a solution?

Some solutions to these problems have already been created. . For example, Hybrid vehicles and EV's could reduce use of fossil fuels. However, this is only true if electricity is created using wind, solar, tidal, or geothermal energy instead of coal or other fossil fuels. Solar panels for homes can also have positive impacts. New irrigation practices reduce demand for water. Many of our purchases and practices also can make a difference. Buying products made from recycled materials, conserving energy use in our homes, reducing use of gas-powered cars and lawn equipment, and not using pesticides in our gardens all can have positive effects.

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, increased illness resulting from air and water quality issues, loss of species, and limited availability of food and housing are potential outcomes.

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

Activities:

Jeopardy

You may use either link below to create a Jeopardy game using slides to review the concepts in this lesson. Note: This may not be accessible to all. Please reach out to jeopardylabs.com if you need modifications.

Copy of Jeopardy Game 6-Topic Template - Google Slides (https://docs.google.com/presentation/d/1IBL1TIsxsh2ygMnIiC_P5rwismckwxlqmnapZYsTF3w/edit?slide=id.p#slide=id.p)

5th Grade Ecosystems Jeopardy Jeopardy Template (https://jeopardylabs.com/play/5th-grade-ecosystems-jeopardy)

Kahoot!

You may use the link below to have students participate in a Kahoot competition on this topic. Students can compete as individuals but can also work collaboratively in small groups. You can also create your own Kahoot! A free Kahoot account is required. Note: This may not be accessible to all. Please reach out to kahoot.com if you need modifications.

Carbon footprint and actions to slow down climate change - Details - Kahoot! (https://create.kahoot.it/details/0690b266-f079-4ace-99be-a1eb8fa5732a)

Estella: The ecological footprint game

This link will provide you with access to the ecological footprint game. All materials and instructions are in the linked pdf. Note: This may not be accessible to all. Please reach out to https://projectestella-learningspace.eu/ if you need modifications.

ESTELLA_Learning-scenario_5-The-ecological-foot-print-game.pdf (https://projectestella-learningspace.eu/wp-content/uploads/2024/04/ESTELLA_Learning-scenario_5-The-ecological-foot-print-game.pdf)

Science Buddies Lesson:

Requires a free account. Note: This may not be accessible to all. Please reach out to sciencebuddies.org if you need modifications.

Sustainability: Reduce Your Environmental Impact! | Lesson Plan (https://www.sciencebuddies.org/teacher-resources/lesson-plans/sustainability-reduce-environmental-impact)

Reflection

Ask students to think about decisions they are going to make as adults which will affect their environment. Have students brainstorm and share their ideas. Their ideas could be collected and made available to the class. Students could then form small groups and work on a short speech that they would give to the United Nations asking for action to reduce Environmental/Carbon Footprints. The groups could deliver the speeches to the class.

Walking Trail Adventure

Grade Level Expectation: 4-6
Content Areas: Science, Social Studies, Visual Arts

Objective

Create a plan for a neighborhood walking trail or other public facility which improves recreational opportunities for people and supports local habitats in your community. Working in groups helps develop collaboration skills. This lesson was adapted from Crayola's Create a Trail.

4th Grade Standards

Social Studies

2-2. Examine the relationship between the physical environment and its effect on human activity.

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Visual Arts

3-1.Use media to express and communicate ideas about an issue of personal interest

5th Grade Standards

Visual Arts

3-1. Plan works of visual art and design where intended meaning is communicated to viewers.

6th Grade Standards

Science

2-5. Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with non-living factors.

.
Visual Arts

3-1. Plan the creation of a work of art utilizing feedback.

3-2. Explore various media, materials and techniques used to create works of visual art and design.

Preparation

Lesson Time

1 to 3 class periods depending on selected scope

Materials

- Art supplies: Cardboard for design bases, clay, coloring and painting supplies, glue, toothpicks, construction paper, and any other miscellaneous items that can be used in creating various design representations.

Procedures and Activities

Activity: Planning

Work with a small group of classmates to design a recreational area in your community—you can choose either a real scenario (based on your actual community and available land and resources) or choose an unlimited imaginary location with elements that you choose. Think about what facilities the recreational area might include: Walking trail? Fishpond? Restrooms? Potable Water? Climbing Rock? Sunflower patch to attract birds? Pollinator gardens? Basketball court? Boat launch? Stage? Skateboard Park? Ask classmates, family members, and others in your community to make suggestions.

