

**Teaching Notes**  
**Lesson 1**  
**The United States**  
**A Lower Middle-Layered Country**

**Overview:**

This lesson introduces students to a definition of a country's shape using the 2015 population pyramid graph or the 2015 population histogram. Students unpack a definition of a country's shape by answering questions and problems linked to the *lower middle-layered* shape of the United States. A similar study of Kenya and Japan follow this lesson that introduce students to different population shapes.

After students complete the lesson, consider assigning an **Exit Summary** using at least two of the problems of this lesson. The **Exit Summary** is **Handout 13** found in the handout section of the teacher's edition. Most of the problems of this lesson address Levels 1 or 2 of the **Modeling Continuum**. A suggested alignment of the problems is provided in the following table. This alignment, however, can be altered based on shared work with other students or special directions provided by you, the teacher. Remind students to think about the descriptors of the **Modeling Continuum** as they complete an **Exit Summary**. An example of a completed summary is included in the **Overview of the Module** section. Consider sharing this example with your students.

A consistent interpretation of these descriptors is initially challenging; however, Lessons 1 to 3 primarily focus on the descriptors in Levels 1 and 2 that are more straight forward. As students continue to work with the **Exit Summary**, the descriptors begin to make more sense, especially as they are introduced to problems that are aligned to Levels 3 and 4. Providing the opportunity for students to summarize their work using the **Exit Summary** is one way to assess a student's thinking and understanding of the problems.

**Modeling Continuum Classification**

Level 1	Level 2	Level 3	Level 4
Problems: 1, 2, 7 8, 9, 10, 15, 16, 21,22,23	Problems: 3, 4, 5, 6, 11, 12, 13, 14, 15, 18, 19, 24, 25, 26		

**Primary tools students use in this lesson to answer the above problems are:**

Arithmetic operations, proportions, percent, areas, ratios.

See the connection of these tools to high school standards in the ***Overview of the Module.***

### Resources needed for this lesson:

Provide students a printed or electronic copy of the **Introduction to the Module** and the **Introduction** of Unit 1. Students will need a copy of Kristin's data story, **Kristin's Story – Chapter 1**, to start this lesson and a printed or electronic copy of the problems for Lesson 1. **Kristin's Story – Chapter 1** sets the stage for the data stories used throughout the module. Students will also need a copy of **Handout 1: United States – 2015** to complete the problems.

Consider providing a globe, a world map, or a geographical app to help students understand the geographical connection of the United States to the other countries they will study in the next lessons. Lesson 2 will involve similar questions and problems using the population data for Kenya. Lesson 3 will involve a similar study using the population data of Japan. Each lesson highlights a different population shape and a different population distribution. Extensions in **Henry's Quilt** are also included at the end of the module that can be used at any time to study the shape and spread for the countries displayed on the the cover of the module. Various maps can be obtained from the website of the United States Geological Survey if maps are not available (<https://www.usgs.gov/products/maps/overview>).

### Launch:

Read and discuss the **Introduction to the Module**. After reading this introduction, ask students what they think this module is about. Also read and discuss the **Introduction** to Unit 1 and again ask students what they Unit 1 is about. Consider recording a few of the students' comments on poster paper. Review and discuss these comments after the unit has been completed.

Provide time for students to read **Kristin's Story, Chapter 1**. After appropriate reading time, ask students to summarize some of the points of the story. For example:

- How old is Kristin at the start of 2015?
- Why did Kristin's mother's comment confuse her?
- Why do you think Kristin did not always like the more popular movies?

Direct students to study the population pyramid graph and the histogram displayed in the lesson and handout. Ask general questions to determine if they understand the information summarized by the graphs. Consider asking questions such as:

- What is represented by the horizontal bars of the pyramid graphs?
- What does the left side of the pyramid graph represent? What does the right side represent?
- What is an estimate of the count of 0 – 4 years old from the histogram?
- How do you think the counts summarized in the pyramid graph were obtained? (This question is also raised in the **Introduction to the Module** section as it describes the challenges undertaken by the United States Census Bureau.)

When you think students understand the graphs, direct them to work in small groups or individually as they complete the problem section.

## Implementation Ideas:

There are several problems that are directed at finding the count of people from the table included on **Handout 1**. Other questions involve approximations that could be answered by the height, length, and area of the graphs (either the population pyramid graph or the histogram). Discuss with students questions that are answered by either the table or the graphs. Also, summarize with students the percent of each layer (for example, the percent of the population in the lower middle-layer or the top layer) and the possible implications that are linked to a country's shape.

