**The Rice Project: One Community, One Grain of Rice, One Person**

***Understanding Statistics, Data Analysis, Measurement, Fractions, and Ratio and Proportion Using Data and Rice***

**Project Overview and Summary:**

We live in a data driven world which regularly impacts our lives. Yet our adult education students often lack the fundamental skills to read, interpret, form opinions about, and reach conclusions based on the data represented in graphs, pie charts, and statistical information. The goal of this lesson is to give participants the opportunity to connect with data about their community in a unique and tangible way—to make the intangible tangible.

The Rice Project is intended to engage students in hands-on activities to create models of community data using rice. Student will explore and engage in “critical thinking and analysis” after measuring, touching, and creating representational models from government data.

This lesson will unlock the wonder and meaning behind numbers to help students build the critical thinking and math skills necessary to make connections to information in a personal and meaningful way.

By harvesting and accessing local population data, students will have the opportunity to explore questions such as: How do shifting ethnicities impact a community? Why do demographics shift over time and what are the implications of those shifts? How, in turn, does this affect ecological systems, governance and municipal systems such as schools, water, public utilities, pollution control, health and wellness services, other public infrastructures, governing bodies, and the overall structure and make-up of a community?

Additionally, these techniques are transferable. They can be used to represent and analyze data from any field of study, from history to biology to math, and so on. In this lesson students will learn and practice data representation and data analysis skills. Through working with the lesson data, by creating bar graphs and charts, using fractions, measurement, and ratio and proportion related to the data, students will build the foundational and mathematical skills that are the underpinnings of data analysis.

**Career and College Readiness Standards**

Math.Practice.MP4 Model with mathematics.

Math.Practice.MP5 Use appropriate tools strategically.

Develop understanding of fractions as numbers

* Demonstrate understanding that a fraction can be represented as part of the set, given some number of items.
* Understand a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a/b* as the quantity formed by a parts of size 1*/b*. (3.NF.1)
* Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. (3.NF.3)

Represent and interpret data

* Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2.MD.10)

Analyze proportional relationships and use them to solve real-world and mathematical problems.

* Recognize and represent proportional relationships between quantities. (7.RP.2)

Summarize and describe distributions

**Life Science**

Ecology

* Recognize that models are representations of processes but are not the real thing, e.g., water use or the cycles of carbon in the environment. (E5. 1b)
* Integrate information provided by the words in a text with a version of that information expressed graphically. (E5. 3b)
* Use appropriate tools (e.g., charts, tables, mathematics, graphs) to analyze relationships between variables that might cause populations within an ecosystem to fluctuate over time. (E3.5a)

Evolution and Biodiversity

* Contribute to a discussion about ways in which humans from various cultures use plants for food, shelter, medicine and clothing. (EB6.1a)
* Design, evaluate and refine a solution for reducing the impacts of human activities in the environment and biodiversity. (EB5.6a)

**Objectives: Students will be able to. . .**

* Create models that represent numerical data.
* Represent the ethnic composition of a city in percentages.
* Make predictions, estimations and inferences, and draw conclusions based on data models.
* Represent data in bar graphs and pie charts.
* Demonstrate that fractions represent parts of the set, given some number of items.
	+ Use fractional components to describe the set.
	+ Identify the fraction relationships associated with the set.
* Use their data representations to make connections to social and scientific challenges and issues.
* Identify, write and compare ratios.
* Find equivalent ratios and identify proportions.

**Materials List:**

* White board or large post-it paper
* 1- 20 pound bag uncooked rice
* 4- one cup measuring cups
* 4- sets of measuring spoons: tablespoons and teaspoons
* White paper (8 1/2 x 11)
* Graph paper
* Scissors
* Ruler
* Colored pencils
* Scotch tape
* Index cards
* Black marker
* Pens/pencils
* Measurement Equivalencies Worksheets (Teacher and Student)

**Activity 1: Understanding Ethnicity**

**Step 1:** Use examplesto explain that communities are made up of different ethnicities.

**Step 2: Define Ethnicity**

“Ethnicity or ethnic group is a social group of people who identify with each other based on common ancestral, social, cultural, or national experience.” (Wikipedia)

**Step 3:** On a whiteboard or post-it paper, brainstorm different ethnic groups anywhere in the world. Examples: Hispanic, Mongols, Russian, Irish, Somali, Polish, French, Chileans, Danish, Caucasian, etc.

