

## *The Next Billion*

- I. Overview**
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- III. Teacher to Teacher**

### **I. OVERVIEW**

#### **Lesson Summary**

In 1999 the world population passed the 6 billion mark. In this lesson, students predict when it will reach 7 billion. To do so, they use an on-line counter that simulates the changing world population. They time the counter to find how long it takes for the population to increase by, say, 50 or 100 people. They use that measurement to predict how long it would take for the population to increase by 1 billion. Students discuss the reliability of their predictions, compare them to past trends, and discuss social factors that can affect population growth.

**Grade Level**            6 – 8

**Estimated Time**    • Activity (Introduction, Activity, and Reflection) 2 periods  
                              • Extension - about 1 period

**Objectives**            • To apply proportional reasoning  
                              • To use a simulation to estimate and make predictions about world population growth  
                              • To look for patterns and draw conclusions about world population growth

**Web sites**

[www.pbs.org/sixbillion/](http://www.pbs.org/sixbillion/)

On this site students view a changing number that represents the changing world population. Another counter displays the number of babies born while the site is accessed. Students use this simulation to predict future world population growth and to consider issues related to population growth.

<http://www.census.gov/ipc/www/popwnote.html>

On this site students read about estimating world population growth. They learn that the simulation of population growth on the previous web site is not an actual count, but an estimate.

<http://www.undp.org/popin/wdtrends/p98/p98cht2.htm>

On this site students study a graph that shows future population growth based on 3 different assumptions concerning fertility rates. They can also compare the trends shown in this graph to the graph they created in the Extension section of this lesson.

**Materials**

- Clock with a second hand or a stopwatch
- Access to web sites used in this lesson
- Calculator

**NCTM Standards** Number and Operation, Measurement

## Outline

### A. Introducing the Activity

1. Discuss Continual Change
- 2 Observing Simulated Population Change
3. Using A Simulation to Estimate Population Change

### B. Doing the Activity

1. Predicting the Next Billion
- 2 Comparing Predictions to Past Trends

### C. Students Reflecting on the Activity

### D. Extension

## Vocabulary

Simulation - An experiment that models a real-life situation

### A. Introducing The Activity

#### 1. Discuss Continual Change.

Have students identify things that continually change, for example, their age and height, the date, the temperature outside, the position of the sun in the sky. Make a list of student responses.

*[Teaching Notes: Teaching notes, answers, and sample student responses are shown indented and in italics]*

#### Guiding Questions

- Do any of the items on the list ever stop changing?  
*[As an example tell students that their height increases as they get older, but at some point the growth stops.]*
- If an amount continually changes, does that mean it is always getting larger? Why or why not?  
*[No, because it could be decreasing all or some of the time.]*
- Can you name something that continually changes, but never decreases?  
*[Sample response: the age of the earth]*

## 2. Observing Simulated Population Change

Let students visit the web site <http://www/pbs.org/sixbillion/> to observe the changing world population. Students will also notice that the web site displays the number of babies born while they are viewing the site.

### Guiding Questions

As students observe these changing numbers, ask these questions:

- Do you think the computer is showing the exact number of people in the world? Why or why not?

*[Help students see that the computer is modeling population growth and not actually counting people. For a more detailed explanation have them visit the web site*

*<http://www.census.gov/ipc/www/popwnote.html>*

*Use this opportunity to discuss what a **simulation** does and doesn't do: it models what is happening or may happen, but it is only a representation and does not necessarily include all the details of the situation being modeled.]*

- Where does the information about population come from?

*[The data comes from census data and different countries.]*

- Do you think that every time 100 babies are born the world population increases by 100? Why or why not?

*[No, because deaths are also occurring.]*

- How would it be possible for the world population to decrease during one month?

*[If more people die than are born during that time.]*

- On the web page, which number is changing faster, the world population or the number of babies being born?

- Which number should be changing faster? Why?

*[The number of babies being born, because as births add to the population, deaths take away from it.]*

### 3. Using A Simulation to Estimate Population Change

Let students consider how they could use the web site to estimate how long it takes for 1000 babies to be born.

#### Guiding Questions

- About how much time do you think it will take for 1000 births?

*[Display students' estimates.]*

- How can we check these estimates?

*[Time the counter to see how long it takes to increase by 1000.]*

- How can we get a good estimate without timing the counter for such a long time?

*[Guide students to see that they can time how long it takes the counter to increase by, say, 50 or 100, and that they can multiply that figure by 20 or 10 to estimate the time for 1000 births.]*

*[Have students estimate the time for 1000 births by timing 50 or 100 births and multiplying.]*

#### Guiding Questions

- How did your original predictions for 1000 births compare to your calculated estimate?
- Which figure do you think is more reliable, your original prediction or your calculated estimate? Why?

*[The calculated estimate is more likely to be more accurate because it's based on a measured sample.]*

- How would you estimate how long it will take for 10,000 births?

*[Multiply the time for 1000 births by 10.]*

## B. Doing the Activity

### 1. Predicting the Next Billion

Organize the class into groups of 2-3 students and have them visit <http://www/pbs.org/sixbillion/> (the same site visited in *Introducing the Activity*). As students view the changing population on the opening page of this site, point out the following statement that appears there: *The world population reached 6 billion on October 12, 1999.* Explain to students that their job is to predict, as best they can, when the world population will reach 7 billion.

