Teaching Notes

Lesson 14

Kenya, Japan, and the United States – Summing It Up

Overview:

This lesson summarizes the main points derived about the recursive model from the previous lessons. It also extends the interpretation of these summaries by asking questions that compare the 3 countries, the United States, Kenya, and Japan.

The problems and questions extract data from either the graphs or **Handouts 6, 7, and 8**. Students summarize and reflect on the impact of the data.

An alignment of the problems in this lesson to the **Modeling Continuum** is suggested in the following table:

Modeling Continuum Classification

Level 1	Level 2	Level 3	Level 4
Problems:	Problems: 1, 2,3, 8, 9, 10, 14, 21	Problems: 4, 5, 6, 7, 11, 12, 15, 16, 17, 18, 19, 20.	Problems: 13

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

Arithmetic operations, proportions, ratios, percent, interpreting proportions and percent, recursion. See the connection of these tools to high school standards in the ***Overview of the Module***.

Resources needed for this lesson:

Provide a copy of a complete Lesson 14 for each student (either printed or online). This lesson requires three additional handouts for students to use to complete the problems, **Handout 6: *United States 2010 – 2050.*** (Students should use the completed copy of Handout 6 from Lesson 12.) In addition students need **Handout 7*: Kenya 2010 – 2050*** and **Handout 8*: Japan 2010 – 2050***.

Launch:

Begin this lesson by reminding students that the future counts of a country are impacted by:

- people moving into the country (increasing a country's population),
- people moving out of the country (decreasing a country's population),
- people dying (decreasing a population), and of course
- birth (increasing a population).

The interaction of these factors results in new projections for not only the total population of a country, but also for the age groups discussed throughout this module. Direct students to examine the 2015 and 2050 histograms, and the handouts identified in this lesson, that summarize the counts for 2015 and the years leading to and including 2050 for the United States, Kenya, and Japan. Review with students what the handouts indicate, and then start the problems.

Implication Ideas:

This lesson is a review lesson and a type of overall assessment of the module for Unit 3. It highlights the components of the recursive model by looking at the 2015 population summaries and then the 2050 summaries projected by the model for the United States, Kenya, and Japan. Several questions are similar to questions asked in previous lessons; therefore, this lesson is not breaking new ground, but rather summarizing the complete implications if implementing the recursive model.

Allow students time to work individually or in small groups on the problems. Provide them opportunities to explain their answers and explanations as they work through the problems. If possible, consider assigning students a poster project involving one of the countries. On their posters, students should consider including a graph or a summary of a few of the major changes in their country's population as projected by the model or a summary of key descriptions that the model indicates will not change. Encourage them to use the 2015 and 2050 histograms to explain these projected changes along with copies of the population pyramids graphs found at the International Data Base (IDB) of the Census Bureau. Also encourage them to include some additional research to help others understand its past and present populations. Display posters and conduct a gallery walk.

Student responses or descriptions

Lesson 14 - Problems

The United States

1. What is the count of people who are projected to be 10 – 14 years old in 2025? What is the count of people who are projected to be 15 - 19 in 2030? What is projected to happen during those 5 years to change the count of people in the connected age groups?

   The count of people who are projected to be 10 – 14 years old in 2025 is 20.47 million people. The count of people who are project to be 15 – 19 in 2030 is 20.88 million people. The two age groups are connected age groups. Therefore, the increase in the number of people during these 5 years would be explained by immigration.

2. What is the projected count of people who will be 70 – 74 years old in 2040? What is the projected count of people who will be 75 – 79 years old in 2045? Explain what happened from 2040 to 2045 that changed the count of people in these connected layers?

   The count of people who are projected to be 70 – 74 years old in 2040 is 16.61 million people. The count of people who are projected to be 75 – 79 years old in 2045 is 14.44 million people. The decrease in the connected age group is likely a result of deaths.

3. What is the projected count of people 0 – 4 years old in 2030? What is the projected count of people 0 – 4 years old in 2035? Explain why the count of people in this age group is not predicted to stay the same.

   The count of children 0 – 4 years old in 2030 is projected to be 21.75 million people. The count of children 0 – 4 years old in 2035 is projected to be 22.33 million people. The recursive model projects more births during this time. Either the birthrate increases (people decided to have more children, therefore, the number of children increases), or the count of people who have children went up. (Typically people in the age groups of 20 – 40 years old have children and if the number of people in those age groups increased during the 5 years from 2025 to 2035, then there would likely be an increase in the number of births even if the birthrate did not change.)