Sketch ideas. Determine how much space your Facility and Trails will require. Recommend where it could be constructed. Google maps could be used to view the area and determine possibilities. Note: Google Maps may not be accessible to all. Please reach out to googlemaps.com if you need modifications.

Activity: Design

Have student groups work together to create models of their plans.

Start with a flat base of stiff cardboard. Use colored paper or clay to distinguish different parts of your facility such as the trails, ponds, gardens, playgrounds etc. For example, press blue clay into a pond shape or cut out a pond ‘shape’ from blue construction paper. Cut out a shape that represents a playground. You could also print images from the internet. You can add models of some of the structures and make the model 3D.

Label areas with paper signs. Attach signs to toothpicks with glue. You could also add labels indicating what types of plants and animals will be supported in the space you are designing. Include names of trees and flowers you might plant. Compare and contrast your group’s plan with others. Consider presenting the most feasible plan to decision makers in your community.

As students are working, evaluate how thoroughly they research the need for recreational spaces. Do they apply what they learned in their model? Is the plan realistic? How well do students work together? Was the choice for a plan to present well reasoned?

Extensions

- 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.
- Have students identify local needs for recreational spaces by interviewing diverse classmates, families, and community members?
- Compare and contrast their plans to select one for presentation to decision makers for action.

Historical Perspectives: Women's Suffrage

Grade Level Expectation: 4-8
Content Area: Social Studies

Objective

This lesson gives students the opportunity to analyze a historical source for accuracy.

4th Grade Standards

1. Write opinion pieces on topics or texts supporting a point of view with reasons and information. (CCSS: W.4.1)

5th Grade Standards

Social Studies

1-1. Analyze primary and secondary sources from multiple points of view to develop an understanding of early United States history.

Reading, Writing and Communicating

1-2. Present to express an opinion, persuade, or explain/provide information.

6th Grade Standards

Social Studies

1-1. Analyze and interpret primary and secondary sources to ask and research historical questions about the Western Hemisphere (including North America, South America, Central America, and the islands of the Caribbean).

Reading, Writing and Communicating

1-2. Develop, organize, and present ideas and opinions effectively.

7th Grade Standards

Social Studies

1-1. Analyze and interpret a variety of primary and secondary sources from multiple perspectives in the Eastern Hemisphere to formulate an appropriate thesis supported by relevant evidence.

8th Grade Standards

Social Studies

4-1. Construct an understanding of the changing definition of citizenship and the expansion of rights of citizens in the United States.

Preparation

Lesson Time

30 minutes plus optional homework assignment

Materials

- Internet connection
- Womens-suffrage-grade-8.pdf (https://www.unco.edu/hewit/educators-conference/pdf/lesson-plans/voting-in-america/womens-suffrage-grade-8.pdf) To provide background knowledge, alternate activities, and extensions, this is an excellent, complete lesson plan targeting 8th graders which can easily be adapted to target standards in grades 4-7 as well. This plan was developed by the University of Northern Colorado. Note: This may not be accessible to all. Please reach out to the University of Northern Colorado if you need modifications.

Procedures

Discussion

Introduce women's suffrage pioneer Susan B. Anthony to the students, incorporating the following quotes, asking them to reflect and relate:

"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."

Writing Assignment

Ask the students to write a short essay supporting or taking a contrary position to one of the statements by Susan B. Anthony with at least three supporting points.

When students have finished writing, invite them to share their work and opinions.

Optional extensions

Implement all or portions of the women’s suffrage lesson linked in materials.

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

Recycled Materials as Art

Grade Level Expectation: 4-6
Content Area: Visual Arts

Objective

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

4th Grade Standard

Visual Arts

3-1.Use media to express and communicate ideas about an issue of personal interest

5th Grade Standard

Visual Arts

1-1. Investigate and analyze how specific points of view can be communicated through the language of visual art and design.

6th Grade Standard

Visual Arts

4-3. Investigate how art addresses contemporary issues and community and societal concerns.

Preparation

Lesson Time

2 class periods

Materials

- Pictures of art made from recycled bicycles (many are available online; consider searching works by the artists shared in the discussion to project on a whiteboard)

Procedures and Activities

Discussion

Share the background on the artists below, sharing online images or other related examples if available:

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.

