

Sky Boys: How They Built the Empire State Building

By Deborah Hopkinson / ISBN: 978-0-375-86541-1

Lesson Author

Erin A. Yetter, Federal Reserve Bank of St. Louis—Louisville Branch

Standards and Benchmarks (see page 12)

Lesson Description

In this lesson, students learn about human resources, productivity, human capital, and physical capital. They participate in three rounds of a reasoning activity. From round to round they receive training and tools to help them improve their reasoning ability and thus increase their productivity. Students will then listen to a story about how the Empire State Building was built and identify examples of key concepts mentioned or shown in the book.

Grade Level

3-5

Concepts

Human capital
Human resources
Physical capital
Productivity

Objectives

Students will

- define human capital, human resources, physical capital (capital resources), and productivity;
- identify examples of human resources, human capital, and physical capital; and
- analyze the relationship between human capital and physical capital and productivity.

Time Required

Approximately 60 minutes (not including the Extension)

Materials

- *Sky Boys: How They Built the Empire State Building* by Deborah Hopkinson (ISBN 978-0-375-86541-1)
 - Visuals 1 and 2
 - Handouts 1 and 2, one copy for each student
 - Handouts 1 and 2 Answer Keys for the teacher
 - At least one calculator per group of four students
 - Pen or pencil and scrap paper for each student
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Procedure

1. To introduce the lesson, display *Visual 1: Empire State Building* (ESB) (or, if you have classroom Internet access, go to the ESB website: <http://www.esbnyc.com/>). Ask the students to tell you what they know about the building pictured.
2. Tell the students they are going to play a game that involves the ESB. Tell them it is located in New York City, was completed in 1931, and up until 1972 was the tallest building in the world! Now it is the 22nd-tallest building in the world and the fourth-tallest in the United States.

(Note: This information is accurate as of 6/26/2013. As more buildings are built, this information could change. Check the following website for up-to-date information: http://en.wikipedia.org/wiki/Empire_State_Building.)
3. Organize students into groups of four.
4. Display *Visual 2: Problem*. Ask the students to estimate how many quarters, stacked in a single column, it would take to reach the top of the ESB. Tell them they may not use anything to calculate an answer except a piece of paper, a pencil or pen, and their **human resources**. Explain that human resources are the quantity and quality of human effort directed toward producing goods and services. The human resources in this exercise are the four students in each group. Give the groups 3 minutes to calculate an answer.
5. Record the answers on the board by group, for example, as follows:

Round 1	
Group 1	10,000
Group 2	33,400

Call on one member from each group to explain the reasoning behind their group's answer. (*Students will likely describe a method they devised for estimating.*)

6. Now tell the students they are going to complete this exercise again, but this time you will provide them with information to aid them in their calculations. Explain the following: When you give them information to help them solve the problem, they are learning and therefore improving their **human capital**. Human capital is the knowledge and skills people obtain through education, experience, and training. In Round 2, their human capital will improve in two ways. One, they will gain more experience. Two, you will provide them with helpful information to solve the problem.
7. Call on a few students and ask them to predict what will happen to the calculations in Round 2 as a result of their experience and the new information. (*Answers will vary but should include things such as the calculations should become more precise, more accurate, or get better.*)
8. Provide the students with the following information:
 - 14.5 quarters stacked measure 1 inch.
 - There are 12 inches in 1 foot.
 - Including the antenna, the ESB is 1,454 feet tall.

Again, tell the students that they may not use anything to aid them in their calculations other than a piece of paper, a pencil or pen, their human resources, and their newly acquired human capital. Give the groups 3 minutes to calculate an answer.

9. Record the answers on the board by group, for example, as follows:

	Round 1	Round 2
Group 1	10,000	100,000
Group 2	33,400	150,000

Call on one member from each group to explain the reasoning behind their group's answer. Point out any trends you see from Round 1 to Round 2. For example, "most groups increased the number of quarters in their answer" or "every group more than doubled its guess."

10. Explain that more-precise answers are examples of increased **productivity**. Productivity is a measure of how much someone can produce with a given set of inputs during a set time period. In this activity, you were producing estimates of the number of quarters it would take to reach the top of the ESB.
11. Ask the groups what would be helpful to aid them in their calculations. In other words, what could further improve their productivity? (*Answers will vary, but the students will likely say calculators and probably already have asked if they could use them.*)

12. Now tell the students they are going to complete the exercise again, but this time they will have tools to help them calculate an answer. Distribute at least one calculator to each group. Explain that the calculators are a form of **physical capital**. Explain that physical capital is a good used to make other goods and services. For example, tools, machines, buildings, and calculators are all types of physical capital.
13. Call on a few students and ask them to predict what will happen to the calculations now that they can use calculators. In other words, what will happen to their productivity? (*Answers will vary but should include things such as it will be easier, they will be able to calculate the right answer, or it will take less time.*)
14. Give the groups 3 minutes to determine their final answers.
15. Record the answers on the board by group, for example, as follows:

	Round 1	Round 2	Round 3
Group 1	10,000	100,000	150,000
Group 2	33,400	150,000	255,000

Answer (approx.): 252,996

Call on one member from each group to explain the reasoning behind their group's answer.