Kenya

4. The Population Factor for the projected change in the 15 – 19 age group to the 20 – 24 age group is 0.988. The same population factor for the United States is 1.032. What does that indicate is different about the projected count of people in these connected age groups?

   A population factor that is greater than 1 indicates the connected age group increases in count. A population factor that is less than 1 indicates the connected age group decreases in count. Therefore, the count of people 20 – 24 years old in the next 5 years is projected to be greater than the count of people 15 – 19 years old in the United States. The count of people 20 – 24 years old is projected to be less than the count of people 15 – 19 years old in Kenya.

5. What is the projected count of people in Kenya in the 80 - 84 age group in 2040? What is the project count of people in the 85 – 89 age group in 2045? Explain what happened during the 5 years to change that count of people.
   The projected count of people in Kenya in the 80 – 84 years old age group in 2040 is 0.30 million people (or approximately 300,000 people). The projected count of people in Kenya in the 85 – 89 years old age group in 2045 is 0.15 million people (or approximately 150,000 people). The count of people declined significantly during those 5 years. The likely factor is death. There could also be some decline due to people moving out of the country.

6. None of Kenya's population factors are projected to be greater than 1.000. What does this indicate is different about the projections for Kenya and the United States?
   Population factors less than 1 indicate the population is declining, therefore, the count of people who die and the count of people who leave the country is greater than the count of people moving into the country. The United States' increase in population is due to immigration which is not the explanation for the increase in Kenya.

7. All of the Population Factors in Kenya are less than the Population Factors in the United States (except for the population factor of the age group 90-94 which is due to a round off of the small projected populations). What does the smaller Population Factors indicate about Kenya that is different than the United States?
   (Note: A special adjustment to the counts were needed to avoid a division by 0 in the population factors for the oldest 2 age groups. The estimated counts from the Census Bureau indicates a loss of the population during the five-years. Population Factors rounded to the next decimal place would be needed to reflect the small numbers and more accurate proportions.)
   Kenya proportionally decreases in count due to people dying or leaving the country. As indicated in previous answers, the United States has population factors greater than 1,

therefore, these age groups increase in count due to immigration. For the age groups connected by Population Factors less than 1, the decrease is connected to death and people leaving the country, which is proportionally less in the United States than in Kenya.

8. What is the Foundation Factor used to estimate the count of people in the 0 - 4 age group? Compare this to the Foundation Factor used in the United States. In what way is the projected population of Kenya changed by this different foundation factor?
   The Foundation Factor for Kenya used in the recursive model is 0.139 or approximately 13.9% of the population is projected to be 0 – 4 years old. The Foundation Factor for the United States is 0.062 or approximately 6.2% of the population is 0 – 4 years old. The difference in the Foundation Factors is significant and results in a projected increase in the population of Kenya. (Use this question to point out that all of the population factors in Kenya were less than or equal to 1 indicating that all connected age groups are projected to decrease in counts. The fact that the total population of Kenya is actually projected to increase is an indication of the large Foundation Factor. It will be highlighted in the last 2 lessons, however, that the recursive projections and the Census Bureau's projections for Kenya are different, with the Census Bureau's projections indicating a smaller rate of growth in Kenya's total population. Analyzing this difference is investigated in Lesson 16.)

9. What is the projected count of the 0 – 4 age group in 2030? What is the projected count of people for the 0 – 4 age group in 2035? Explain why the estimates for this age group are different.
   The projected count of 0 – 4 years old in 2030 is 9.01 million people. The projected count of 0 – 4 years old in 2035 is 10.08 million people. The differences are a result of an increased number of births from 2025 to 2035. This increased number of children within this age group is either due to a higher birthrate or more births from an increased count of people who have reached the age of having children.

10. Determine the projected percent increase in the population of Kenya from 2015 to 2050.
    The total population in 2015 is 45.93 million people. The total population in 2050 is 100.62 million people. The recursive model estimates that there will be an increase of 54.69 million people from 2015 to 2050. The proportion of change is $\frac{54.69}{45.93}$ *or 1.19, or an increase of 119%.*

Japan

11. The Population Factor for the projected change of the 10 – 14 age group to the 15 – 19 age group is 0.998. The population factor for the same connected age groups in the United States is 1.020. What does that indicate is different about the projected count of people who will be in these connected age groups?
    The population factor of 1.020 for the United States indicates the projected count of the connected age groups will increase due to immigration. The 0.998 population factor for Japan indicates the projected count of the connected age groups will decrease due to death or people moving out of the country. The population factor for Japan is close to 1.000, however, resulting in a very slight decrease.

