The Rajah's Rice: Comparing India's Population Over Time

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Grade Level	8
Duration	2-3 class periods

National Standards	AZ Standards	Arizona Social Studies 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.	**ELA** **Reading** **Key Ideas and Details** 8.RI.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text. 8.RI.3 Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories). **Craft and Structure** **8.RI.4** Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **Writing** **Text Types and Purposes** **8.W.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with well-chosen, relevant facts, definitions, concrete details, quotations, or other information and examples. c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style. f. Provide a concluding statement or section that follows from and supports the information or explanation presented. **MATHEMATICS**	**GEOGRAPHY** **The use of geographic representations and tools helps individuals understand their world.** 8.G1.1 Use geographic tools and representations to analyze historical and modern political and economic issues and events. Key tools and representations such as maps, globes, aerial and other photos, remotely sensed images, tables, graphs, and geospatial technology **Human-environment interactions are essential aspects of human life in all societies.** 8G2.2 Evaluate how political, social, and economic decisions throughout time have influenced cultural and environmental characteristics of various places and regions.

Expressions and Equations
8.EE.A.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions
Statistics and Probability
8.SP.A.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

SIOP Elements

Preparation	Scaffolding	Grouping Option
Adapting content Linking to background **Linking to past learning** Strategies used	Modeling **Guided practice** Independent practice Comprehensible input	**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:
B-8 summarizing the main ideas and supporting details from text.
Writing
Standard 1: The student will express his or her thinking and ideas in a variety of writing genres.
B-4: writing a paragraph based on research using topic sentences, main ideas, relevant facts, details, and concluding statements.

Overview

Students need to understand that squaring (using exponents) is not the same as doubling. A way to have students discover the difference is to use population over time as an example and to understand the consequences of population growing too quickly.

Purpose

In this lesson, students will learn about exponents through reading a folktale story from India. Students will be able to link math to social studies by analyzing population change over time and creating a graph to show their findings. This lesson contains strategies for teaching diverse learners (ELLs).

Key Vocabulary

line of best fit: a precise line drawn over the most data points possible

scatter plot: a graph that shows the relationship between two sets of data

line graph: a graph that shows change over time

outlier: a data point on a graph or in a set that is much bigger or much smaller than the next closest data point

population: all the people living in a particular place

Materials

- Paper
- Scissors
- Population of India (2016 and Historical)
- India population history
- Population Growth in India since 1901
- Rough Draft handout
- Final Draft handout
- 3 Jars
- Rice
- Vocabulary Cards and Vocabulary Test
- Graphing Checklist and Scoring Rubric
- Graphing paper (optional)
- The Rajah's Rice (see Sources)
- PowerPoint showing how to make the foldable
- Foldable Definitions for Inside
- Foldable Labels for Front Side

Objectives

The student will be able to:

1. Apply the properties of integer exponents to generate expressions to predict future population in India.
2. Graph population data using previous knowledge. Predict a line of best fit for the data.
3. Analyze population change over time by applying the properties of exponents to determine if growth is exponential.
4. Use the graph they created to write a paragraph explaining their prediction of India's population.

Procedures

Prerequisite Knowledge: Students should have been introduced the the basics of exponents. Students should know how to graph data points.

Before the lesson: Prepare the 3 jars of rice. Amounts in the jars will be exponential.

SESSION ONE

Engage:

1. Bring out 3 different sized jars filled with rice.
2. Ask students to predict how much rice is in each containter and write their prediction in their Interactive Notebook or on a slip of paper. **(Preparation: Linking to Background)**
3. Have students share some of their predictions.

Explore:

1. Read the story of The Rajah's Rice to the students.**(Grouping Option: Whole Class)**.
2. Have students converse (small groups and whole class) about the story and how it relates to mathematics and population. Continue by reading the section about the chess board from the story.
3. Share the exact number of grains of rice in each jars. Have students decide who was the closest to guessing the number in each jar.

Explain:

1. Write the vocabulary words for this lesson on the whiteboard. Hand out copies of the vocabulary cards to those who may want and/or need them. Instruct them to put the cards in their Interactive Notebooks. Review the meaning of the vocabulary words with the whole class.
2. Next review what is an exponent. Model how to create a foldable on exponents by showing the PowerPoint. Guide students in creating their own foldable. **(Scaffolding: Guided Practice)**
3. Ticket Out of the Room: Have students turn to a shoulder partner and share their foldable.

SESSION TWO

Elaborate:

1. Divide students into groups of four. **(Grouping Option: Small groups)**
2. Explain that students will be using several resources to create a graph and statement about the population of India. There will be rough draft and a final draft.
3. Distribute the Graphing Checklist and Scoring Rubric as well as the Rough Draft handout. Now distribute the three sources of data: Population of India (2016 and Historical), India population history, and Population Growth in India since 1901.
4. Explain the requirements of the graph by reviewing the checklist. Emphasize the idea that students must analyze the three sources of data and come to a consensus with their group to

determine the most appropriate way to design their graph. The graph will be drawn in the top section of the Rough Draft handout. Students will work in table groups together, but must create their individual graph.
(Integrating Process: Listening)

5. Now explain the writing prompt which will be completed in the lower section: "Describe the population trend of India using mathematical terms. Predict the population trend of India for the next 2 years."
6. Provide time for students to create a rough draft based on the collaboration of their group.
7. Rough drafts that are not completed will be homework.

SESSION THREE

Evaluate:

1. Review Graphing Checklist and Scoring Rubric one more time and have students peer edit within their small groups.
1. When students are ready, they can complete the final draft of their graph and paragraph.

Assessment

ELA and Geography
Mastery will be considered:

- A score of 80% or higher on the Vocabulary Test.
- 12 out of 16 points on the Scoring Rubric for the paragraph.

Mathematics and Geography

- A "Yes" in Teacher Column for 8 of the 10 criterial needed for the graph.

Extensions

1. Students can create a digital representation of their graph.
2. Students can compare India's population to the United States or another country.
3. Students can create a population pyramid. See http://geoalliance.asu.edu/poppyramids
4. Students can find different information to create a linear graph.
5. Use one of the websites below to get the current population information.

Sources

Population information obtained from:
http://www.worldometers.info/world-population/india-population/

http://countrymeters.info/en/India

infochangeindia.org

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Berry, D. (1994). *The Rajah's Rice A Mathematical Folktale from India.* New York, NY: W. H. Freeman and Company.