Students might begin by measuring the time for the population to change by 50. Then they might make a chart to keep track of each interval, converting seconds to minutes, minutes to hours, and so on as shown in this sample:

Increase in Population	Time
50	19 s
100	$19 \text{ s} \cdot 2 = 38 \text{ s}$
1000	$38 \text{ s} \cdot 10 = 380 \text{ s} \_ 6.3 \text{ min}$
10,000	$63 \text{ min} \cdot 10 = 63 \text{ min} = 1.05 \text{ h}$
1,000,000	$1.05 \text{ h} \cdot 100 = 105 \text{ h} = 4.4 \text{ days}$
1,000,000,000	$4.4 \text{ days} \cdot 1000 = 4400 \text{ days} \_ 12 \text{ yrs}$

Or they might first find the total number of seconds:

Increase in Population	Time
50	19 s
100	38 s
1,000,000,000	$36 \text{ s} \cdot 10,000,000 = 360,000,000 \text{ s}$

And then divide to find the number of years:

$$380,000,000 \text{ s} * 1 \text{ min}/60 \text{ s} * 1\text{hr}/60 \text{ min} * 1\text{day}/24 \text{ h} * 1\text{yr}/365 \text{ days} = 12 \text{ yrs}$$

The results above are samples. Students' results may vary depending on how they measure and round.

As students work on their predictions, observe and ask questions such as the following, in order to provide help and assess student progress.

## Guiding Questions

- How much change in population do you want to time?  
*[Guide students to time amounts that will be easy to work with, such as 25, 50, 100.]*
- How will you keep track of time as you watch the population grow?  
*[If a stopwatch isn't available, one person can watch the population numbers while the other looks at a watch or clock.]*
- How can you use your measurement to estimate the time for a change of 100? 1000? 100,000?  
*[Help students apply proportional reasoning. For example, if it takes 21 seconds for the population to increase by 100 people, it will take 210 seconds for the population to increase by 1000 people, because 1000 is 10 times 100. Or students may divide and multiply. For example, since  $21/100 = 2.1$ , it would take 2.1 seconds for the population to increase by 1 and  $2.1 \cdot 1000$ , or 210 seconds, to increase by 1000.]*

## Guiding Questions

Ask these questions about time and large numbers:

- How will you record and calculate with numbers in the millions?  
*[Sample responses: Use scientific notation. Use a scientific calculator.]*
- How will you convert seconds (or minutes) to years?  
*[Help children see how they can use division for this. See sample charts above.]*
- Do you need to include leap years?  
*[Help students see that leap years can be ignored because the population counter and the students' time measurements are not that precise.]*
- If it will take about 12 years for the seventh billion, in what year will the 7 billion mark be reached?  
*[2011]*
- If it will take about 12 1/2 years for the seventh billion, in what year will the 7 billion mark be reached?  
*[2012, if you use the October date for when 6 billion was reached.]*

## 2 Comparing Predictions to Past Trends

After students have made their predictions, have them look at the billion-benchmark data shown below. This chart can be accessed on the web site by clicking *Study Guide* and then *Did You Know?* and then scrolling to the end of the page.

In 1804; world population reached 1 billion
1927: 2 billion (123 years later)
1960: 3 billion (33 years)
1974: 4 billion (13 years)
1987: 5 billion (12 years)
1999: 6 billion (12 years)

### Guiding Questions

- What trend do you see in the population growth data?  
*[Sample response: The time needed to add a billion to the population has decreased and then leveled off at about 12 years.]*
- Does your prediction follow the trend? Explain.
- What could happen in the future to change the time it takes for the next billion?  
*[Students can find information about this question on the web site. Sample responses: Policies in large countries could affect the birth rate. Medical advances could help people live longer]*
- How could the chart be correct even though it shows 13 years instead of 14 years from 1960 to 1974?  
*[The 3-billion benchmark could have been reached near the end of 1960 and the 4-billion benchmark near the beginning of 1974.]*
- Could the chart be correct even though it also shows 12 years instead of 13 years from 1974 to 1987? Why not?  
*[If the 4-billion benchmark was reached near the beginning of 1974, then it would be 13 or 14 years to any part of 1987.]*

### **C. Students Reflecting on the Activity**

Pose questions like the following to encourage students to evaluate their predictions, to critique the methods they used, and to draw conclusions about population growth and related social issues. Use students' responses to help assess their understanding.

- Do you think using the simulation for population growth gave you a good estimate of when the world population will actually reach 7 billion? Why or why not?
- Are you pleased with the methods you used to predict when the population would reach 7 billion? If so explain the methods you used. If not, explain what you would change and why.
- During which "billion benchmark" year would you have most liked to live? Explain why.