16. Verbally explain how to calculate the answer:
 - 14.5 quarters stacked measure 1 inch.
 - Because one foot equals 12 inches, there would be 174 quarters per foot (14.5×12).
 - Because the Empire State Building is 1,454 feet tall, it would take approximately 252,996 quarters to reach the top ($174 \times 1,454$).

Next, write out and explain how the answer is calculated mathematically:

$$14.5 \times 12 = 174; 174 \times 1,454 = 252,996 \text{ or}$$

$$14.5 \times 12 \times 1,454 = 252,996$$

17. Finally, point out that in all three rounds the students had the same human resources, but in subsequent rounds both human capital and physical capital helped them become more productive. In Round 2 they used their experience and knowledge (human capital, in this case gained from learning facts) to fine-tune their calculations. In Round 3 they also used calculators—physical capital. During the course of the rounds, they become more productive.
18. Tell the students you are going to read a book about how the ESB was built called *Sky Boys: How They Built the Empire State Building*. Give a copy of *Handout 1: Activity* to each student. Assign a student to read the directions (as follows):

As you listen to the story, cross out the examples of the human resources and physical capital that went into the construction of the Empire State Building. Cross out only those items specifically mentioned in the story or shown in the pictures.

19. Read the story, pausing periodically to show the pictures and to allow the students to complete the handout. Review answers. (See the Handout 1 Answer Key.)

Closure

20. To review the important concepts of the lesson, ask the students to think back to the reasoning activity they participated in earlier in the lesson and then discuss the following:
- What were the human resources used in the ESB activity at the beginning of the lesson? (*Students, four in each group*)
 - What is the knowledge and skills people obtain through education, experience, and training called? (*Human capital*)
 - Other than the calculators, what forms of physical capital would have helped you? (*Answers will vary, but students may suggest a computer.*)
 - If you had [insert the above mentioned form of physical capital], what do you think would happen to your productivity? (*It would increase.*) Explain your answer.

Assessment

21. Distribute a copy of *Handout 2: Assessment* to each student. Turn to pages 15-16 of *Sky Boys*. Display the pages on a document camera or allow the students to take turns viewing the book. Ask them to read the directions and complete the handout. Review answers. (See the Handout 2 Answer Key.)

Extension

22. Complete the reasoning activity with a building or landmark near to you. Examples:

City, State	Building/Landmark	Landmark height (feet)	Answer (# of quarters)
Biloxi, MS	Biloxi Lighthouse	64	11,136
Chicago, IL	Willis Tower	1,729	300,846
Little Rock, AR	Metropolitan National Bank Tower	547	95,004
Memphis, TN	Pyramid Arena	321	55,854
New York City, NY	Statue of Liberty	305	53,070
Philadelphia, PA	City Hall	548	95,352
San Francisco, CA	Coit Tower	210	36,540
Seattle, WA	Space Needle	604	105,096
St. Louis, MO	Gateway Arch	630	109,609

Visual 1: Empire State Building

The Empire State Building



New York City, NY

Visual 2: Problem

**How many quarters
stacked like this**



**would it take to reach the top of
the Empire State Building?**

Handout 1: Activity

Name _____

Directions: As you listen to the story, cross out the examples of the human resources and physical capital that went into the construction of the Empire State Building. Cross out only those items specifically mentioned in the story or shown in the pictures.

Human Resources

Architect Bricklayers Bucker-up Carpenters
Catcher Derrick men Electricians
Foreman Gunman Heater Masons
Nurse Plumbers Water boy

Physical Capital

Bricks Cement Elevators Fabric
Hoists Limestone Marble
Paper Pipes Railcars Rivets
Rulers Stairs Steel
Tongs Windows Wires Wood

Handout 1: Activity Answer Key

Name _____

Directions: As you listen to the story, cross out the examples of the human resources and physical capital that went into the construction of the Empire State Building. Cross out only those items specifically mentioned in the story or shown in the pictures.