View the image at this link:

18470e1f6a9473b52082f0da75dd9456.jpg (700×519) or search this web address: https://i.pinimg.com/originals/18/47/0e/18470e1f6a9473b52082f0da75dd9456.jpg

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.”

View the image at this link:

A chandelier built of bicycle parts? It makes a statement - Los Angeles Times or search this web address: https://www.latimes.com/home/la-hm-bicycle-chandelier-20150328-story.html

Discuss and reflect:

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

- What motivates artists to use recycled or reclaimed items in their art?
- What other items have you seen at home or in your neighborhoods that could be used in art projects?
- Where have you seen recycled materials used in artwork?
- How do artists recycle materials to make their artwork? Why do you think they choose the materials they use?

Project

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, 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.

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

How Walkable or Bikeable Is Your Community?

Grade Level Expectation: 4-6

Content Areas: Social Studies; Reading, Writing, and Communicating

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.

4th Grade Standards

Social Studies
2-2. Examine the relationship between the physical environment and its effect on human activity.

Reading, Writing, and Communicating
1-1. Pose thoughtful questions after actively listening to others.

1-2. Create a plan to effectively present information both informally and formally.

5th Grade Standards

Reading, Writing, and Communicating

1-2. Present to express an opinion, persuade, or explain/provide information.

6th Grade Standards

1-2. Develop, organize, and present ideas and opinions effectively.

Preparation

Lesson Time

1 - 3 class periods, optional homework assignment

Materials

- Walkability Checklists printed and copied
  Please note, these may not be accessible to all. If you need accommodations, please reach out to the National Highway Traffic Safety Administration (NHTSA).
- Bikeability Checklists printed and copied
  Please note, these may not be accessible to all. If you need accommodations, please reach out to the NHTSA.
- Clipboards if available

- Pens, pencils

Procedures and Activities

Discussion

1. Ask students if they walk or bicycle to school. If they don't, this exercise can be done in their neighborhoods and the results shared with 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.

4. Take a group walk through the school neighborhood and have students fill out the checklists.

5. Review student findings. Ask what they noticed 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.

6. Repeat this lesson with the other checklist.

Extensions

- Send students home with additional checklists for their home neighborhoods or another area they frequent.

- Have students write letters to their planning agency discussing the challenges and suggesting corrections to the problems.

A Bicycling We Will Go

Grade Level Expectation: 5-6
Content Areas: Social Studies; Reading, Writing and Communicating

Objectives

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

5th Grade Standards

Social Studies
1-1. Analyze primary and secondary sources from multiple points of view to develop an understanding of the history of Colorado.

Reading, Writing, and Communicating

2-2. Apply strategies to interpret and analyze various types of informational texts.

4-1. Research to locate, summarize, synthesize, and document information from print and digital sources, and communicate findings appropriately.

6th Grade Standards

Reading, Writing, and Communicating

3-2. Write informative/explanatory texts characterized by appropriate organization, ample development, precise language, and formal style.

4-1. Pose research questions, gather, synthesize, and credit relevant and credible resources, and present findings.

Preparation

Lesson Time

2 Class periods

Materials

- Print resources
- Vetted online search engines
- Internet connection

Setup

Prior to the lesson, explore the following online resources, selecting which to share with the group in a manner of your choosing:

Bicycle Timeline -The Bicycle's Progression (https://www.bicyclehistory.net/bicycle-history/bicycle-timeline/)

Bicycle History (Very good images for comparisons)

https://www.bicyclemuseum.com/bicycle-history

The Evolution of the Bicycle: 10 Key Models That Made History (Very good images for comparisons)

https://www.pedalchef.com/post/the-evolution-of-the-bicycle-key-models-that-made-history/

Note: These sources may not be accessible to all. Please reach out to the site administrators if you need modifications.

Procedures and Activities

Introductory Discussion

Share the following 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. Only really strong people were able to ride a "hobbyhorse". Through the years as technology was developed, 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.

Option: The following two videos could also be used instead of the passage above:

The World's First Bicycle: A Look Back in History!

"The First Bicycle Ever Made! #Facts #History"

Note: These videos may not be accessible to all. Please reach out to the creators if you need modifications.