**Step 4:** Brainstorm a list of the ethnic groups in your community. (Students may want to guess the numbers or percentages for the groups before researching.)

**Activity 2: Research and Application**

**Activity Goal:** Research accurate ethnicity data for the community you intend to study. Create a 3d model of the ethnicity data using rice.

**Materials:**

Blank 8 ½ x 11 white paper, measuring cups, conversion/equivalency handout, set of measuring spoons, rice and index cards.

Step 1: Introduce the concepts involved in the Rice Project:

**One Grain of Rice Represents One Individual**

Step 2: Hand out community population data broken down by ethnicity

Step 3: Hand out one sheet of 8 ½ x 11 white paper for each item in the data set you are working with.

Example: If there are six ethnic groups in the data set, you need six pieces of paper.

Step 4: At the bottom of each piece of paper create a label by writing the name of the item and raw number that students plan to represent.

 For example:

* Sheet 1: Hispanic Population, Holyoke, MA: 19,000
* Sheet 2: Caucasian Population, Holyoke, MA: 19,000
* Sheet 3: Asian Population, Holyoke, MA: 400
* Sheet 4: African American Population, Holyoke, MA: 1,400
* Sheet 5: Two or more races, Holyoke, MA: 240
* Sheet 6: American Indian alone, Holyoke, MA: 100
* Sheet 7: Other race alone, Holyoke, MA: 90

**Activity 3: Introduce measurement and fractions**

Step 1: On a whiteboard write and explain that one cup of rice equals 10,000 people. Tell students that, as a class, they will figure out the number of grains of rice in smaller and smaller units of measurement.

**Teacher chart with answers…**

|  |  |
| --- | --- |
| One cup of rice equals  | 10,000 people |
| ½ cup of rice equals  | 5,000 people |
| ¼ cup of rice equals  | 2,500 people |
| 1/3 cup of rice equals  | 3,333 people |
| 2/3 cup of rice equals  | 6,666 people |
| **(4 tablespoons equals ¼ cup)** |  |
| 1 tablespoon of rice equals  | 625 people |
| **(3 teaspoons equals 1 tablespoon)** |  |
| 1 teaspoon of rice equals  | 208 people |
| ½ teaspoon of rice equal  | 104 people |
| ¼ teaspoon of rice equals  | 52 people |
| 1/8 teaspoon of rice equals  | 26 people |

**Student chart to fill out ….**

|  |  |
| --- | --- |
| One cup of rice equals  | 10,000 people |
| ½ cup of rice equals  |  |
| ¼ cup of rice equals  |  |
| 1/3 cup of rice equals  |  |
| 2/3 cup of rice equals  |  |
| **(4 tablespoons equals ¼ cup)** |  |
| 1 tablespoon of rice equals  | 625 people |
| **(3 teaspoons equals 1 tablespoon)** |  |
| 1 teaspoon of rice equals  |  |
| ½ teaspoon of rice equal  |  |
| ¼ teaspoon of rice equals  |  |
| 1/8 teaspoon of rice equals  |  |

Ask students to measure how many ½ cups of rice equal **one cup of rice**. Have them write the answer on the **Student Measurement Worksheet.**

Do the same for each of the measurements. Write the answers on the **Student Measurement Worksheet.**

**Leveling:** Teach the idea/concept of leveling when measuring. Demonstrate what leveling means and invite students to practice.

**Differing calculations—Teachable moment:** What if students come up with different numbers of tablespoons that equal ¼ cup? Ask the question: WHY? Which calculation is correct and why?

**Rounding up the data:**

For this project, I rounded up the data to make it easier to measure and represent. (See below). You may want to do the same depending on your data set.

