

Geography and STEM: Engineering that Made a Difference

Author	Patricia Touchette Hutchinson
Grade Level	6
Duration	2 class periods

National Standards

GEOGRAPHY

Element 1: The World in Spatial Terms

1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

Element 4: Human Systems

12. The processes, patterns, and functions of human settlement

NEXT GENERATION of SCIENCE STANDARDS

MS.Engineering Design

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

AZ Standards

ELA

Reading

Key Ideas and Details

6.RI.1 Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

Integration of Knowledge and Ideas

6.RI.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

Language

Conventions of Standard English

6.L.2 Demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing.

- Use punctuation (commas, parentheses, dashes) to set off nonrestrictive/parenthetical elements.
- Use correct spelling.

Arizona Social Science Standards

GEOGRAPHY

Human-environment interactions are essential aspects of human life in all societies.

6.G2.1 Compare diverse ways people or groups of people have impacted, modified, or adapted to the environment of the Eastern Hemisphere. Key concepts include but are not limited to hunter-gatherer communities, human settlement, Neolithic Revolution, irrigation and farming, domestication of animals, and influence of climate and seasons

Examining human population and movement helps individuals understand past, present, and future conditions on Earth's surface.

6.G3.2 Analyze the influence of location, use of natural resources, catastrophic environmental events, and technological developments on human settlement and migration. Key concepts include but are not limited to development of early river civilization, pastoral societies, rise of cities, innovations in transportation, and collapse of empires

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

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: Stage IV 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-4: answering who, what, where, when, why, which and how questions about text..HI-8: summarizing the main idea and supporting details from text using academic vocabulary.

Writing

Standard 2: The student will identify and apply conventions of standard English in his or her communications.

The student will identify and apply conventions of standard English in his or her written communications by:

B-3: writing words and sentences using appropriate capitalization (*e.g., proper nouns, pronoun "I", titles, abbreviations, words used as names*).

B-4: writing sentences using appropriate punctuation (*e.g., ending punctuation; period; abbreviations; colons; time; commas; items in a series, introductory words, friendly letters; apostrophes; contractions*).

Overview

Man has the ability to solve problems. While engineers are often seen as the problem solvers, they also deal with geographic challenges in many of their worksites. So how does geography and engineering tie together?

Purpose

In this lesson, students will connect geographic themes and locations with engineering advances, using six different locations. This lesson can be considered a beginning lesson to show how geography ties with STEM subjects. It has adaptations for diverse learners (ELLs).

Key Vocabulary

geography: the study of the Earth

technology: use of science to solve problems

engineering: using science to solve problems

Materials

- World Map
<http://geoalliance.asu.edu/sites/default/files/maps/World-at.pdf>
- Computer, projection device, and Internet
- Atlases (if available)
- 5 Themes video
<https://www.youtube.com/watch?v=6eKjwr8qo4I>
- Engineering Design Process image
- Short Youtube videos of each engineering project (6 of these about 2 min. each)
- Video Analysis Sheet
- Engineering that Made a Difference readings (6)
- Reading Analysis Sheet and Answer Key
- Highlighters
- Vocabulary Cards and Test

Objectives

Students will be able to:

Geography and STEM: Engineering that Made a Difference

1. accurately locate the different sites on a map of the world.
2. connect the engineering design process to their own construction projects.
3. articulate the result of the engineering process that is associated with each site.

Procedures

Prerequisite Knowledge: Students have learned the 5 Themes of Geography.

SESSION ONE

Engage:

- a. Begin the lesson with the 5 minute video reviewing the 5 Themes of Geography.
<https://www.youtube.com/watch?v=6eKjwr8qo4I> Take time to write the 5 themes on a whiteboard and have students give examples of each. **(Preparation: Linking to Past Learning)**

Explain:

- a. Tell the students that the 5 themes will be used throughout this lesson. They will also be using certain map skills to learn about engineering feats the following locations:
 - Hama, Syria
 - Avignon, France
 - Isthmus of Panama
 - Mohenjo-Daro, Pakistan
 - Chand Baori Jaipur, India
 - Chunnel English channel at Dover
- b. Distribute the World Map. Have students work together to locate the countries mentioned in the above list. They may use atlases or hand held devices if they don't already know these countries.
- c. Have the students brainstorm what they may know about the environment (physical landscape) of each of these locations. What do they know about the vegetation, water, climate, elevation, etc. What do they know about the people and their culture(s) in this location? What religion(s) and language(s) are present here? Is it densely or sparsely populated? Record this information on the whiteboard. **(Preparation: Linking to Past Learning)**
- d. At this point write "Human-Environmental Interaction" on the board. This is the geographic theme that is most important to this lesson., Ask the students for some examples of human-environmental interaction (HEI). Examples may range from mining, to road building, to creating and enjoying a park, etc. **(Scaffolding: Comprehensible Input)**
- e. Introduce the following vocabulary words:
 - geography: the study of the Earth
 - technology: use of science to solve problems
 - engineering: using science to solve problems

Have students suggest images that could illustrate each of the words. Give Vocabulary Cards to diverse learners.

- f. Introduce the Engineering Design Process by projecting the image that explains the process.

(Scaffolding: Comprehensible Input)

- g. Ask if any students have ever tried to build a fort or another project. Did it work the first time? If not, what did they have to do to make it work? Students should take an example from their own lives and practice the engineering design process in a think/pair/share. For example: give a problem you solved such as: Too much trash was being left in desks. Be sure to model the design process on how you solved the problem.

(Scaffolding: Modeling) (Group Option: Partners)

- h. End the session by having several students share orally their problem and how it was solved. **(Integrating Processes: Listening and Speaking)** Collect the maps.

SESSION TWO:

Explore:

- a. Pass out Video Analysis Sheets to each student. Instruct students to answer the questions after each Engineering that Made a Difference reading is discussed and the video is played. **(Group Option: Independent or Partners) (Application: Promotes Engagement)**
- b. Project and read the Engineering that Made a Difference on Hama, Syria. Then project the video on Hama. Have students answer the two questions about Hama.
- c. Have students share their responses so students can see what is expected and if they are correct in what they are doing. **(Scaffolding: Modeling)** Then continue to play the six short videos (each about 2 min).

Elaborate:

- a. Distribute the Reading Analysis Sheet and instruct students to pick one of the six locations to elaborate upon. They should answer the five questions with details from the text and using correct spelling, capitalization, and punctuation.

Assessment

ELA, Science, and Geography

Reading Analysis Sheet can be graded for reading/language/geography/science using the point system given on the worksheets. Mastery will be considered 80% or higher.

Geography and STEM: Engineering that Made a Difference

<https://www.youtube.com/watch?v=jvO1P4BEYkM>

Geography

Mapwork can be graded for a geography grade.
Mastery would be 100% on locating the 6 locations.

Science/Engineering

The Video Analysis Sheet can be graded for science (engineering) concepts. Mastery would be considered completing 80% of the questions with reasonable answers.

Extensions:

1. Create a Google Earth tour to link the different geographic locations. Use the coordinates listed at the top of the reading selections and insert a virtual tack at each location.
2. Show da Vinci Self-Supporting Bridge video at <https://www.youtube.com/watch?v=8sEa3MXXzw8> (1.44 min). Have students build Leonardo's Self-Supporting Bridge. You will need Popsicle sticks (craft sticks) This self-supporting bridge was supposedly designed to help move war brigades over water.

Sources

Youtube Videos

5 Theme of Geography (5 min)

<https://www.youtube.com/watch?v=6eKjwr8qo4I>

History of the Panama Canal

<https://www.youtube.com/watch?v=dTIndhU8-DA>

Mohenjo Dara and Harappa

<http://www.youtube.com/watch?feature=endscreen&NR=1&v=RAyK2AXTAeA>

Pont du Gard: Roman Aqueduct

<http://www.youtube.com/watch?v=zQqtiwlq9gw>

Chand Baori Well- Jaipur, India

<http://www.youtube.com/watch?v=9aWj0aqCPi0>

Hama Water Wheels

<http://youtu.be/-8Ys-EzwgWE>

English Channel Underground Tunnel

<http://www.youtube.com/watch?v=vGBnjM72WsA>

Tunnel Boring Machine as seen in Kuala Lumpur

http://www.youtube.com/watch?v=Q41vzLjwZqM&feature=player_detailpage

Leonardo daVinci: The Miter Lock