Project

Part 1

Print out images of different bicycle designs from different eras. Hand out two different images to small groups of students (2-3). Ask students to create a Venn diagram comparing and contrasting the different bicycles. Students could share what they discover with the class if desired. The two websites provided are good sources for such images.

Part 2

Instruct students to use the various print and internet resources to trace the history of the bicycle, then write a one-to-two-page report showing how technology changed the way the bicycle looks and works. They should describe how the features of the various designs of the bicycle help to accomplish its purpose.

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

When projects are complete, invite students to present their reports to the class or share key items of interest.

Historical Perspective on Racial Integration in Sports

Grade Level Expectations: 5-6
Content Area: Social Studies

Objective

This lesson gives 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

Social Studies

1-1. Analyze primary and secondary sources from multiple points of view to develop an understanding of early United States history.

6th Grade Standard

Social Studies

1-1. Analyze and interpret primary and secondary sources to ask and research historical questions about the Western Hemisphere (including North America, South America, Central America, and the islands of the Caribbean).

Preparation

Lesson Time

1-2 class periods

Materials

- Internet connection
- Vetted online search engines

Procedures and Activities

Discussion

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

Ask the students if they have ever heard of Marshall Taylor, or Major Taylor. Share background such as the following:

Many have never heard of Marshall Taylor. This is not because he does not deserve to be noted on any list of great all-time 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.

Independent Research

Have students research Marshall Taylor. Afterward, discuss Marshall Taylor's accomplishments as a group.

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

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?

Taming the Bicycle

Grade Level Expectation: 6-7
Content Area: Reading, Writing and Communicating

Objective

Students will 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

6th Grade Standards

1. Oral Expression and listening

    1-1. Employ appropriate presentation and collaboration strategies to meet the needs of a given task and purpose.

2. Reading for All Purposes

    2-1. Analyze literary elements within different types of literature to make meaning.

    2-3. Apply knowledge of word relationships, word structures, and sentence structures to determine the meaning of new words in context.

3. Writing and Composition

    3-4. Plan, draft, edit, and revise as needed to craft clear and coherent writing that demonstrates a grasp of standard conventions for grammar, usage, and mechanics as well as a style appropriate for purpose and audience.

7th Grade Standard

2. Reading for All Purposes

    2-1. Analyze literary elements within different types of literature to make meaning.

    2-2. Analyze organization and structure of informational text to make meaning.

Preparation

Lesson Time

1-3 class periods (1 to read and discuss the story, 1 to work on writing and editing if choosing, 1 for presentations if choosing)

Materials

- Mark Twain's essay, "Taming the Bicycle", available online, printed and copied or shared for whole group reading or listening
- Pens/pencils, paper
- Taming the Bicycle by Mark Twai pdf
- Taming The Bicycle (Audio Book by Mark Twain)
- Internet Access (for research purposes)

Procedures and Activities

Introduction

Ask students, 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 the background relevant to the reading: 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. Share 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, Nintendo Switch, Smart Phone , etc.). Ask if they would be able to write instructions for one of these inventions so that someone else could learn to use them successfully.

According to Clemens, attempting to ride a bicycle was a painful and short-lived experience. He wrote an essay about it. It was 3,400 words long, and he was not happy with it, so it was not published until after his death.

Reading and Discussion

Share the story. You can read aloud and have students follow along with their own copy or simply listen. There is also a link provided above to the story in an audio format. Invite them to sketch an image of an event from the story as they listen.

Discuss:

- 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 challenges Twain 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 points for evidence.
- Where was the author being ironic?

Relate 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 these to photos of modern cyclists, Tour de France competitors, motorcycles, etc.

Student Essays/Projects

Optionally, have students select from the options below. When complete, these can be presented to the whole group.

- 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.

Other related activities/extension opportunities:

- 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.

The Bicycle as a System

Grade Level Expectation: 6-8
Content Areas: Reading, Writing and Communicating

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.

6th Grade Standards

Reading, Writing and Communicating

> 1-2. Develop, organize, and present ideas and opinions effectively.

7th Grade Standards

Reading, Writing and Communicating

> 4-1. Pose research questions, synthesize answers from multiple credible sources, and present conclusions in an appropriate format.

