

# Steam and You! How Steam Engines Helped the United States to Expand

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**Grade Level** 5  
**Duration** 2 class periods

## National Standards

### GEOGRAPHY

#### Element 4: Human Systems

12. The processes, patterns, and functions of human settlement.  
 13. How the forces of cooperation and conflict among people influence the division and control of Earth's surface

#### Element 6: The Uses of Geography

17. How to apply geography to interpret the past.

## AZ Standards

### ELA

#### Reading

5.RL.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.  
 5.RI.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

#### Writing

5.W.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.  
 5.W.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

### MATHEMATICS

#### Number and Operations in Base Ten

5.NBT.B.5 Apply and extend understanding of division to find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors.

#### Geometry

5.G.A.2 Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

### SCIENCE

#### Physical Science

5.P3U2.5 Define problems and design solutions pertaining to force and motion.

## Arizona Social Science Standards

### GEOGRAPHY

5.G1.1 Use and construct maps and graphs to represent changes in the United States over time.  
 5.G3.1 Use key historical events with geographic tools to analyze the causes and effects of environmental and technological events on human settlements and migration.

#### Disciplinary Skills and Processes

5.SP4.1 Explain probable causes and effects of events and developments in United States history from the revolutionary period to the rise of industry

## SIOP Elements

### Preparation

#### Adapting content

Linking to background

#### Linking to past learning

Strategies used

### Scaffolding

#### Modeling

#### Guided practice

Independent practice

#### Comprehensible input

### Grouping Option

#### Whole class

Small groups

#### Partners

Independent

## Steam and You! How Steam Engines Helped the U.S. to Expand

Integrating Processes	Application	Assessment
Reading Writing Speaking Listening	Hands on Meaningful Linked to objectives Promotes engagement	Individual Group Written Oral

### Arizona English Language Proficiency Standards

#### Stage IV

#### Basic

#### Reading

**Standard 4: The student will analyze text for expression, enjoyment, and response to other related content areas. The student will demonstrate knowledge of reading comprehension by:**

B-12: identifying the author's main purpose (e.g., to inform, to persuade, to entertain).

B-13: identifying the cause and effect relationship between two related events in a literary selection.

B-14: drawing conclusions from information implied or inferred in a literary selection.

#### Writing

**Standard 1: The student will express his or her thinking and ideas in a variety of writing genres.**

B-6: writing a variety of functional text (e.g., *instructions, directions*) that addresses the audience, stated purpose and context.

## Overview

The invention of the steam engine in the late 1700s was key to the Industrial Revolution when new technology rapidly changed human societies. The steam engine fostered the construction of railroads and steamboats that enabled the United States to expand rapidly and its population and economy to grow quickly. However, this expansion of the eastern population into western areas of the United States resulted in Native American populations losing homelands and the creation of the reservation system.

## Purpose

In this lesson, students will learn why steam engines were invented, where they were invented, and the basics of how steam engines work. They will learn how the invention of the steam engine promoted the construction of railroads across the United States. As the country expanded westward, many immigrant Americans benefited but many Native Americans were harmed. This lesson contains strategies for diverse learners.

## Key Vocabulary

**reliable:** trusted to do what is needed, dependable  
**steam engine:** an engine powered by steam  
**Industrial Revolution:** when new machines rapidly changed the world  
**train locomotive:** a train car containing the engine that moves the train  
**steamboat:** a boat powered by a steam engine  
**technology:** useful things to solve problems  
**turbine:** a large metal cylinder with fan blades that steam can spin to generate (make) electricity  
**piston:** a short cylinder that moves up and down that causes other parts of the engine to move

## Materials

- Toy pinwheels
- Tea kettle and water, preferably a whistling tea kettle (optional)
- Hot plate to heat tea kettle (optional)
- Vocabulary Cards
- Steam and You! How Steam Helped The United States To Expand Reading
- Steam and You! worksheet and Answer Key
- World map centered on the Atlantic Ocean from Arizona GeoAlliance
- World atlas or map that includes names of countries
- Steam and You Quiz and Answer Key

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- Steam Engines and the Expansion of the U.S. reading
- Steam Engines and the Expansion of the U.S. worksheet and Answer Key
- Steam Engines and the Expansion of the U.S. quiz and Answer Key
- Colored pencils

### Objectives

The student will be able to:

1. Describe steam and how it moves.
2. Describe how steam can push a piston or spin a turbine to power a steam engine.
3. Explain three ways that the invention of the steam engine changed life in the U.S. for better or worse.
4. Identify the meaning of the 8 vocabulary words by matching each word with its definition and by correctly using each word in a sentence.
5. Use information in a table to create a bar graph illustrating the Number of Miles of Railroads in the U.S. per decade from 1830 to 1890.
6. Practice rounding numbers to nearest 10,000 and the division of whole numbers.
7. Explore the spatial context of the world by using a world map to locate the country where the steam engine was invented, and by comparing a map showing railroads that existed in the U.S. in 1860 with another map showing railroads that existed in the U.S. in 1890 and answering questions about the information in the two maps.