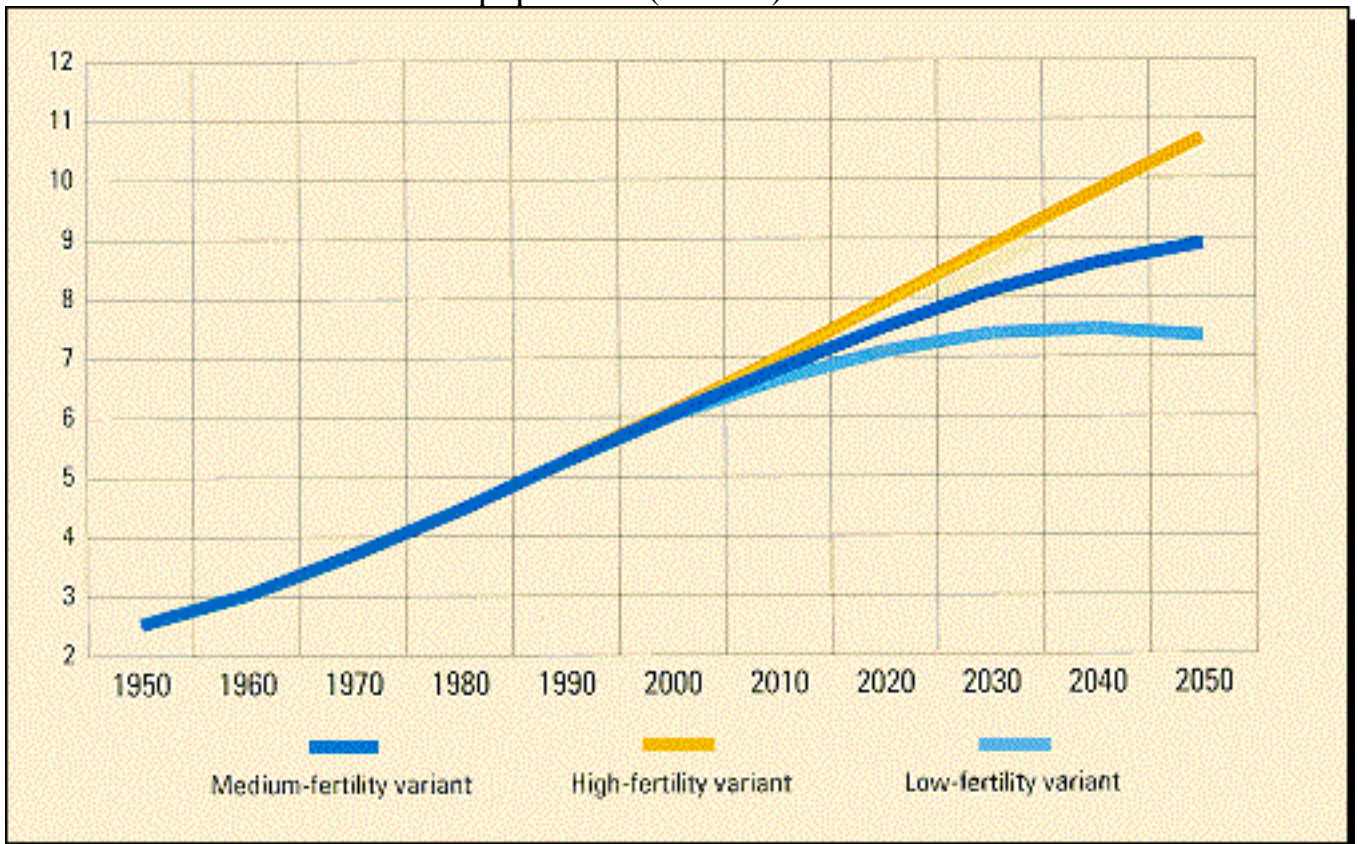
### **D. Extension**

- Have students make a line graph of world population from 1927 to 1999, using the data obtained from the web site:
  - 1927: 2 billion
  - 1960: 3 billion
  - 1974: 4 billion
  - 1987: 5 billion
  - 1999: 6 billion
- Then ask students to show 3 extensions for the graph, with a separate line for each of the following conditions:
  - The birth rate stays about the same.
  - The birth rate increases.
  - The birth rate decreases.

Students can compare their graph to the one displayed on the web site:

<http://www.undp.org/popin/wdtrends/p98/p98cht2.htm>

World population (billions) 1950-2050



### **III. TEACHER TO TEACHER**

#### **A. TEACHER REFLECTIONS**

Here are a few questions to ask yourself or discuss with a colleague during and after the lesson.

- Did students achieve the objectives for this lesson?
- What additional experiences do students need to be successful with this lesson?
- What additional experiences do students need before moving to the next lesson?
- Are students able to give and explain their reasoning? Are their reasons logical?
- What are the indicators that students are able to work together?
- How do students decide upon shared responsibilities?
- Are students able to quantify, organize and/or record information?
- Were directions clear and usable by students? If not what adjustments would be appropriate for me to make?
- What new vocabulary did students use that might need to be reinforced in the next lesson?
- What additional extensions would be appropriate?

#### **B. RELATED RESOURCES**

Correlation To State Standards

To verify or modify the teaching of this lesson so that it is in alignment with your local/state standards requirements, visit these web sites:

<http://putwest.boces.org/StSu/Math.html>

<http://www.enc.org/>