

Mathematical Thinking Lesson Plan

Grade Band: 7-10

Topic: Mathematical Thinking

Lesson Description: In this lesson, students will consider the limitations of their knowledge of numbers and learn how to reframe them in ways that allow for better decision-making, as shown in the second episode of Crash Course Statistics.

Learning Outcomes:

1. Students will be able to express unexpected ways that math is involved in their everyday lives.
2. Students will recognize the human difficulty of comprehending extremely large and extremely small numbers and learn strategies to understand them better.

Featured Crash Course video:

[Crash Course Statistics #2: Mathematical Thinking](#)



5-E Model

Engage

Ask students to brainstorm answers to this question in groups or as a class: Where in your daily life do you use math? Give out prizes to the student/group that comes up with the most unexpected answer.

Have students watch [Crash Course Statistics #2: Mathematical Thinking](#). Afterward, give them a couple minutes to gather any new thoughts or questions.

Explore

The question you will address in this activity is: Do you really know what numbers mean?

Prior to the lesson, attach a variety of numbers to the board in a way that allows them to be moved easily (magnets, sticky tack, etc.) Include extremely small numbers and extremely large numbers alongside more familiar numbers, and show them in various formats (e.g., scientific notation, spelled out in words, etc.).

Divide students into groups and give them some time to discuss guesses for the proper order the numbers should go in, from lowest to highest. After the discussions, have a representative from each group move the numbers into what they think is the correct order. After each guess,

tell them how many numbers are in the correct position, but not which ones. When the guesses are finished, rearrange the numbers into the correct order and discuss as a class what aspects of the order surprised you the most.

Explain

Explain three ways to understand extremely large/small numbers:

1. Put the number in context (e.g., US debt → how much money per American)
2. Turn a big number into a unit of measurement you're more comfortable with (e.g., thousands of feet → a few miles)
3. Have reference points for big numbers (e.g., words → pages, seconds → days)

Discuss as a class ways to conceptualize the numbers below with each of these three strategies.

Extremely Large Numbers

- 100 trillion bacteria in a human body
- 10 quintillion insects alive on the Earth
- 300 sextillion stars in the universe
- 7.6 billion people in the world

Extremely Small Numbers

- 1 in 302.6 million chance of winning the Mega Millions jackpot
- 1 in 309.6 million chance of an American dying from Ebola
- 1 in 3.64 billion chance of an American dying from a terrorist attack committed by a refugee

Vocabulary

Numeracy: the ability to understand numbers and use them to make decisions

Scientific notation: a way of expressing extremely large or small numbers using a number between 1 and 10 multiplied by 10 raised to a certain power

Law of truly large numbers: the idea that, with a large enough group (or sample) unlikely things are completely likely to happen

David Hand: statistician who explained why the Bulgarian lottery pulled the same set of numbers a few days apart

Abraham Wald: statistician whose mathematical thinking helped protect the planes of American fighter pilots during World War II

Elaborate

Give students a worksheet of extremely large/small numbers and have them do their own

research to come up with different comparisons for each one, like Adriene did in the Crash Course video. In the next class, have students share and compare their answers.

Evaluate

Formative monitoring: Student ideas in discussions of where they use math in their daily lives and how to conceptualize extremely large/small numbers, contributions to number ordering activity

Summative Assessment: Number comparisons worksheet

