Lesson 2: If our class were the world

Goals

- Apply reasoning about percentages and equivalent ratios to analyse and approximate characteristics of the world's population.

- Generate (orally and in writing) mathematical questions about the world's population, e.g., "How many people . . . ?"

- Present (using words and other representations) a comparison that uses the number of students in the class to represent the proportion of the world's population with a particular characteristic.

Lesson Narrative

This lesson is optional. In this lesson, students look at ratios of different populations in the world and determine what their class would be like if its ratios were equivalent. In the process, they again work with percentages that are not whole numbers, using knowledge gained in a previous unit. Moreover, the ratios will be "close" to being equivalent because the exact world population is not known and all populations need to be whole numbers. The activities in this lesson could take anywhere from one to four days, depending on how much time is available and how far the class takes it. Earlier activities are needed for later ones in this lesson. A variant on this activity involves developing, administering, and analysing a survey: If the *school* were our class. Students brainstorm some questions they would like to know about the students in their school. Questions might include:

- How many people in the school play an instrument?

- How many people in the school eat school lunches?

- How many people in the school ride the bus to school?

- How many people in the school have a mobile phone?

- How many people in the school plan to attend a four-year college or university?

- How many people in the school were born outside of this county?

- How many people in the school have travelled outside of this country?

As with all lessons in this unit, all related standards have been addressed in prior units; this lesson provides an *optional* opportunity to go more deeply and make connections between domains.

Addressing

- Calculate fluently with multi-digit numbers and find common factors and multiples.

- Understand ratio concepts and use ratio reasoning to solve problems.

Instructional Routines
• Discussion Supports

Required Materials
Four-function calculators
Internet-enabled device
Tools for creating a visual display
Any way for students to create work that can be easily displayed to the class. Examples: chart paper and markers, whiteboard space and markers, shared online drawing tool, access to a document camera.

Required Preparation

Internet-enabled devices are only necessary if students will conduct research to find quantities that they need to know. As an alternative, you can supply the information when they ask for it.

Tools for creating a visual display are only needed if you would like students to present their work in an organised way and have the option of conducting a gallery walk.

Student Learning Goals

Let's use maths to better understand our world.

2.1 All 7.4 Billion of Us

Optional: 10 minutes

In this activity, students review work with percentages and arithmetic from earlier units. It also gives them a framework for thinking about the next activity. Students have to decide how to treat a situation in which ratios are approximately equivalent. People can only be reported in whole number quantities, and students need to decide how to round numbers appropriately as a result.

Instructional Routines
• Discussion Supports

Launch

Give students 5 minutes of quiet think time followed by a whole-class discussion. Provide access to four-function calculators.

Anticipated Misconceptions

For the third question, students may not recognise that the ratio of people from Africa to the world population is only approximately equal to the ratio of students in the class from Africa to the total number of students. Ask these students *about* how many people they think live in Africa.

Student Task Statement

There are 7.4 billion people in the world. If the whole world were represented by a 30-person class:

- 14 people would eat rice as their main food.

- 12 people would be under the age of 20.

- 5 people would be from Africa.

1. How many people in the class would *not* eat rice as their main food?

2. What percentage of the people in the class would be under the age of 20?

3. Based on the number of people in the class representing people from Africa, how many people live in Africa?

Student Response

1. 16. There are 30 students and 14 eat rice as their main food, so the other 16 do not eat rice as their main food.

2. 40% since $12 \div 30 = 0.4$

3. About 1.2 billion. About 16.7% of the world's population live in Africa since $5 \div 30 = 0.167$, and 16.7% of 7.4 billion is about 1.2 billion.

Activity Synthesis

Make sure that students recognise 12 students out of 30 as a benchmark percentage. Point out to them that the fraction $\frac{12}{30}$ is equal to $\frac{2}{5}$ (a benchmark fraction) and also to $\frac{40}{100}$ (showing 40% explicitly).

For the third question, ask students if the ratio for the world population is *equivalent* to the population for people in the class. The answer is no. But 7.4 billion is only an approximate value of the population, so what we are looking for here is a value of people from Africa that gives a ratio close to 5 out of 30 (or equivalent).

Speaking: Discussion Supports. As students describe their strategies for calculating the number of people that live in Africa, revoice student ideas to demonstrate mathematical language use. Press for details in students' explanations by requesting that students challenge an idea, elaborate on an idea, or give an example. This will help students to produce and make sense of the language needed to communicate their own ideas.
Design Principle(s): Support sense-making; Optimise output (for explanation)

2.2 About the People in the World

Optional: 10 minutes

Students brainstorm quantitative questions about the world and submit their best ideas to the class. For the next classroom activity, compile all of the questions into one document, removing inappropriate questions. Either do the necessary research, provide resources that students can use to find the needed information, or let students do the research themselves, depending on time and internet access.

Note that some student ideas may be challenging to research (for example, how many people in the world have a car?). If there is no chance to gather data beforehand, encourage students to make some simplifying assumptions with the data that they do find.

