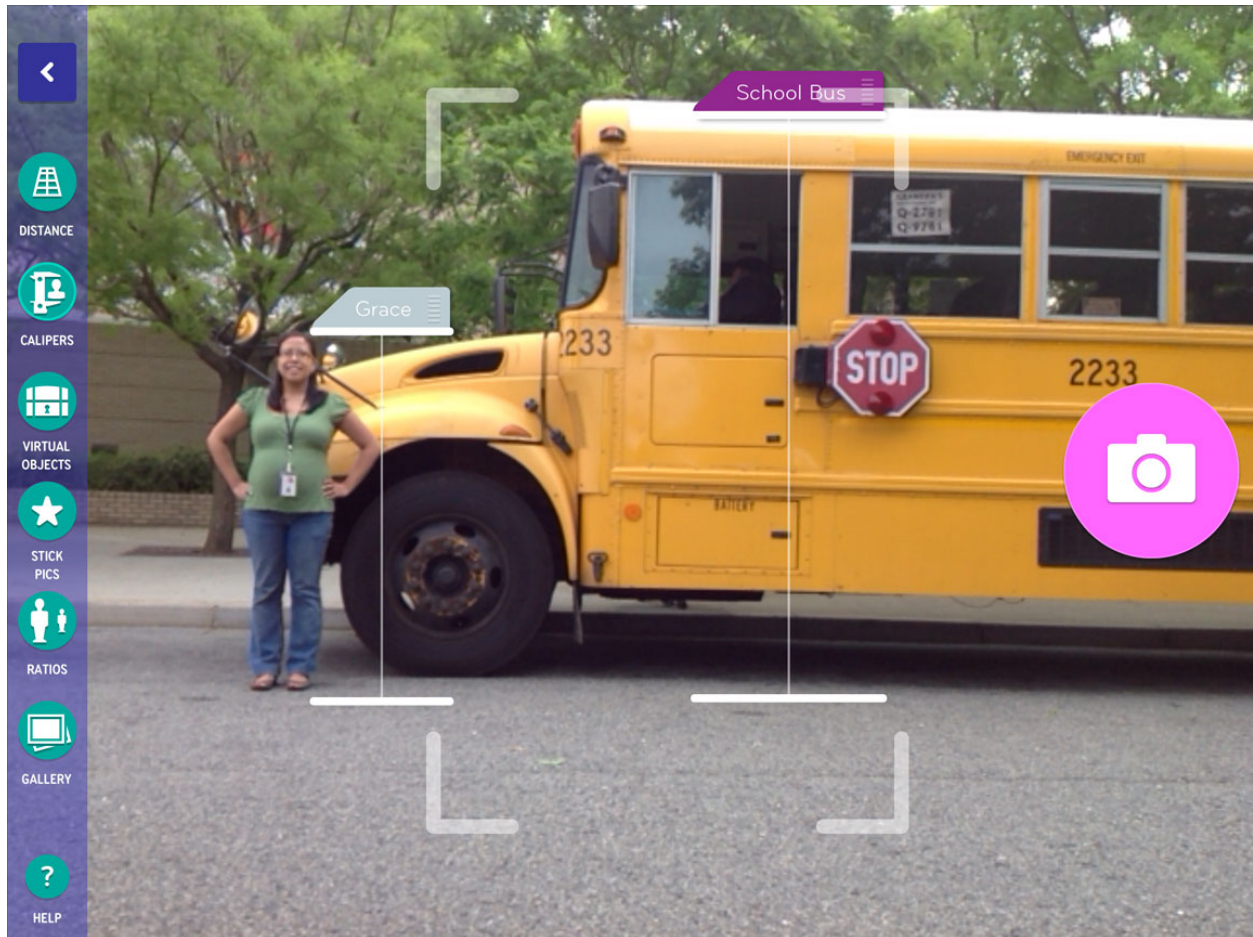


Size Wise Activity 2: You Are The Ruler

Measurement Through Ratios

Overview

Students will use the caliper tool to determine the height of larger or smaller objects using their own heights as a comparison.



Big Idea

Ratios are useful for figuring out the dimensions of the world around you. In this activity, students will get to estimate the heights of things by standing next to them, taking a picture, and then analyzing the relative heights in the image. Calculations can be made using images to make estimations of the heights of these objects. Having one known quantity, your height, enables students to figure out what other object heights are in the image.

Have students notice if they stand next to an object in a picture and its image is three times the size of your image then the object must be approximately three times the size of your height. Ratios can be represented using different kinds of language. If the object is 3 times larger then the student is $\frac{1}{3}$ of its size.

Learning Objectives

Students will use ratios to solve real world problems that pertain to investigating dimensions in the world around them.

Students will be able to:

- Use ratios to represent the relationship between two quantities.
- Follow a multi-step procedure when performing technical tasks.

Vocabulary

- Ratios
- Calipers

Grades

6-8, middle school

Standards Addressed

Common Core State Standards-Math

Ratio and Proportional Relationships

6.RP.A.1. Understand the concept of ratio and use ratio language to describe a relationship between two quantities.

Common Core State Standards-Math

Mathematical Practices

MP2 Reason abstractly and quantitatively.
MP4 Model with mathematics.