### Procedures

*Prerequisite Skills: Students should have been introduced to Simple Machines. Students should have practice graphing, rounding numbers to the nearest 10,000, and dividing large numbers by 10,000. Students should have basic knowledge of map skills.*

*Prior to the Lesson: Divide the students into partner reading groups. Group higher readers with EL students and lower readers. (Grouping Option: Partners)*

#### SESSION ONE

**Engage:**

**(Optional Engage)** If you want to demonstrate to students how steam from a boiling steam kettle can move a pinwheel, **you need to practice it beforehand** to make sure you can get the steam to turn the pinwheel. The steam must be exiting the hole in the spout of the tea kettle rapidly to make the pinwheel move. I have done it, but depending on the design of the tea kettle, it is not always easy to do. If it works for you, you want to plug in the hot plate and begin heating the water in the tea kettle to a boil a few minutes before you begin talking to the students about the lesson.

Ask students to raise their hand if they can describe steam. Discuss some of their answers. Ask a few more questions to engage them in the topic. Where have they seen steam? What is steam made of? Steam is hot--can it be used to cool people?

**(Grouping Option: Whole Class)**

**Explore:**

- a.) Distribute the pinwheels to the students. Model how the pinwheel turns when air hits it. Allow them to enjoy turning the pinwheel by blowing air on it or pulling it through the air. Have several students explain what they think is happening when the wind hits the pinwheel. Then ask if they think this pinwheel could be part of a machine. Is this design ever useful?
- b.) Discuss with the students how windmills are similar to pinwheels. Wind turns the blades of a windmill. What do windmills do? (The blades turn a shaft that is connected to gears that can turn a grinding stone to grind grain or pump water.) **(Preparation: Adapting content)**

**Explain:**

- c.) Distribute the Vocabulary Cards and the Steam and You! Reading, the Student Worksheet for Steam and You! Reading, and the map of the world. Tell the students they will read an article with their partner about how steam engines were invented, why they were invented, and how they work. Tell them that in the late 1700s, inventors realized that steam could also be used to move things like turbines and pistons. Using the photo of a turbine and the illustration of a piston on the Vocabulary Cards, mention that steam can turn a turbine like it can turn a pinwheel. The turbine can be used to generate electricity. Tell the students to use their colored pencils to color in the piston in the diagrams of the steam engine and the piston on the sheet and explain to them how steam can make a piston move back and forth, which can turn the wheels of a train or other machines. Introduce all the other vocabulary words. **(Scaffolding: Comprehensible Input)**

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- d.) Collect the pinwheels from the students. Demonstrate in front of the class how steam from the tea kettle can move the blades of a pinwheel. Practice this beforehand to find out the best way to position the pinwheel near the steam so it turns the pinwheel most visibly. Make sure all the students can see it, but **use caution** because the **steam is hot** and students should not get too close. When you are done, use the diagram of a steam train locomotive on p. 3, tell the students that steam can also be used to move a piston that can power a train. **(Scaffolding: Comprehensible Input)**
- e.) Read the first page of the reading aloud with the whole class. Tell the students they must describe steam on the line and write in answers on the two spaces. **(Scaffolding: Guided Practice)**
- f.) Tell the students they will read pages 2 and 3 of the article with their partners **(Grouping Option: Partners)** and they should highlight any words that they don't know as they read. (ELs will receive assistance from their reading partners and will be given more time to complete answers) Tell the students they will be writing answers to questions on the reading itself and on the Student Worksheet for Steam and You!. **(Integrating Processes: Reading, Writing)**
- g.) After most of the students have answered the questions with their partners, read aloud p. 2 and 3 of the Steam and You! reading with the whole class. **(Scaffolding: Modeling, Grouping Option: Whole Class)** Then call on students to share their answers with the whole class and ask them to tell the class where in the article they found evidence for their answer so other students can view the evidence. **(Application: Promotes Engagement)** **(Integrating Process: Listening)**

### Elaborate:

- h.) Show students a 2 min. 43 sec. **Animation of How a Steam Locomotive works** using the following link:  
<https://www.youtube.com/watch?v=d1OpJzWtk8g>

### Evaluate:

- i.) Have students complete The Steam and You! Quiz, which includes vocabulary matching.

