Introduction:

Small differences can add up quickly where population growth is concerned. A population with a higher average family size produces larger numbers of people over time than a population with a smaller average family size. This activity shows what a difference a two- versus three-child average family size can make over time.

Materials:

A set of wide steps, bleachers or 18 chairs
4 signs: “Age 0-19”; “Age 20-39”; “Age 40-59”; “Age 60-80”
Optional: “Extra People” cards

Procedure:

1. Using wide steps or bleachers in a gym or outdoors, label the bottom step “Age 0-19,” the second step “Age 20-39,” the third step “Age 40-59,” and the fourth step “Age 60-80.” If no bleachers or steps are available, you can substitute rows of chairs or just place the signs along one wall. In the classroom, you can use two rows of chairs. When doing the activity, designate people sitting on the floor in front of the first row of chairs to be “Age 0-19”, people sitting on the front row of chairs to be “Age 20-39”, people standing behind them to be “Age 40-59”, and people standing on the back row of chairs to be “Age 60-80.”

2. Explain to the students that this activity is designed to show the importance of average family size. Point out that many different family sizes can result in an average size of two children per family. For example, one couple may have three children, one couple four children, one couple one child and one couple none, but the average of these four families is two children. An average family size over more than two children can result in a significant increase in population over time. In the world today, the average family size is about three children.

3. Tell students that in Round 1, they will see what happens to a population when each couple has an average of two children. Ask four students to represent the first generation and to stand on Step 1 (Age 0-19). To avoid any confusion over “couples,” emphasize that students are representing two random individuals in a population, and not themselves. Explain that in this simulation, one minute will represent 20 years, so they will quickly be able to see changes over multiple “generations.” Keep track of the number of students in each generation on the board or another area visible to all the students. Use the table on page 4 as a model.
4. After one minute, ask the students on Step 1 to move up to Step 2. They now represent “Age 20-39,” and have reached the age when people traditionally start families. “How many couples could the four people on Step 2 form?” (2) “If each of those couples has two children, how many children would that be in total?” (4) Now ask four new students to stand on Step 1 and represent the second generation.

5. After one minute, each of those eight students in the first and second generations moves up one step. Now there are four people on Step 3, “Age 40-59,” and four on Step 2, “Age 20-39.” The four students on Step 2 could form two couples, and if they each had two children, another four students are chosen to stand on Step 1 to represent the third generation.

6. Continue with the same procedure for the next minute, after which there will be four students on each step, or 16 total.

7. After the next minute, the students in the first generation, who were standing on Step 4 (Age 60-80), have reached the age when people naturally die. This generation can sit back down in their seats. Select four new students to stand on step one and represent a new generation. Once again, there will be a total of 16 students standing on the steps. “If we continued this for another generation, how many students would be on the steps?” (16) “If we continued for 50 generations, how many would be on the steps?” (16) This tells us that this population has reached zero population growth, which means that the birth rate and the death rate are equal.

8. Have all the students, except the generation on Step 1, sit down, and begin the simulation again. Explain that this time, they will see how a population changes when the average family has three children, as this is close to the average in the world today. Before you start ask students to estimate how many they expect will be standing on the steps after five generations. Remind them that after five generations, there were 16 students when the average family size was two children.

9. Continue the simulation, moving the students on Step 1 up to Step 2. “How many couples could these four individuals form?” (2) “If each of those couples has three children, how many children would that be in total?” (6) This time ask six students to come stand on Step 1 to represent the second generation.

10. Continue through 5 generations. When an odd number of students land on Step 2, one person will need to proceed through the activity without pairing with anyone. Students will discover that after five generations, 45 people are standing on the steps. If you have fewer than 45 students, you can use copied “Extra People Cards” to represent additional students.

11. Compare the actual population to the student estimates. Were they close? Students will see that when families average three or more children, population grows exponentially. Students can also create bar or line graphs to compare the populations in the two and three child models.
Discussion Questions:

1. Do you think family sizes are likely to stay the same, generation after generation? Why or why not?

   No. The sizes of generations in most families vary over time. People’s family-size decisions depend on many things: marital status, economics, desire for more or fewer children, ability to have children and career choices, to name a few.

2. How would the simulation change if the youngest generation began bearing children before age 20?

   The younger people bear children, the likelier it is that there will be more generations of a family alive at one time, especially if this trend continues. Studies show that the younger people are when they bear their first child, the more children they are likely to have during their lifetimes.

3. How would the simulation change if life expectancy changed?

   Growth rate would be higher if people lived longer, and lower if life expectancy was shorter.

Follow-up Activity:

Now that students understand the different growth patterns between two- and three-child average families over time, follow this activity with Family Perspective. This activity illustrates the true family sizes over several generations of the students’ own families and allows for discussion on how family size decisions are sometimes made.
### Two-Child Family – Number of Students on Each Step

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning of simulation</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>After 1 minute</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>After 2 minutes</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>After 3 minutes</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>After 4 minutes</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

### Three-Child Family – Number of Students on Each Step

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning of simulation</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>After 1 minute</td>
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<td>4</td>
<td>0</td>
<td>0</td>
<td>10</td>
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<tr>
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<td>6</td>
<td>4</td>
<td>0</td>
<td>19</td>
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<tr>
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<td>6</td>
<td>4</td>
<td>31</td>
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<tr>
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<td>18</td>
<td>12</td>
<td>9</td>
<td>6</td>
<td>45</td>
</tr>
</tbody>
</table>

### Graphs of Families – Two-Child Model

- **Ages**
  - 60-80
  - 40-59
  - 20-39
  - 0-19

### Graphs of Families – Three-Child Model

- **Ages**
  - 60-80
  - 40-59
  - 20-39
  - 0-19