Launch

Arrange students in groups of 2–4. "We are going to investigate the world population. Think about what you would like to know about all the people of the world!"

Student Task Statement

With the members of your group, write a list of questions about the people in the world. Your questions should begin with "How many people in the world. . ." Then, choose several questions on the list that you find most interesting.

Student Response

Answers vary. Sample responses:

- How many people in the world live on each continent?

- How many people in the world are adults?

- How many people in the world own a car?

- How many people in the world can read?

- How many people in the world speak more than one language?

- How many people in the world have a mobile phone?

- How many people in the world play or have played football?

Activity Synthesis

Invite students to share which questions they are *most* interested in investigating. Ask them how they might learn more about a given topic and how easy or hard it might be to find the information. The most likely resource is the Internet and some populations will be easier to investigate than others. For example, it is not difficult to find information about the number of cars in the world (more than 1 billion but well less than 2 billion). But this does not answer how many people own a car, and that data can be very difficult to find. Encourage students, in preparation for investigating these questions, to make some reasoned assumptions with the data that they can find to make their best estimate. For the car example, they might assume, for example, that 1 billion people in the world own a car.

2.3 If Our Class Were the World

Optional: 30 minutes

If students investigated the answers to their questions in the previous activity, they need access to their findings. They can either work with the questions generated by their group, or everyone can work from a master list of questions compiled by the teacher.

If students have access to a spreadsheet program, they can use it to find the results. Students need to communicate their findings clearly in graphical displays. They can choose to illustrate all or some of the questions in their graphical displays. Encourage the students to be creative with their displays. For example, if students are examining the question "How many people would live on each continent?" they might sketch the continents and place stick figures on the continents to represent the class. They might also draw a bar graph showing the same information in a different way.

Launch

Students work in same groups of 2–4 from previous activity. Provide access to four-function calculators. If students are doing their own research, provide access to internet-enabled devices. If conducting a gallery walk at the end, provide access to tools for making a visual display.

To give students a sense of the magnitude of the world versus the classroom, consider zooming in from Earth to the United Kingdom, England, your county, your town, and finally your school.

Invite students to work on the question or questions that are of most interest to them either from their own group work on from the compiled list.

Action and Expression: Internalise Executive Functions. To support development of organisational skills, check in with students within the first 2–3 minutes of work time. Check to make sure students are beginning to choose characteristics about the world's population that are available to find, and that they can calculate percentages for the class for those characteristics.
Supports accessibility for: Memory; Organisation

Anticipated Misconceptions

Students may struggle with the difficult numbers for the percent of the world population with different characteristics. For example, there are about 1.2 billion people living in Africa. Ask them to calculate $1.2 \div 7.4 \approx 0.162$. "What percent of the world population this is?" (16%). "If our class were the world, then about 16% of the class would live in Africa. So how many students in our class would live in Africa?" (Since 16% of 25 is 4, that means that 4 students in our class would live in Africa.)

In some cases, there might be two acceptable answers to how many students in our class have a certain characteristic. About 10% of the world population is in Europe. For our class,

we could have 2 students (8%) or 3 students (12%) that are in Europe. Either one is an acceptable answer. Make sure that students understand that 2.5 (10% of 25) is not a reasonable answer.

Student Task Statement

Suppose your class represents all the people in the world.

Choose several characteristics about the world's population that you have investigated. Find the number of students in *your* class that would have the same characteristics.

Create a visual display that includes a diagram that represents this information. Give your display the title "If our class were the world."

Student Response

Answers vary. Sample response (based on a class of 25 students):

- 800 million people do not have access to clean water. That is about 11% of the world population. If our class were the world, that would mean that about 3 of us (12%) would not have access to clean water.

- 300 million people play football. That's about 4% of the world population. If our class were the world, that would mean that 1 of us (4%) would play football.

- 2.2 billion people practice Christianity. That's about 30% of the world population. If our class were the world, 7 (28%) or 8 (32%) of us would practice Christianity.

- 4.4 billion people live in Asia. That's about 59% of the world population. If our class were the world, 15 (60%) of us would live in Asia.

- 6.6 billion people can read and write. That's about 89% of the world population. If our class were the world, 22 (88%) of us would be able to read and write.

- 1.9 billion people are children (under the age of 15). That's about 26% of the world population. If our class were the world, 6 (24%) or 7 (28%) of us would be children.

Activity Synthesis

Invite groups to share their displays. Consider doing a gallery walk and asking:

- Were you surprised by any of your findings?

- In what ways is the class actually representative of the world? (possibly gender distribution, religious adherence, etc.)

- In what ways is it not? (age, place of residence, access to clean water, etc.)

Make sure to highlight the fact that having a small class limits the percentages that are possible. This can make deciding how many students in the class have a particular characteristic difficult. Consider asking:

- What percentages are possible for students in the class? (0, 4, 8, . . . multiples of 4 up to 100)

- There are 1 billion people living in the Americas. That's a little more than 13.5% of the world population. If our class was the world, how many students in our class would be from the Americas? (3 students would be 12%, and 4 would be 16%. So 3 students is as close as we can get.)