12. None of Japan's population factors are projected to be greater than 1.000. What does this indicate is different about the projections for Japan and the United States?
    None of the connected age groups in Japan are projected to increase during a 5-year period. There are several population factors greater than 1 in the United States indicating several connected age groups are projected to increase during a 5-year period. The gains in the United States are anticipated due to immigration and the loss of population in Japan is anticipated due to death and fewer immigrants.

13. You are able to travel to a city in Japan. Do you expect to meet people who immigrated to Japan? Explain your answer.
    No. As explained above, the population factors are all less than or equal to 1 and indicate that most of the connected age groups decrease in counts due to death. There is no gain in connected age groups, therefore, little indication of immigration.

14. Identify the age groups in which the population factors for Japan are greater than the population factors for the United States.
    The population factors for all the connected age groups from 45 – 49 years old to 95 – 99 years old are greater in Japan than in the United States.

15. What does it indicate about the projected counts of people for connected age groups that have a greater population factor than the United States?
    Although the population factors are less than 1 in Japan, they are greater than than the United States population factors for several connected age groups in the United States that are less than 1. For those connected age groups, the proportion of the decrease in population in Japan is less than the proportion of decrease in population in the United States.

16. What is the Foundation Factor used to project the count of people in the 0 - 4 age group? Compare this to the Foundation Factor used in the United States. What does the different Foundation Factor for Japan indicate when comparing Japan to the United States? Kenya?

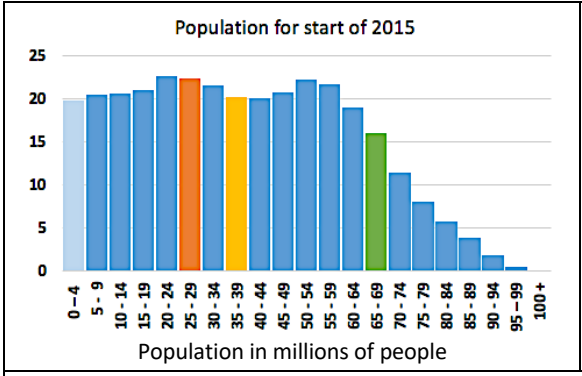
The recursive model indicates that the Foundation Factor in Japan is 0.042, or 4.2% of the population is projected to be 0 – 4 years old. The Foundation Factor in the United States is 0.062 indicating 6.2% of the population is projected to be 0 – 4 years old. The Foundation Factor in Kenya is 0.139 indicating 13.9% of the population in Kenya is projected to be 0 – 4 years old.

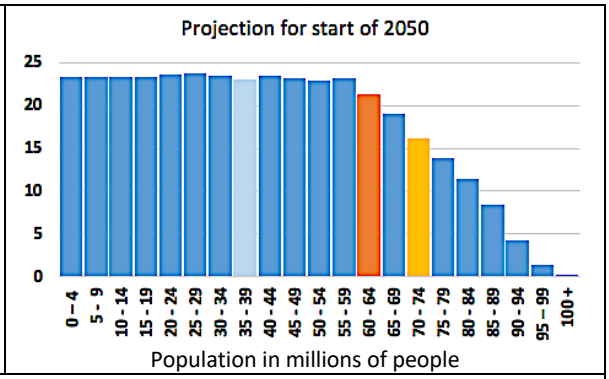
17. What is the projected count of the 0-4 age group for 2045? What is the projected count of the 0-4 age group for 2050? What does the difference in the projected counts tell us about Japan's future?

The projected count of children in Japan 0 – 4 years old in 2045 is 4.47 million people. The projected count of children in Japan 0 – 4 years old in 2050 is 4.29 million people. The projected decrease of 0.18 million people (or approximately 180,000 people) is due to fewer people who were of the age to have children or a declining birthrate.