## SESSION TWO

### Engage:

- a.) Divide the students into partner reading groups of two again, but assign different partners. Group higher readers with EL students and lower readers. **(Grouping Option: Partners)**

- b.) Distribute paper and tell the new partners to write down 4 things they learned during the "Steam and You!" Session One of this lesson. **(Preparation: Linking to past learning)** After a few minutes, ask students to raise their hand if they can share some answers with the whole class. Review the important concepts from Session One. **(Grouping Option: Whole Class)**

### Explore:

- c) Ask the students to use the same piece of paper to write two ways that the invention of steamboats and steam train locomotives might have influenced the growth of the United States. Then have them write a sentence to explain whether the growth of the U.S. was good or bad. Have students share their answers and discuss their answers with the whole class. **(Application: Promotes Engagement, Grouping Option: Whole Class)**
- d) Distribute the Steam Engines and the Expansion of the U.S. reading, the Student Worksheet for "Steam Engines and the Expansion of the U.S.", and the Vocabulary Cards. Tell the students you will read with the class the first half of a reading about how steam engines influenced the expansion of the U.S. They will read the second half of the reading with their partner. Show them the two-page article and talk about the illustrations and photos. **(Scaffolding: Comprehensible Input)**
- e) Tell them they will be studying data in a table about the expansion of railroads. They will write answers to questions about the data and complete a graph illustrating the data on the grid on p. 2 of the worksheet. Tell them they will also study information contained in two maps showing U.S. railroad routes in 1860 and in 1890 and answer questions about what they see. Finally, read over questions 7 and 8 with them. Tell them they can use the vocabulary cards to complete sentences for question #8.
- f) Read the first 2 paragraphs of the article aloud with the whole class **(Scaffolding: Guided Practice)** Ask the students again how they think the invention of steamboats and steam train locomotives influenced the growth of the U.S. **(Integrating Process: Listening, Speaking)**
- g) Tell the students they will read the rest of the article with their partners **(Grouping Option: Partners)** and they should highlight any words that they don't know as they read. Tell them that after they finish reading the article, they should work with their partners to complete answers to the questions on the Student Worksheet for Steam Engines and the Expansion of the U.S. and to graph the information in the table in question #4 on the grid on the worksheet.

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### (Integrating Processes: Reading, Writing)

Remind them they can use the Vocabulary Cards to complete sentences for question #8.

- h) After most of the students have answered the questions with their partners, read aloud the rest of the article "Steam Engines and the Expansion of the U.S." with the whole class. **(Grouping Option: Whole Class)** Then tell student partners to share some of the answers they wrote on their worksheets with the whole class **(Integrating Process: Listening, Speaking)** Discuss their answers with the class.
- i) Ask student partners to show their graphs to other student partner groups. **(Application: Promotes Engagement)** Show some of the completed graphs to the class. Ask the students to tell the class where in the article they found evidence for their answer or where in the table they found evidence for their answer so other students can view the evidence.
- j) Discuss the Railroad maps and what they show. Make sure the students know the correct answers.

### Elaborate:

- k) Show students a 3 min. 41 sec. video about the construction of the **Transcontinental Railroad** and its effects on Native Americans using the following link:

<https://www.youtube.com/watch?v=0CdAzizWiyI>

### Evaluate:

- l) Have students complete the Steam Engines and the Expansion of the U.S. Quiz.

## Assessment

### ELA and Geography

The Steam and You! and the Steam Engines and the Expansion of the U.S. quizzes can be graded. Mastery is considered 80% or higher.

b.) The Steam and You! Student and the Steam Engines and Expansion of the U.S. Student Worksheets can be graded as a classwork assignment. Mastery will be considered 90% or higher since the answers were given in class.

### Mathematics

The Steam Engines and Expansion of the U.S." graph on the expansion of railroads can be graded

for accuracy. Mastery will be considered 80% or higher.

## Extensions

Students can write an essay about how advancements in technology can have both positive and negative effects on people.

To learn more about steam locomotives, students can read **Locomotive** by Brian Floca, Antheneum/Richard Jackson Books, 2013. It is a Caldecott Medal winner. This is a great book about locomotives and trains.

To learn more about Native American History, students can read **Native American History for Kids: With 21 Activities** by Karen Bush Gibson, Chicago Review Press, Act edition, 2010.

Students can read an illustrated picture book entitled **Coolies** by Yin, illustrated by Chris Soentpiet, Puffin Books 2001. This book describes the lives of Chinese laborers who worked to build the Transcontinental Railroad.

Students can think of two topics that have a relationship with each other, research the data, and complete a bar graph to illustrate the data.

## Sources

Wikipedia: History of Rail Transport in the United States.

[https://en.wikipedia.org/wiki/History\\_of\\_rail\\_transport\\_in\\_the\\_United\\_States](https://en.wikipedia.org/wiki/History_of_rail_transport_in_the_United_States)

Central Pacific Railroad Photographic History Museum. [www.cprh.org](http://www.cprh.org) Maps Showing the Progressive Development of U.S. Railroads – 1830 to 1850.

World Map (centered on the Atlantic Ocean) from Arizona Geographic Alliance  
<http://geoalliance.asu.edu/maps/world>

### Classroom Materials

**Pinwheels** are available online through Amazon.com from Forest Haven LLC (Fun Express Rainbow Pinwheel Set (3 dozen) \$11.15 plus shipping