Human Resources

Architect Bricklayers Bucker-up Carpenters
Catcher Derrick men Electricians
Foreman Gunman Heater Masons
Nurse Plumbers Water boy

Physical Capital

Bricks Cement Elevators Fabric
Hoists Limestone Marble
Paper Pipes Railcars Rivets
Rulers Stairs Steel
Tongs Windows Wires Wood

Handout 2: Assessment

Name _____

Directions: As you look at pictures from the book, answer the questions below.

1. What human resources are illustrated in the pictures? Circle all that apply.

Bricklayers

Bucker-up

Catcher

Derrick men

Gunman

Heater

2. Does everyone illustrated in the pictures have the same training, skills, and education? Place an X next to your answer.

_____ Yes, they are all using the same human capital to build the Empire State Building.

_____ No, they are all doing different jobs and each one requires different human capital.

3. List 5 examples of physical capital illustrated in the pictures.

_____	_____
_____	_____

4. If all of the men on the riveting gang were replaced with other men who had never done those jobs before, what do you think would happen to productivity? Place an X next to your answer.

_____ Productivity would go up. The new men will not be as tired.

_____ Productivity would go down. The new men have no experience.

_____ Productivity would stay the same. It does not matter who does the job.

Handout 2: Assessment Answer Key

Name _____

Directions: As you look at pictures from the book, answer the questions below.

1. What human resources are illustrated in the pictures? Circle all that apply.

Bricklayers

Bucker-up

Catcher

Derrick men

Gunman

Heater

2. Does everyone illustrated in the pictures have the same training, skills, and education? Place an X next to your answer.

_____ Yes, they are all using the same human capital to build the Empire State Building.

X No, they are all doing different jobs and each one requires different human capital.

3. List 5 examples of physical capital illustrated in the pictures.
Answers will vary, but could include any of the following:

*Bar**Gloves**Steel**Fire**Hammer**Tin can (bucket)**Forge**Rivets**Tongs*

4. If all of the men on the riveting gang were replaced with other men who had never done those jobs before, what do you think would happen to productivity? Place an X next to your answer.

_____ Productivity would go up. The new men will not be as tired.

X Productivity would go down. The new men have no experience.

_____ Productivity would stay the same. It does not matter who does the job.

Standards and Benchmarks

National Standards in Economics

Standard 1: Productive resources are limited. Therefore, people cannot have all the goods and services they want; as a result, they must choose some things and give up others.

- **Benchmark 6, Grade 4:** Productive resources are the natural resources, human resources, and capital goods available to make goods and services.
- **Benchmark 8, Grade 4:** Human resources are the people who do the mental and physical work to produce goods and services.
- **Benchmark 9, Grade 4:** Capital goods are goods that are produced and used to make other goods and services.
- **Benchmark 10, Grade 4:** Human capital refers to the quality of labor resources, which can be improved through investments in education, training, and health.

Standard 15: Investment in factories, machinery, new technology, and in the health, education, and training of people stimulates economic growth and can raise future standards of living.

- **Benchmark 1, Grade 4:** When workers learn and practice new skills they improve their productivity by improving their human capital.
- **Benchmark 2, Grade 4:** Workers can improve their productivity by using physical capital such as tools and machinery.

Common Core State Standards: Mathematics, Grade 2

Measurement and Data

- **Measure and estimate lengths in standard units.**
CCSS.Math.Content.2.MD.A.3: Estimate lengths using units of inches, feet, centimeters, and meters.

Common Core State Standards: Mathematics, Grade 4

Operations and Algebraic Thinking

- **Use the four operations with whole numbers to solve problems.**
CCSS.Math.Content.4.OA.A.2: Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
CCSS.Math.Content.4.OA.A.3: Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Measurement and Data

- **Solve problems involving measurement and conversion of measurements.**

CCSS.Math.Content.4.MD.A.1: Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*

CCSS.Math.Content.4.MD.A.2: Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Common Core State Standards: English Language Arts, Grade 4

Reading: Literature

- **Key Ideas and Details**

CCSS.ELA-Literacy.RI.4.1: Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

- **Craft and Structure**

CCSS.ELA-Literacy.RL.4.4: Determine the meaning of words and phrases as they are used in a text, including those that allude to significant characters found in mythology (e.g., Herculean).

- **Integration of Knowledge and Ideas**

CCSS.ELA-Literacy.RL.4.7: Make connections between the text of a story or drama and a visual or oral presentation of the text, identifying where each version reflects specific descriptions and directions in the text.

Speaking & Listening

- **Comprehension and Collaboration**

CCSS.ELA-Literacy.SL.4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

Language

- **Vocabulary Acquisition and Use**

CCSS.ELA-Literacy.L.4.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., *wildlife, conservation, and endangered* when discussing animal preservation).