

India's Contributions to the World: Zero!

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Grade Level 6
Duration 4 class periods

National Standards

GEOGRAPHY

Element 4: Human Systems

10. The characteristics, distribution and complexity of Earth's cultural mosaics.

Element 6: The Uses of Geography

17. How to apply geography to interpret the past.

AZ Standards

ELA

Reading

Key Ideas and Details

6.RI.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Craft and Structure

6.RI.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

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.

Writing

6.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

MATHEMATICS

Ratios of Proportional Relationships

6.RP.A.3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

The Number System (NS)

6.NS.C.7. Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line.

b. Write, interpret, and explain statements of order for rational numbers in real-world context.

c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world

Arizona Social Science Standards

GEOGRAPHY

The use of geographic representations and tools helps individuals understand their world.

6.G1.1 Use and construct maps, graphs, and other representations to explain relationships between locations of places and regions. Key concepts include major landforms and water bodies, countries, cities, ecosystems, climate, languages, religion, economic systems, governmental systems, population patterns, disease, trade routes, and settlement patterns

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

6.G3.1 Analyze how cultural and environmental characteristics affect the distribution and movement of people, goods, and ideas.

HISTORY

The development of civilizations, societies, cultures, and innovations have influenced history and continue to impact the modern world.

6.H1.1 Compare the development and characteristics of historical cultures and



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context.

d. Distinguish comparisons of absolute value from statements about order in mathematical problems and problems in real-world context.

Expressions and Equations (EE) **(Extension Idea)**

6.EE.A.1. Write and evaluate numerical expressions involving whole-number exponents

civilizations from different global regions within designated time periods.

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

Arizona English Language Proficiency Standards

Grade 6

Basic

Listening and Reading

Standard 1 By the end of each language proficiency level, an English learner can construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.

B-1: determine the central idea or theme and explain how they are supported by using some text evidence.

B-2: recount specific details and information in a variety of texts.

Speaking and Writing

Standard 3 By the end of each language proficiency level, an English learner can speak and write about grade appropriate complex literary and informational texts and topics.

B-3 compose informational text that includes details to develop a topic while using appropriate conventions.

B-5: use examples of precise language and domain-specific vocabulary within informative texts.

Listening, Speaking, Reading, and Writing

Standard 6 By the end of each language proficiency level, an English learner can participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.

B-5: contribute relevant information and evidence to collaborative oral and written discussions.

Standard 7 By the end of each language proficiency level, an English learner can conduct research and evaluate and communicate findings to answer questions or solve problems.

B-1: gather information from multiple provided resources to answer questions.

B-2: paraphrase observations/information notes with labeled illustrations, diagrams, or other graphics, as appropriate.

Overview



Education Studies Department
Teachers of Language Learners Learning Community (TL²C)



India's Contributions to the World: Zero!

By 2025 India is projected to be the world's most populated country, surpassing China. But population is just one facet of this amazing country. This sub-continent is home to some of the most ancient and varied civilizations. Each wave of people brought fresh ideas and ways of life. India has a legacy of mathematics, writing, architecture, literature, religion, and science.

Purpose

In this lesson students will gain insight into the cultural diffusion of Indian mathematical achievements, namely the zero. They will practice computing ratios and identifying numerical values. This lesson has adaptations for diverse learners (ELLs).

Key Vocabulary

zero: the symbol 0 that in math can be used to show nothing (0 dogs) or to hold a place in the number system (202 dogs)

placeholder: a symbol in math that can show the relationship of the numbers (ones, tens, hundreds) (05, 50, 500)

spread: to move from one place to another, get larger

cultural diffusion: spread of ideas, religions, languages and other characteristics from one place to another

drain: a pipe or a ditch to carry water or liquids

merchant: person who sells things

Materials

- World Population Video
- Internet access and computer lab
- Classroom computer and projection system
- A Short History of Zero
- A Short History of Zero Map Assignment and Map Assignment Answer Key
- Colored pencils
- World map
- Map Scoring Guide
- A Short History of Zero Writing Assignment (Cloze paragraphs for ELLs) and Answer Key
- A Short History of Zero Writing Assignment (Writing prompt for English proficient students)
- Is Zero Nada? worksheet and Answer Key
- Indus Inch worksheet and Answer Key
- Vocabulary Cards
- Vocabulary Test and Answer Key

Extension Materials

- Tower of Brahma worksheet

- Kolams worksheet
- Brahmi Writing
- Sanskrit Writing

Objectives

The student will be able to:

1. construct a map to display geographic information.
2. define cultural diffusion.
3. identify an example of cultural diffusion.
4. create a summary.
5. compute ratios.
6. identify numerical value.

Procedures

Prerequisite Knowledge: Students should have knowledge of the Cradles of Civilization. Students have experience with computing ratios and determining numerical values.

Note: Tailor these procedures to your students' needs. If you are teaching a self-contained class, you may choose to follow the order suggested. If you are departmentalized, you may choose to have social studies teachers do the reading, writing and map making lessons.. Then the math teacher can do the set of lessons highlighting mathematical achievements.

SESSION ONE AND TWO

Engage:

a. Ask students what countries have the most people in the world. Record their responses on the whiteboard. **(Preparation: Linking to past learning)** Then show the 7-minute video on World Population.

http://www.youtube.com/watch?v=9_9SutNmfFk

Share that the Top Four are: China, India, United States and Indonesia.

