Math in Idaho - Forestry: Exploring Logarithms with Wildfire Data

BACKGROUND INFORMATION

This is a single-day lesson exploring logarithms with the support of CODAP software in better understanding the relationship between the data and the implications of the data on Idaho wildfires and our forests. Wildfire data within Idaho counties with the aid of the online CODAP platform.

LESSON DURATION

Teachers should use their discretion to keep pace with the needs of students. This lesson is designed for 50 minutes, but the exploration section could easily be extended for a longer lesson.

INSTRUCTIONAL SEQUENCE SUMMARY

This lesson is built to engage students in guided-inquiry using the 5E lesson model. In this model, there are 5 phases that students will experience; (1) **Engage**: The teacher provides context to engage the students in curiosity and surface existing knowledge through class discussion, (2) **Explore**: The students collaborate to investigate targeted questions from the context; (3) **Explain**: The teacher leads a whole class discussion making explicit connections between student's thinking from the explore phase and formalizing the mathematics; (4) **Elaborate**: The teacher provides context or discussion to generalize the important concepts and their connections beyond the original lesson context; (5) **Evaluate**: Teacher provides students with a brief assessment to gauge understanding and inform future instruction.

- Idaho Wildfires Data By County
- CODAP Tutorial Video (for teachers & students)
- Video: Forestry and the impact of Idaho wildfires on our forests

STANDARDS ALIGNMENT:

F.IF.B. Interpret functions that arise in applications in terms of the context. Include linear, quadratic, exponential, rational, polynomial, square root and cube root, trigonometric, and logarithmic functions.

S.ID.B. Summarize, represent, and interpret data on two categorical and quantitative variables.

S.IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

STUDENT LEARNING TARGETS

- I can use a large data set to explore logarithmic relationships.
- I can interpret the data set and articulate logarithmic relationships better factors and wildfires.
- I can draw sound conclusions based on the logarithmic relationships.

ASSESSMENT:

Students will complete an exit ticket to demonstrate their understanding.

KEY VOCABULARY:

"Good statistical question", data set, measurement variable, center, spread, parameter, sample, inference, rate, logarithmic

Important Questions:

How can we use logarithms to better understand Idaho wildfire data and the health of Idaho forests?

Lesson Plan/Learning Experience

Engage (5-10 minutes)

Video: Forestry and wildfires in Idaho

Discuss: Have students watch and listen carefully for key points in the video that help answer the following questions. If you wish, you can ask students to take notes as they watch. They may watch the video more than once and read the transcript, as needed. This discussion does not need to bring up math content yet. Its purpose is to engage with the context.

1. What is one thing you heard during the video that surprised you?
2. What is one question you thought of while watching the video?
3. What data do we need in order to know about wildfires in Idaho to make good decisions to preserve and maintain our forests?

Explore (25-30 minutes)

Use the same data from Forestry Lesson 1 or download that data found here: Idaho Wildfires by County, as a .csv file, and upload it to CODAP. **Be sure to look at the "guide" tab on the original data file to better understand the column headings.** Students will calculate new variables in their spreadsheet. Teacher can demonstrate functionality or students can watch this [how-to video] to help in them in their analysis, including:

logFires = log(nfires)
logFireArea = log(fireArea)
logPop = log(population)
percBurned = 100*fireArea/area

Then, answer the following:

1. Is there a relationship between **precipitation** and wildfire outcomes?
2. Is there a relationship between **temperature** and wildfire outcomes?
3. Is there a relationship between **air pollution** and wildfire outcomes?
4. Is there a relationship between **urbanicity** and wildfire outcomes?
5. Is there a relationship between **education** and wildfire outcomes?
6. What **other relationships** can you find among the variables in the data set?

Explain (Together With Explore Section)

The teacher monitors student progress during the exploration. As students use data to make and record their conclusions, the teacher presses them to use the newly created logarithmic variables to define the “wildfire outcomes.”

The teacher leads a discussion to intentionally make general connections to statistical measures such as average, range, population size, inference, evidence (as opposed to proof), and so on.

Example questions:

“Is that a fair comparison? If not, what would make that a fair comparison? If so, what makes that a fair comparison?”

“Will you share with (another student) what you just learned about rates and fair comparisons?” or “(Another student) has a really good answer to your question – will you go talk to them about this?”

Select a few of the arguments to highlight in a classroom discussion.

The teacher will drive the discussion to the use of logarithms and how utilizing them changes our views of the data. For example, display the graphs of “precip by nfires” and the graph of “precip by logfires.” Have a discussion of how the graphs are similar or different. What is lost when a variable is converted to logarithms and what could be lost? Comparing multiple non-log and log graphs will help with this discussion.

Elaborate (10-15 minutes)

As the explain phase lands on how the graphs appear differently due the different scaling of the logarithms. This can be extended and generalized with this video on how to interpret a logarithm scale.

Emphasizing the power of scaling a graph by multiplicative powers in order to show a different spread of the data and connect back to the scales of the logarithmic graphs in the explore.

Finally, lead a discussion on why this was useful for our wildfire data (large spread, outliers, clustering, etc.) and what other types of data might necessitate (or at least be helped with) some logarithmic modeling

Evaluate (5 minutes)

Give students an exit ticket to capture their learning:

Focused on the concept of today’s lesson:

“Why is a logarithmic function used to transform data and how does that affect our ability to analyze data?”

Focused on the general learning progression:

Give students some additional time to write down their thoughts, especially in reaction to the class discussion. The prompt might sound like this: “Take another few moments to consider the most important things you thought about today. Did you revise any of your conclusions? Write down what changed! That’s evidence of your brain stretching and growing!”