Common Core State Standards-ELA

Literacy

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Classroom Strategies

Single-device implementation

Take a series of photographs of a person next to a range of tall objects. Have students discuss how they might figure out how tall the objects are. Share examples via your smart board or projector and discuss what children notice about how knowing one quantity helps you solve for another.

Multiple-device implementation

Because this activity requires collaboration, this is a perfect activity for pairs. Have students photograph themselves next to a variety of objects. Be sure they measure the subjects in the photos they take so they have the data they need to estimate the heights of other objects.

Tips and Tricks

Students might remember from previous activities that their image size changes as they move farther away or closer to the camera. To make this technique work, students will have to be the same distance from the camera as the object they're measuring, or their image size will be distorted. One student will have to stand right next to the objects or perhaps flat against them (if they're measuring a building or a tree.) Also, the photographer needs to hold the camera perpendicular to the floor and not tilt it up or down.

Urge students to take care both when they take their photos and when they adjust their calipers. The data they'll get is only as good as their measurement techniques.

App Features

In Camera Mode, you will use:



To enter and calibrate the height of individual and/or group members.



To reflect on the things they notice about the pictures they take.



To see how image sizes of subjects/objects relate to one another.

In Gallery mode, you can use:



To compare data across pictures (e.g., distances one had to stand to get different image sizes).



To write ratios seen in photos taken.

Expected Activity Time

Part 1: How Tall Is It? (20 minutes)

Part 2: How Short Is It? (20 minutes)

Materials and Prep

- You Are The Ruler Student Sheets
- 1 iPad with Size Wise app for each group of 3-4
- Wifi access to send work to other iPads and to online project space
- Measuring Tapes
- Prep: Ensure that your classroom has some tall objects, architectural details, etc. to photograph. You may want to plan to go outside for trees and buildings.

Activity Prompt

Sometimes the world looms large around you, but how can you figure out how tall things actually are? Surveyors do this all the time. Collect data about the size of objects in the world around you by photographing yourself next to things large and small. Use your findings to estimate their real world measurements.

Part 1: How Tall Is It? Figure out the heights of some tall buildings, trees or other things in your vicinity using yourself and the calipers.

Part 2: How Short Is It? Figure out the heights of things that are shorter than you in your vicinity.

To Do

Part 1: How Tall Is It? (20 minutes):

Have students:

- Find something that's quite a bit taller than them and stand right next to it.
- Open the app, and select "Take Some Pics." Have a friend take a full body picture with the full height of the tall object also in the frame. Remind them not tilt the camera up or down.
- Repeat with a few other tall things until

they have a collection of images in the gallery to examine.

- Create an Image Size Caliper, in the Gallery, for the object that they would like to know the height of. Create a caliper for them by tapping on "Calipers" and then "Add New Friend Or Object". Students enter their names and real heights.
- Use the Ratio Tool to see the ratio of their image heights in relation to the images of the object they want to measure. Students use this information to figure out the heights of the objects they have photographed.
- In the Gallery, use the Write Ratios tool to represent their data.

Part 2: How Short Is It? (20 minutes):

Have students:

- Find some objects that are shorter than they are and take pictures standing next to them.
- As they did before, have students analyze the pictures using the calipers in the gallery and figure out the heights of the objects.
- After they figure out the heights of the objects, use an actual ruler to measure the heights and compare those measurements with the heights they found. Are they the same? Why or why not?

Discussion

Prompt students to use ratio reasoning to determine the size of tall objects around them. Encourage students to determine how many times larger or smaller an object is in relation to another.

- How many times larger/smaller is one object than another?
- Is there a mathematical way to represent this relationship?

Language and discourse to listen for:

- 25% the size of _____
- 1.5 times larger than

Extensions and Inquiring Further

Have students do some research into what surveyors and other professions do to figure out the dimensions of really large things.

Name: _____

Date: _____

Part 1: How Tall Is It?

Figure out the heights of some tall buildings, trees or other things in your vicinity using yourself and the calipers.

- Open the Size Wise app and choose “Take Some Pics.”
- Find something that’s quite a bit taller than you and stand right next to it.
- Have a friend take a picture of you, full body with the full height of the tall object also in the frame. Do not tilt the camera up or down.
- Repeat this with a few other tall things until you have a collection of images in the Gallery that you can examine.
- In the Gallery, create an Image Size Caliper for the object that you would like to know the height of. Create a caliper for yourself by tapping on “Add New Friend Or Object”, and entering your name and your real height.
- Use the Ratio Tool to see the ratio of your image in relation to the image of the object you want to measure. Use this information along with your height to help you figure out the real heights of the objects you have photographed.
- In the Gallery, use the Write Ratios tool to describe the relationships.

Part 2: How Short Is It?

Figure out the heights of things that are shorter than you in your vicinity.

- Find some objects that are shorter than you and take pictures standing next to them.
- Analyze the pictures using the Calipers in the Gallery and figure out the real heights of the objects as you did with the last activity.
- After you figured out the heights of the objects, use an actual ruler to measure the heights and compare those measurements with the heights you found.
- Are they the same? If not, why not?