Explore:

a. Show the video once more pausing at the historically important events and have students discuss how they relate to today's population.

(Preparation: Linking to past learning) Now tell students that in 2025, India is projected to have more people than China.

b. Ask them what they know about India. Write responses on the whiteboard. **(Preparation: Linking to past learning; Application: Promotes engagement)**



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c. Introduce vocabulary words and create a word wall for students to access during this unit of study. **(Scaffolding: Comprehensible input)**

Explain:

a. Distribute copies of A Short History of Zero and a World map. Project a map to point out where India is located. **(Scaffolding: Modeling)** Have students take turns and read aloud the information and discuss important parts. Reinforce use of vocabulary words. **(Scaffolding: Comprehensible Input)**
b. End the reading portion of the lesson by discussing which of the cultures (Mayan, Indian, or Chinese) was responsible for cultural diffusion of the zero. (Indian) **(Grouping: Whole Group; Integrating Processes: Reading and Listening)**

Elaborate:

a. Now distribute the A Short History of Zero Map Assignment and clarify directions and scoring guide. Allow students to work in partners so everyone understands what is expected. It is important that each student have their own map and assignment sheets since this may become homework if time runs out. **(Grouping: Partners; Assessment: Individual and Written)**

Evaluate:

a. Distribute A Short History of Zero Writing Assignment (Cloze paragraphs) to ELLs, and distribute A Short History of Zero Writing Assignment (Writing prompt for English proficient students). Explain the directions and allow students time to complete their work in the computer lab. **(Assessment: Individual and Written)**

SESSION THREE AND FOUR

Engage:

a. Show students the YouTube video <http://www.youtube.com/watch?v=wb4Npexda4A> on India's famous mathematician and astronomer, Aryabhata. **(Integrating Processes: Listening)**

Explore:

a. Look back at the first session's list on the whiteboard of what was known about India. Have any of these been discussed? Are there any that are misconceptions? **(Preparation: Linking to past learning) (Application: Promotes engagement)**

Explain:

a. Review how to compute ratios and identify numerical values. **(Preparation: Linking to past learning)**

Elaborate:

a. Distribute the worksheet, Is Zero Nada? Model how to write out the numbers in words by using the first example. **(Scaffolding: Modeling)** Have student pair up to complete the rest of the problems. **(Grouping Option: Partners)** Then have the whole class work on the next sections of the worksheet (Is the zero necessary or not and writing out the two numbers). **(Grouping Option: Whole class; Assessment: Individual and Written)**
b. Read about the Indus Inch. Pair up students and have them complete the math computations. **(Grouping Option: Partners; Assessment: Individual and Written)**

Evaluate:

a. Have students trade papers and compare their answers to those of a partner's. Then display the correct answers and let the students grade the work but also ask questions about those problems that were incorrectly done. **(Integrating Processes: Listening; Application: Promotes engagement)**
b. A vocabulary test can be given to the ELLs over the words stressed in this lesson.

Assessment

For mastery, students will score:

- 13 points or higher on the map assignment for a social studies grade.
- 80% or higher on the math worksheets (Indus Inch and Is Zero Nada?) for math grades.
- 80% or higher on filling in the A Short History of Zero Writing Assignment (Cloze paragraphs for ELLs) for a reading and writing grade.
- 4 or higher on the 6 Traits Writing Rubric for Content and Ideas for paragraph written on cultural diffusion for a reading and writing grade.
- 80% or higher on Vocabulary Test of the vocabulary words or a reading, mathematics and social studies grade.

Extensions

Have students read about the Tower of Brahma puzzle. Then show the website (<http://www.sdmath.com/hanoi.html>) on the classroom computer or take the students to the computer lab. Let the students play the computer version of the Tower of Brahma.

Show the YouTube video

(<http://www.youtube.com/watch?v=kbQcGdyT86M&list=LPhQ6TDsKgVcA&feature=plcp>)

on Kolams. Have students share orally with their partners how the Indians create these designs. Distribute the worksheet on Kolams. Go over the



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Indian vocabulary for dot, row, straight, and centered. Add these new words to the word wall. Then have students work in groups of three to complete the worksheet.

Included are 2 types of early writing (Brahmi and Sanskrit) that was used in ancient India. Students can compare this to what our present day number system. Students can practice their math facts or use these to decorate their games.

Sources

Maps

World Map from Arizona Geographic Alliance
<http://geoalliance.asu.edu/sites/default/files/maps/world-at.pdf>

Video:

World Population

<https://www.youtube.com/watch?v=khFjdmp9sZk&t=19s>

Father of Hindu Arabic number system

<http://www.youtube.com/watch?v=wb4Npexda4A>

Websites:

"O (zero)" Wikipedia. Retrieved March 2019 from

<https://en.wikipedia.org/wiki/0>

O'Connor, JJ and EF Robertson. A history of zero.

Retrieved July 2013 from <http://www-history.mcs.st-and.ac.uk/HistTopics/Zero.html>

"Who Invented Zero?" Retrieved March 2019, from

<https://www.livescience.com/27853-who-invented-zero.html>

Other Sources are listed on lesson plan and worksheets.