8th Grade Standards

Reading, Writing and Communicating

> 1-1. Engage in effective collaborative discussions and analyze information presented.

Preparation

Lesson Time

2-3 class periods

Materials

- Internet access
- A bicycle or picture of a bicycle for students to reference, noting various subsystems and parts
- Copies of the Student Sheet “The Bicycle as a System” that follows this lesson
- Pens or pencils for notetaking

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 enhance students' abilities to critically analyze complex mechanisms.

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.”

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. The purpose for which the bicycle is intended, such as for racing, riding 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.

Procedures and Activities

Introductory Discussion

Invite students to share 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?
- Can you identify different parts of the bicycle?
- What different parts do you know, and what do they do?
- In your opinion, list in order of importance the following bicycle characteristics: speed, safety, comfort, durability. Explain your choice.

Group Project

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.

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 System’. 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.

After groups are given ample time to research, 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.

Questions to potentially incorporate into discussion:

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 roads, 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?

The Bicycle as a System Student Sheet

Apply your research 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. This lesson can be supplemented with the Gears and Proportions online lesson from PBS Learning Media.

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.

Bicycle Subsystems a.

Subsystem	Speed	Safety	Comfort	Durability
The Wheel				
Drivers and Gears				
Frames and				

Subsystem	Speed	Safety	Comfort	Durability
Materials				
Brakes and 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?

Bicycle Subsystems b.

Subsystem	Parts	Function	Input	Output
The Wheel				
Drivers and Gears				
Frames and Materials				
Brakes and Steering				

Subsystem	Parts	Function	Input	Output
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 Art

Grade Level Expectation: 6-8
Content Area: Visual Arts

Objective

Students will analyze two famous works of art which were later copied by the original artist.

6th Grade Standards

1-1 Apply the language of visual art and design to distinguish and differentiate meanings.

7th Grade Standards

1.-2. Recognize and interpret works of art through the lens of time, place, and culture.

1-3. Knowledge of art vocabulary is important when critically analyzing works of art

4-2. Identify where the visual arts and artistic thinking are present in the real world.

8th Grade Standards

2-2. Analyze, interpret, and make informed judgments about works of art using different points of view.

Preparation

Lesson Time

1 class period

Materials

- Pictures of Picasso's "Head of a Bull" and Duchamp's "Bicycle Wheel", to show or project

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.

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

Procedures and Activities

Introduction

Display photos of Picasso’s “Head of a Bull” and Duchamp’s “Bicycle Wheel”.

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?

Share the vocabulary and ask students to discuss it with respect to the two works of art:

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?

Project

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

Extension Option: Writing Assignment

Choose any of the above questions to pose to the students as a writing assignment.

Transportation Efficiency

Grade Level Expectation: 8
Content Area: Science

Objective

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

Physical Science

> 1-5. Kinetic energy can be distinguished from the various forms of potential energy.

> 1-6. Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter.

> 1-7. When two objects interact, each one exerts a force on the other that can cause energy to be transferred to and from the object.

Preparation

Lesson Time

1-2 class period

Materials

- Internet access
- Chart-making materials based on project choice

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 at 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.
- For the 2023 model year, the average fuel economy is 34.9 mpg for cars and 24.0 mpg for truck
- The average fuel efficiency of school buses typically ranges from 6 to 12 miles per gallon (MPG)
- The average car weighs approximately 4,094 pounds. Small cars typically weigh around 2,600 pounds, while large cars can weigh about 4,400 pounds.
- Chart: Energy Efficient Travel: Nothing Beats the Bike | Statista (Useful infographics and charts)

Vocabulary

Energy, calorie, Kilocalorie

Procedures and Activities

Discussion and Reflection

1. Discuss the calorie as a unit of measure. A calorie is defined as the amount of energy required to raise the temperature of 1 gram of water by 1 degree Celsius. Note that the calories listed on food containers are actually Kilocalories (as is the value for gasoline and diesel above). Share calorie specifics from background information.

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. (It may be necessary to model how to perform such a calculation for the students or provide the equations that they could use) 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 students 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. This may be a good extension activity.

5. Have the students determine the calories per pound needed to travel one mile by each of the modes. (It may be necessary to model how to perform such a calculation for the students or provide the equations that they could use)

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 someone would have to walk, bike, drive, or ride a bus.