

Teaching Guide for Mr. Eads' Bridge

The Language Arts and Newspaper Connections sections of this guide are divided into chapters, as the words and questions are specific to a chapter. Activities in the other disciplines may be used at any time during the story's run.

Chapter One - The Other St. Louis Arches

Background Information:

The Gateway Arch National Park, formerly the Jefferson National Expansion Memorial, was created to honor the vision of President Thomas Jefferson, who purchased the Louisiana Territory from France and sent Lewis and Clark on their mission to find a passage to the Pacific Ocean. St. Louis' location near the confluence of the Mississippi and Missouri Rivers made it an ideal place for a trading post. Fur traders and mountain men began their exploration of the West from St. Louis, paving the way for the emigrant trains that followed. The Gateway Arch is a symbol of St. Louis' role in the Westward Expansion of the United States during the nineteenth century.

In the 1930s, civic leaders Mayor Bernard Dickmann and Luther Ely Smith formed an organization of likeminded people to begin the process of getting approval for "A suitable and permanent public memorial to the men who made possible the western territorial expansion of the United States, particularly President Jefferson, his aides Livingston and Monroe, the great explorers, Lewis and Clark, and the hardy hunters, trappers, frontiersmen and pioneers."

The process was a lengthy one, lasting from the early 1930s to the opening of the park in June 1967. The design of the proposed memorial was a two-stage competition; the first stage would narrow the entries to five, with the final design being decided in the second stage. There were 172 entries in the first stage. Eero Saarinen's arch design was one of the five that advanced to the second stage and on February 18, 1948 was unanimously selected.

The Gateway Arch is an inverted catenary curve, the shape that a free hanging chain assumes under its own weight when supported only at its ends. The curve is created by tension from each end. A catenary arch is supported entirely by compression from its own weight with no shear or strain on the structure.

Language Arts

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Sweeping

Piers

Spans

Reading Comprehension:

Why do you think the author titled this chapter The Other St. Louis Arches?

Discussion Question:

Why was Becky surprised to be wearing hair ribbons and a dress?

Writing Activity:

Becky described the buzz from the bug as “fairies singing.” Rewrite that section using a different description of the buzz.

Newspaper Connections:

Record the facts in each chapter. Take note of the 5 Ws and 1 H of journalism: who, what, where, when, why and how. Compare this chapter with a newspaper article. Do 5 Ws and 1 H appear in both? Why or why not?

Chapter Two – We Start at the Bottom

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Masonry

Superstructure

Force

Reading Comprehension:

What did Miss Laura Ascot describe to Becky?

Discussion Question:

Do you think it would be normal for there to be a female architecture student in the 1870s? Why or why not?

Writing Activity:

Becky did not give away the fact that she had jumped back in time when she explained that she had recently arrived. Rewrite this section, imagining Miss Ascot’s reaction if Becky had said she was a time traveler.

Newspaper Connections:

Look through your local newspaper for images and stories about bridges. How many different types of bridges did you find? Are any older than 1868?

Chapter Three – Caissons in the Mississippi

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Caisson

Nasal

Bedrock

Reading Comprehension:

Where did Mr. Eads see how to use a caisson?

Discussion Question:

Do you think you'd be able to go under water using a diving bell? Why or why not? Would your answer be different if you could use modern diving equipment?

Writing Activity:

Ms. Ascot gave Becky several explanations of technical accomplishments that Mr. Eads had to create or use: how a diving bell works, how a caisson helps in building under water and what a sand pump does. Think of a procedure or equipment that you are familiar with, and write an explanation like Ms. Ascot's.

Newspaper Connections:

Look at the comics in your local newspaper. Create a comic with copy and art about working on the bottom of a river.

Chapter Four – The Bends

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Incapacitated

Falsework

Lobbied

Reading Comprehension:

What is the name mentioned in this chapter for the disease that some of the underwater workers were getting?

Discussion Questions:

Many professions have inherent dangers, just as the underwater workers did in the 1870s. How did various industries become safer through the years?

Becky starts this chapter by accepting that she has more to learn. Why do you think the beetle sent her to this time period? What did it want her to learn?

Writing Activity:

Write a letter to the editor from either the viewpoint of the steamship or the railroad industry about having a bridge across the Mississippi River.

Newspaper Connections:

Look through the newspaper for stories about on-the-job injuries or illnesses. Do you see any patterns in the risks?

Chapter Five – Captain Eads

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Curtsy

Treacherous

Frivolous

Reading Comprehension:

What is an ironclad?