Summaries

18. The United States

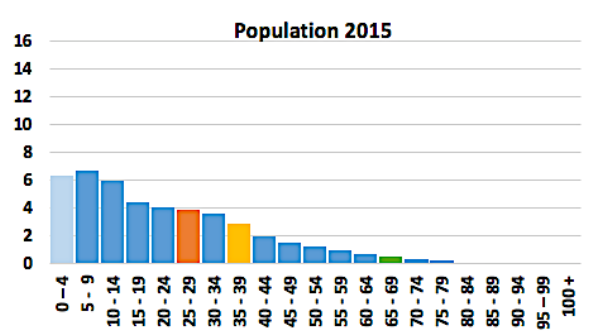


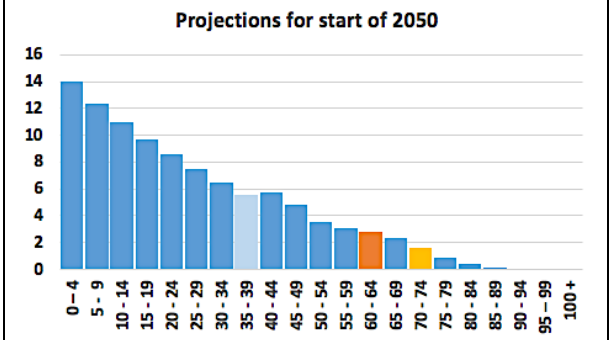


Summarize what happens from 2015 to 2050 if the assumptions about the changes in the population are accurate:

The overall population of the United States is projected to increase from 2015 to 2050, with all age groups also projected to increase in counts. The increases are a result of immigration and the projected number of births. The projected increase in the number of births is likely more a result of an increase of the number of people who have children rather than an increase in the birthrate.

19. Kenya

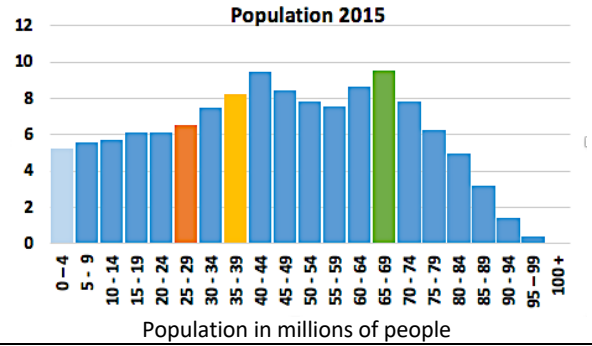


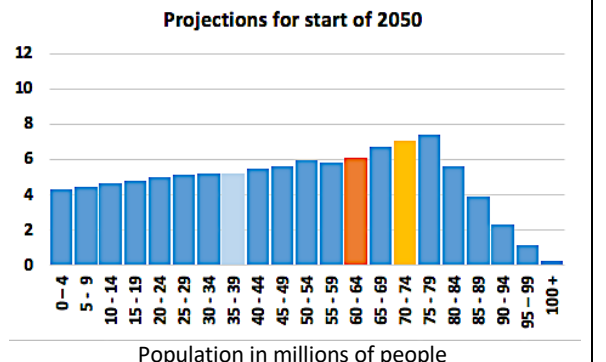


Summarize what happens from 2015 to 2050 if the assumptions about the changes in the population are accurate:

The large Foundation Factor (0.130) of the 3 countries results in a major increase in the total population of Kenya with most population factors less than 1. The increase in the births is projected to result in more people than the loss due to deaths or people leaving the country.