Using Kristin as an example, identify where people counted in her age group are summarized in the graphs. Highlight that there is a larger count of people in the older age groups than Kristin, and similarly, a larger count of people is in the younger age groups. This observation will be picked up and enhanced in the next chapters of the data stories as it impacts the generational diversity of the United States.

Consider arranging students in groups of 2 to 3 to answer the problems in the lesson. Several of the problems involve calculations that encourage students to coordinate their work with other students. In addition, the questions that ask students to share an idea are more interesting when discussed within smaller groups before discussed with the entire class.

## Student responses or descriptions

### Lesson 1 - Problems

**Handout needed to complete the following problems: Handout 1: *United States – 2015***

1. What 5-year age group has more people (males and females) than any other age group?  
*Based on the table, the 20 – 24 years age group with 22,693,026 people is the largest count of people. Students might also indicate that they used the visual length of the bars from the population pyramid graph or histogram.*
2. In what age group was Kristin counted in the 2015 population pyramid graph or histogram? In what age group was Kristin's mother counted? In what age group was Kristin's younger sister counted?  
*Kristin was counted in the 35 – 39 years old age group at the start of 2015. Her mother was counted in the 65 – 69 years old age group. Her younger sister was counted in the 25 – 29 years old age group.*
3. What 5-year age group of just males has more counts of males than any other age group of males?  
*Using the table, the 20 – 24 years age group with 11,644,934 males is the largest age group of males.*

4. What 5-year age group of just females has more counts of females than any other age group of females?

*Using the table, the 50 – 54 years age group with 11,348,281 is the largest age group of females.*

A population distribution is defined by the following *layers*:

- The **bottom-layer** refers to the counts of people in the 0 to 24 years old age groups.
- The **lower middle-layer** refers to the counts of people in the 25 to 49 years old age groups.
- The **upper middle-layer** refers to the count of people in the 50 to 74 years old age groups.
- The **top layer** refers to the count of people in the 75 to 100+ years old age groups.

Based on the summary of layers, a country's shape is defined by the following terms:

- A country that has most of its people in the bottom-layer is identified as **Bottom-Layered Country**.
- A country that has most of its people in the lower middle-layer is identified as a **Lower Middle-Layered Country**.
- A country that has most of its people in the upper middle-layer is identified as an **Upper Middle-Layered Country**.
- A country that has most of its people counted in the top layer is identified as a **Top-Layered Country**.

5. Estimate what age group layer (bottom, lower middle, upper middle, top) you think will have the least number of people in the United States? Did you use the population pyramid graph, the histogram, or the table to make your estimate? Explain how you made your estimate using the graphs or table.

*Using the graphs, the top-layer appears to have the smallest total area covered by the age groups.*

6. Estimate what age group layer you think will have the greatest number of people? Did you use the population pyramid graph, the histogram, or the table to make your estimate? Explain how you made your estimate using the graphs or table.

*Answers vary. The increasing/decreasing pattern in the lower middle-layer and also in the upper middle-layer makes it difficult to summarize this question based on the graphs. If the table is used, it would be the lower middle-layered group.*

7. Kristin used the table included with Handout 1. She added up the count of people who were 0 – 4 years old, 5 – 9 years old, 10 – 14 years old, 15 – 19 years old, and 20 – 24 years old. The total count she obtained was 104,776,994 people. What is the percent of people 0 to 24 years old based on the estimates summarized by the table? Summarize your answer to the nearest tenth of a percent.  
*104,776,944 people/320,896,618 people or approximately 32.7%.*
8. In a similar way, what is the percent of people 25 to 49 years old?  
*105,289,239 people/320,896,618 people is approximately 32.8%.*
9. What is the percent of people 50 to 74 years old?  
*90,623,165 people/320,896,618 people is approximately 28.2%.*
10. What is the percent of people 75 to 100+ years old?  
*20,207,271 people / 320,896,618 people is approximately 6.3%.*
11. Identify two different age groups in which the count of people in the first age group is approximately double the count of people in the second age group. (There are several examples to answer this problem.)  
*Using the table, the possibilities that could be considered are the 70 – 74 years old is nearly double the 80 – 84 years old age group. Also, the 20 – 24 years old age group is nearly double the 70 – 74 years old. Analyze other possibilities.*
12. Kristin’s data story indicates that she felt disconnected from the more popular choices of movies and political views. Look at the age group that includes Kristin at the start of 2015. Why might people older or younger than Kristin have different interests than Kristin in movies or political views? Using the population estimates provided in **Handout 1**, why might the entertainment choices or political views of people older or younger than Kristin be reported in the news or social media more often?  
*Using the graphs or table, the 35 – 39 years age group is less than the count of people in the age groups just younger than her and is also less than the count of people in the age groups just older than her. Kristin’s age group is a type of “valley” with age groups older and younger more dominant in count. Several of the areas of disconnect that Kristin mentioned are influenced by age. People identify with a certain actress or actor by age, or by a certain political leader by age, etc. This results in the more dominant age groups seemingly more targeted by social media, entertain options, and political outreach.*