Discussion Question:

Mr. Eads says the title of captain is honorary. What does that mean?

Writing Activities:

Mr. Eads states clearly that he was a Union supporter during the Civil War, but Missouri also had many Confederate supporters. Write a short story about how a Confederate may have reacted to the building of the ironclads.

Becky met Mr. Eads, who was an important person of his time. Research a person from history that you would like to meet and write a short story about it.

Newspaper Connections:

Ironclads were important during the Civil War. Find stories in the local newspaper about ships, trucks, trains or other vehicles that are impacting our world today.

Chapter Six – Rails Across the River

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Regional

Backwater

Menace

Reading Comprehension:

What city has always been a rival to St. Louis?

Discussion Question:

Do you think the restrictions on how the bridge had to be designed were for safety or strictly for the benefit of the steamship companies?

Writing Activity:

Write a letter to your friend, the President, asking for help in making a government agency do what you want.

Newspaper Connections:

Find articles in your local newspaper about construction projects, and look for words common to the stories.

Chapter Seven – Steel Resolve

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Monopoly

Supplier

Shoddy

Reading Comprehension:

What building material did Mr. Eads have trouble with?

What do you think an “Immelmann” loop is?

Discussion Question:

This chapter has a detailed description of different types of iron and steel. Do you feel this level of detail enhances or detracts from the overall story? Why or why not?

Writing Activity:

The beetle tells Becky that it is a time beetle, but we don’t know much else about it. We don’t know how many there are, what they eat or where they live. Write a descriptive paragraph that gives us your ideas about the time beetle.

Newspaper Connections:

Building materials, such as steel, may be affected by tariffs. Use newspaper articles to read about and understand tariffs.

Chapter Eight – History Lessons

Vocabulary: Use context clues or a dictionary to find the meaning of these words:

Wavering

Publicity

Iconic

Reading Comprehension:

Does Eads Bridge support the amount of weight it was designed for, or more or less weight?

Discussion Question:

Many structures are torn down when their usefulness is gone. The Eads Bridge remained, however. Do you think there is value to communities in preserving old structures or should they be removed to allow for progress?

Writing Activity:

Watching an elephant walk across the bridge must have been quite the sight. Write a newspaper-style article about the event.

Newspaper Connections:

Use the facts in the chapters to write a newspaper-style story. Write an article describing this story with a strong lead sentence and include the 5 Ws and 1 H: who, what, where, when, why and how.

STEAM – Science Technology Engineering Arts Mathematics

Vocabulary Words:

Arch bridge - A *bridge* with abutments at each end shaped as a curved *arch*

Beam bridge - A *bridge* supported by an abutment or pier at each end

Cable-stayed bridge - A bridge that has one or more towers (or pylons), from which cables are attached to support the bridge deck

Cantilever bridge - A *bridge* built using *cantilevers*, structures that project horizontally into space, supported on only one end

Compression - Force that tends to shorten or squeeze something, decreasing its volume

Deck - Portion of a *bridge* that acts as the roadway in the support of vehicular or pedestrian traffic

Force - An exertion of pressure either focused toward or pulling away from an object

Load - A weight or mass that is supported

Tension - Force transmitted through a rope, string, cable or similar object

Thrust - A push in a specific direction

Truss bridge - A bridge with a solid deck and a lattice of pin-jointed girders on each side

Learning Objectives: Students will

1. find the height of the Arch
2. identify the four main types of bridges
3. demonstrate compression and tension
4. list several examples of loads that could affect a bridge
5. explain why knowledge about various loads or forces is important in bridge design

6. describe the process that an engineer uses to design a bridge, including determining loads, calculating the highest load and calculating the amount of material to resist the loads
7. design and build a bridge while adhering to a budget

Activity One – Human Arches: Compression and Tension

Materials Needed: Writing materials

Directions:

Divide the class into pairs of students.

Compression

Pairs should face each other, press their palms together at about shoulder height and slowly lean into one another.

Have students record what they felt, where they felt it and what they think is causing the feeling. Guide them in understanding that they experienced compression.

Tension

Either keep or change the pairings.

Pairs should face each other, join hands and slowly lean away from each other.

Have students record what they felt, where they felt it and what they think is causing the feeling. Guide them in understanding that they experienced tension.

Activity Two – Crackers and Marshmallow Cream Arch Building

Materials Needed: Crackers, marshmallow cream, cardboard or cafeteria trays

Directions:

The crackers represent building blocks while the marshmallow cream represents construction adhesive like concrete or mortar.