20. Japan

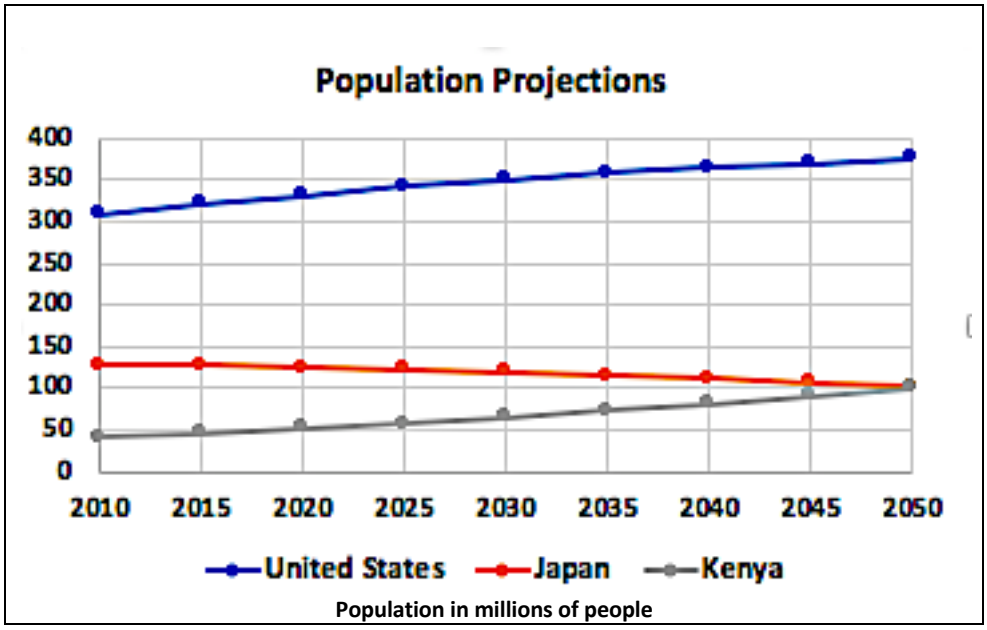




Summarize what happens from 2015 to 2050 if the assumptions about the changes in the population are accurate:

The total population of Japan decreases from 2015 to 2050. The decrease in the population is due to a small Foundation Factor and all population factors less than or equal to 1. As a result, the number of births is less than the count of people who leave the country or die. As all of the population factors are less than or equal to 1, there is little indication of immigration.

21. Use **Handouts 6, 7, and 8** to complete the following graph:
The following graph completes the graph started for students:



Give at least two reason why the recursive model used in making the above projections cannot continue without revisions.

The recursive model indicates an increase in the total population for Kenya and the United States. Although the projections seem to be leveling off for the United States, the total population is still projected to increase. An increase in the population cannot continue without some adjustments over time as the population would grow too large to sustain. In a similar way, the decrease indicated for Japan cannot continue or eventually the entire country would have 0 people.

Consider assigning as an independent research for students a summary report of "carrying capacity". The topic explores whether or not a country can adequately support its population. Discussions concerning this topic are especially important in sociology and research conducted in that discipline. This topic could be controversial for some students, so address this only if it adds to the general interest of the discussions with students.

Extension

*The goal is for students to use their population values for My Country in the recursive model. A projection model entitled **MyCountry Recursive Model.xisx** has been created to analyze the data for the fictitious country MyCountry. Recall that My Country is an example of a top-layered country. If students enter the data for the country data they created in Lesson 5, direct them to open the Excel file "The 1 Country".xisx and replace the population counts for 2010 and 2015*

with the counts they generated. Make sure they save the revised file by a different name as the 1-Country file will be used in the next 2 lessons.

This extension is to be completed using the Excel file **"The 1 Country".xisx** or ***MyCountry Recursive Model.xisx***. Recall that the file **"The 1 Country".xisx** implemented the recursive model for a fictitious country, or "The 1 Country", in which the count for each of the age groups and the foundation and population factors were 1. Replace the counts of the age groups in 2010 and 2015 with the population counts of your country. Make sure you carefully save the revised spreadsheet using a different file name as "The 1 Country" file will also be used in Lessons 15 and 16. If directed by your teacher, use the Excel file ***MyCountry Recursive Model*** to answer the following questions or topics based on the fictitious country introduced in earlier lessons as My Country. Describe the results of applying the recursive model to your data or to the My Country data by completing the following summaries:

a. Shape of your country or My Country in 2010 (bottom-layered, lower middle-layered, upper middle-layered, top-layered):

b. Shape of your country or My Country in 2050:

c. Description of the histogram for 2015.

d. General description of the Population Factors (for example, age groups in which the factors were greater than 1, less than 1, or even equal to 1):

e. Value of your foundation factor for 2015. Change the foundation factors for all of the other years (2020, 2025, etc.) to this value.

f. Description of the histogram for 2050.

g. General summary of the population of your country in 2050:

Assessment Ideas:

Lesson 14 is a type of unit assessment as this lesson concludes Unit 3 and the design of the recursive model. It was a model incorporating two actual data sets of a country's population as the anchors for summarizing change in 5-year intervals of time. Assuming (and this of course is the big assumption) that the proportion of the summarized changes in the anchor populations remain the same for the next several decades, what are the estimated future counts of this country by age groups? Will different age groups emerge as the dominant counts? Will the country change its shape as a result of different age groups increasing or decreasing in counts?

Problems 18, 19, 20 and 21 provide a basis for assessing students' ability to answer these questions. As a final set of wrap-up questions on these ideas, ask students to explain the role of the Population Factor in the recursive model. Also, ask them to explain the role of a Foundation Factor. If an adequate description is given to these two terms, ask them to explain or answer the following problems:

- Explain how Kenya is projected to experience more than double its population by 2050 with the recursive model, and yet each of its connecting age groups are projected to decline in counts.
- Will Japan eventually fade away?