13. For this problem, adjacent age groups are age groups next to each other. For example, 0 – 4 years old is adjacent to 5 – 9 years. In a similar way, the 45 – 49 years old age group is adjacent to the 50 – 54 years old age group. The age group 45 – 49 years old is also adjacent to the 40 – 44 years old age group. Identify two adjacent age groups that have approximately the same count of people in each age group. (There is more than one answer to this problem.)

*Answers vary. Visually, age groups 20 – 24 and 25 – 29 years old age groups appear to be nearly the same. Also, 50 – 54 and 55 – 59 years old age groups are nearly the same.*

14. Estimate the count of teenagers (13 -19 years old). Explain how you derived your estimate.

*Caution: This problem is more rigorous than the previous problems. Consider discussing this problem before students derive an estimate. If necessary, highlight that each group counts 5 distinct ages. Consider the number of 13 and 14 years old to be approximately  $\frac{2}{5}$  of the count of 10 – 14 years old. Therefore, an estimate of the number of teenagers is:*

*$\frac{2}{5} \times (20,605,579) + 21,084,710$  which is approximately 29,326.942 people (to the nearest person), or a general estimate of 29 or 30 million people.*

15. What is the count and percent of people who are under 10 years old?

*The count of people 0 – 4 years is 19,912,499 people and the count of people 5 – 9 years is 20,481,130.*

*Total: 40,393,629 people. This is approximately 12.6% of the country's population.*

16. What is the count and percent of people who are 65 years old or older?

*There are approximately 47,734,292 people 65 years old or older. This is approximately 14.9% of the country's population.*

17. Why is it important that the count and percent of people under 10 years old and the count and percent of people 65 years old or older are given special attention when analyzing a country's population?

*These age groups include people who are not working (at least fulltime in many cases). People in these groups may need the most care from the country in terms of health care, education, and retirement support.*

18. "Old" and "young" are subjective descriptions that in many cases are defined by several factors other than age (for example, health status, or income status). For this unit, however, consider the definition of "young" as people less than 10 years old, and the definition of "old" as people who are 65 years old or older. What is the ratio of "old" to "young" using the above definitions of young and old? Derive a

decimal from this ratio and interpret it by describing the approximate count of “old people” to the count of one “young person.” Express your answer to the nearest whole number.

*47,734,292 people to 40,393,629 people, or approximately 1.18 as a decimal. This means a little more than 1 old person to 1 young person to the nearest person, or approximately 1 old person to 1 young person.*

19. Kristin’s data story indicated that she worked in the health field. Do you think that working in the health field is a major area of employment? Explain your answer by referring to the data.

*Yes, the combined percent of young and old as defined above is greater than 27% of the population, or more than one-quarter of the population is at the age that they may require more health care than other age groups.*

20. The voting age in the United States is 18 years old or older. Derive an estimate of the number of potential voters in the United States at the start of 2015.

*Consider 18 and 19 to be  $\frac{2}{5}$  of the age group 15 – 19 years. So, voting ages would be:*

*$\frac{2}{5} \times (21,084,710)$  plus the total of the age groups older than the age group of 15 – 19 years old. This resulting estimate is 247,246,584 people. This estimate includes, however, the count of immigrants and other people who may not be eligible to vote. Therefore, this is a high estimate.*

21. Identify the age groups in which the count of males is estimated to be more than the count of females.

*Age groups 0 – 4, 5– 9, 10, 14, 15 – 19, 20 – 24, 25 – 29, and 30 – 34 years age groups.*

22. Identify the age groups in which the count of females is estimated to be more than the count of males.

*All age groups from 35 – 39 years to 100+ years.*

23. Identify an age group that has approximately the same count of males and females?

*The age group 35 – 39 years has approximately the same count of females and males as noted in the table.*