Actual Data Verses Rounded Up Data:

* **Hispanic Population in Holyoke**: **round to nearest thousand: 19,000:** 18,916 (47.4%)
* **Caucasian Population: round to nearest thousand: 19,000:** 18,790 (47.1%)
* **Asian Population in Holyoke: round to nearest hundred: 400:** 383 (1.0%)
* **African American Population in Holyoke: round to nearest hundred: 1,400:** 1,367 (3.4%)
* **Two or more races: round to nearest 10: 240:** 242 (0.6%)
* **American Indian alone: round to nearest hundred: 100:** 107 (0.3%)
* **Other race alone: round to nearest 10: 90:** 92 (0.2%)

**Activity 4: Data Analysis and Interpretation**

**Once the data models are created with rice, students are invited to interpret the data and draw meaning from the activity.**

**Questions for Discussion:** For all questions, encourage student to explain their reasoning.

* Describe what you see when you look at the data models. Which mounds of rice were similar? Which were different?
* Can you use any math words to describe the relationships you see?
* What conclusions would you draw from the data? What does it tell you? Why do you think that?
* What inferences can you make from data? Please explain your thinking.
* What predictions can you make? Why?
* How does what you see compare to what you thought before creating the models?
* Invite students to summarize the activity. What do they think it was about? Can they think of other areas where a similar technique would help them understand numbers?

**Activity 5: Representing the Data with Graphs**

Bar graph:

After students create and analyze the data using rice and discuss the critical thinking questions about their findings, they can turn their three-dimensional data into 2-D bar graphs. This exercise helps students understand that data can be represented in multiple formats, but each format still describes the same information.

**Materials:**

Pencil, colored pencils, graph paper and ruler.

Step 1: Hand out graph paper, rulers, colored pencils and pencils.

Step 2: X and Y axis. Invite students to create an X and Y axis on their graph paper. I use the phrase: “Y to the Sky” to help students remember Y is on the vertical axis and X is on the horizontal.

Step 3: Create a number scale on the Y axis going up in increments of a hundred.

**Step 4:** Create the X axis charts to include the ethnicity data from the rice exercise. My categories would include:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Hispanic | Caucasian | African American | Asian | American Indian | Two or more races | Other race alone |
| 19,000 | 19,000 | 1,400 | 400 | 100 | 240 | 90 |

Invite students to color in the information on the X axis (see above).

**Step 5: Questions and Connections**

Once students have created a bar graph using the ethnicity data, invite them to answer the following questions:

1. Describe what you see when you look at the bar graph and the rice representation?
2. What do you notice?
3. Compare and contrast the two representations of the data.
	1. Was one representation of the data easier to understand? Why?
	2. Were you able to make more, or different inferences from one of the representations of the data? If yes, why do you think that was?

**Enhancement Activity: Vocabulary Word Wall**

Word wall: science concepts and vocabulary in the Rice Project. Remind students that these words will most likely appear on the HiSET test

* Analysis, Data Analysis, Statistical Analysis
* Visual representation
* Interpretation, Interpretation of Data
* Inference
* Conclusion
* Prediction
* Prior knowledge
* Bar graph
* Pie chart
* Measurement
* Fraction
* Percentage
* Ratio
* Quantity
* Proportion
* Equivalent

**Resources for Educators**:

To make data relevant and meaningful to students, we suggest the following links to access local data and statistics by ethnicity by city or town:

* http://www.city-data.com/ **Type in name of city or town**
* Type name of town or city: http://.city-data.com/city/ **NAME OF CITY -**Massachusetts.html

<http://www.city-data.com/city/Holyoke-Massachusetts.html>

<http://www.city-data.com/city/Boston-Massachusetts.html>

<http://www.city-data.com/city/Lynn-Massachusetts.html>

* Worksheets and websites for teaching measurement equivalencies:

<http://www.sophia.org/tutorials/relating-teaspoons-and-tablespoons--6>

<http://www.factmonster.com/ipka/A0001723.html>

* List of Modern Ethnic Groups website:

You can find the ethnic composition of communities in Massachusetts at the following website:

<http://en.wikipedia.org/wiki/List_of_modern_ethnic_groups>