Students should plan and build arches with the materials on the cardboard or cafeteria trays. The arches must be able to stand and support weight.

Students should record the arch building process with the vocabulary words. Did they apply each concept correctly? Guide them on using the terms properly in their descriptions.

Activity Three – Logger’s Method of Calculating Height

Materials Needed: A stick as long as your arm

Directions:

Hold your arm out straight and parallel with the ground.

Point the stick straight up, so that it makes a 90° angle to your arm.

Walk forward or backward until the tip of the stick coincides with the top of the Arch.

You are now at approximately the same distance from the Arch as it is tall. Measure the distance between you and the Arch. This will give you a rough determination of the Arch's height.

Activity Four – Shadow Method of Calculating Height

Materials Needed: A ruler or tape measure, a sunny day

Directions:

Measure yourself.

Measure your shadow.

Measure the Arch's shadow.

Place the values into this equation (Arch's shadow * your height) / your shadow = Arch's Height.

This method works best with relatively flat ground.

Activity Five - Design Competition

Materials needed: Paper and colored pencils

Directions:

Have the student research their community with the idea of creating a monument, which highlights a unique feature or person of the area.

Students should do several sketches of their vision for the monument and then choose the one that they feel best represents the area or person.

Student should then create a poster-sized drawing of the new monument and give a short presentation that addresses these topics:

1. why they chose that person or feature to honor
2. how their monument accomplishes that
3. the nature of the new monument, with size and material suggestions

Activity Six – Popsicle Bridge Building

Materials needed: Paper and colored pencils

Directions:

Divide your class into small groups.

Direct groups to design and build an arch bridge with the following requirements:

be at least 30.48 cm long

support 907 grams

follow the design plan

stay within budget

Each group should get a piece of cardboard large enough for the bridge with a 30.48 cm hole cut in the middle.

Each group receives a budget of \$50,000.

The price list is as follows:

Graph paper for design - \$10,000

Single popsicle sticks, beams - \$2500

Bundles of 15 popsicle sticks, beams - \$33,000

One day's worth of glue, concrete - \$2000

Upon completion of the bridge, each group will present their final design plan and budget and demonstrate their bridge's ability to carry the 907-gram load. This will be done by placing the cardboard between two chairs or tables and hanging a 907-gram weight from the center of the structure.

Social Studies

Learning Objectives: Students will

1. be able to label and identify geographic features such as rivers and lakes
2. identify important information in non-fiction text
3. use research to discern the reasons changes in topography and/or population happen over time

Activity One – Compare and Contrast

Materials Needed: Town histories

Directions:

St. Louis is often called the Gateway to the West. But before explorers, mountain men and pioneers could leave from St. Louis, it had to be founded. In 1764 French fur traders founded St. Louis at what is now the base of the Gateway Arch.

Have your students research the founding of St. Louis and your town and compare and contrast the beginnings of each place.

Activity Two: Map Study

Materials Needed: Road, topological, flood, recent and old maps, aerial photographs of your area and maps of the various trails taken by settlers

Directions:

Have your students review these map sources and answer the following questions:

What made your area's location attractive for settlement? Possible answers include the available water or good soil.

What features were important to the area's development? Possible answers include access to trade routes, good farmland or abundant game.

How has nature altered the landscape? Have your students study the maps for changes in the topography over the years.

How did geographical features drive the routes taken by settlers? Possible answers include rivers, low mountain passes and availability of grass and water.

Activity Three: Place Name Geography

Materials Needed: Road, topological, flood, recent and old maps, aerial photographs of your area and books on local history

Directions:

Have your students find streets, areas or neighborhoods that are named after natural formations or famous people.

Have them report on these people or places using plays, PowerPoint, posters or any other media to present the information to their classmates.

Activity Four – Growth or Decline

Materials Needed: Road, topological, flood, recent and old maps, aerial photographs of your area, census data and books on local history

Directions:

Using old maps, census data and local histories, have your students track the development of your area.

Can they discern patterns of immigration/emigration or growth or decline of the area?

Do they see any changes in the landscape, such as creeks channelized, mounds destroyed, or hills flattened?

Have them research the history of the area, looking for reasons behind the changes they noticed in their map work.

Assign your students to interview parents, grandparents, older relative and neighbors about the changes they noticed in their map work.

Have them create reports about what they've noted and found by using a variety of media to present the information.

Thank you for using the Teaching Guide for the 2019 serial story, Mr. Eads Bridge. Please let your local newspaper know that you use and appreciate these stories and the guides.

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