24. Similar to the way you estimated the ratio of old to young people in problem 18, estimate the ratio of females to males for the following age groups. Derive a decimal from the ratio and estimate the number of females to one male in that age group (round your answers to the nearest whole number):
- In the age group of 85 – 89 years, there are approximately \_\_\_\_\_ females to one male.  
*2,423,021 females to 1,441,268 males, or 2 females to 1 male.*
  - In the age group of 90 – 94 years, there are approximately \_\_\_\_\_ females to one male.  
*1,263,123 females to 588,497 males, or 2 females to 1 male.*
  - In the age group of 95 – 99 years, there are approximately \_\_\_\_\_ females to one male.  
*367,526 females to 127,836 males, or 3 females to 1 male.*
  - In the age group of 100+ years, there are approximately \_\_\_\_\_ females to one male.  
*62,137 females to 15,105 males, or 4 females to 1 male.*
25. Notice the changes in the ratio of females to males that you derived in problem 24 as the age groups grew older. Write a sentence or two that describes what is happening. Why might these changes be important for people interested in the health care of the population?  
*As people age, the count of females per male increases. Females live longer than males. Health care that provides for these differences will be critically important.*
26. What questions would you like summarized for specific age groups? Answers to your questions would not necessarily be derived by the population graphs or table. Discuss with your class at least one of your questions and why you think the answer to your question is important.  
*Questions or summaries will vary. The goal of this problem is for students to reflect that the population of the country consists of age groups that differ in interests, activities, opinions, etc. Some of the suggested questions students list in the table could be further analyzed by actually asking people to respond to the questions (i.e., family members, friends of the family, older or younger friends) and discussing the range of answers collected by the students. Several of these type of questions will be discussed in other lessons based on the changes in the country's shape over time.*



Age group	Questions you would like summarized for this age group
<p>Example:</p> <p>0 – 4 years old</p>	<p>How many children 0 – 4 years old are in a pre-school program?</p> <p>(The answer to this question is important in determining whether or not our country has enough trained pre-school teachers.)</p> <p>How many children 0 – 4 years old can count out loud to 20?</p> <p>(The answer to this question would help determine what skills 0 – 4 years old have or have not mastered or what skills can be used to extend learning opportunities.)</p>
15 – 19 years old	
35 – 39 years old	
An age group of your choice:	

## Assessment Ideas

### Assessment Task:

Consider the following assessment task to determine a student’s understanding of the lesson:

Oostburg, a small town in Wisconsin, had a population at the start of 2015 of 1000 people. Ages of the people in the town ranged from 0 years old to 102 years old. Someone described the town as a lower middle-layered town. Sketch a histogram of the 1000 people's ages using the same design presented in this lesson, namely, set-up your histogram with age groups of 0 – 4 years old, 5 – 9 years old, etc.

After you have made your sketch, answer the following:

1. Indicate why your sketch represents a lower middle-layered town.
2. Identify a 5-year age group in your sketch that you think will have the greatest percent of town's population. Explain your reasoning in selecting that age group.
3. What age group do you think will have the least count of people? Explain your reasoning in selecting that age group.

**Comments on the Assessment Task:**

Evaluate the assessment task based on a student's understanding of an age distribution as presented in this lesson. A sketch that has the greatest count or percent of the people in the age groups of 25 - 49 years old would indicate an understanding of a lower middle-layered town. Any sketch that is similar to the shape of the United States represents a lower middle-layered town. If time is a factor, a general overview of the shape is the most important to evaluate.

Any of the 5-year age groups in the lower middle-layer or 25 – 49 years old would be a reasonable age group to identify as having the greatest count or percent of the population. It is possible, of course, for students to create a histogram that has the greatest count in an age group either below or about the lower middle-layer. Anticipate some students will be creative with their sketches as various arrangements could be possible. The key is that the **total count** of the layer defined as the lower middle-layer, or people 25 – 49 years old age groups, has the greatest count of people of the 4 layers. Also anticipate that students would identify the 100+ age group as having the least count due to the aging of the population.

**Additional Assessment Ideas:**

Several of the problems could be used to determine if students understood the lesson's overview. Particularly, discuss as a whole group problems 7, 8, 9, 10 and what these problems indicate about the shape. Also, consider evaluating problems 12 and 13 to determine if students understood the smaller count of people in Kristin's age group to the greater estimates of the count of people in the age groups above and below.

Discuss as a whole group answers to problems 7, 8, 9, 10 and 26 and what these problems indicate about the shape of the population distribution. Discuss with students why the age groups with the larger estimated counts may impact preferences of entertainment, employment skills, types of technology, etc. For example, why might the target audience of a certain smartphone be 20 to 29 years old and not 35 to 44 years old?

Students will discover in later lessons that the estimated counts of various age groups will vary over time, and result in different shapes of the population pyramid graphs or histograms. The connection of a country's shape to some of the challenges the country faces is an important step in understanding why models that estimate future counts are important. Problem 26 particularly encourages students to extend their thinking about the population by age groups.