Lesson Implementation and Reflection   Karen Weir-Brown
Astronomy and Space Science (Endeavor Course)   Fall 2018
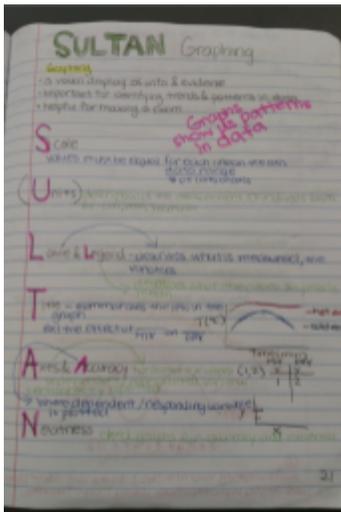
Graphing Global Temperature Trends

Description of Resource:
Graphing Global Temperature Trends is an activity that has students analyzing data from 1880 until 2016 to draw conclusions about trends in temperature changes.
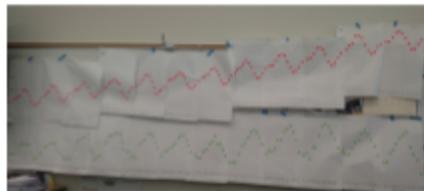
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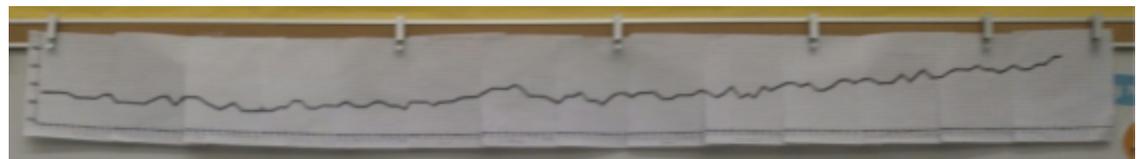https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/

Student Generated Artifacts:

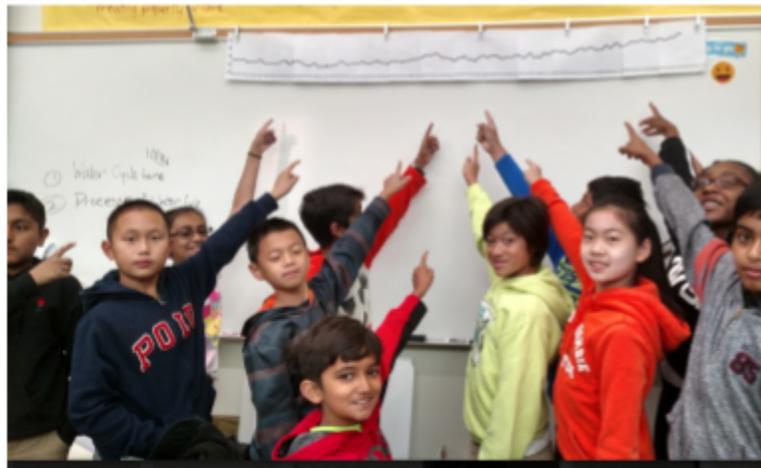
Student notebook page on learning how to graph.

Temperature and carbon dioxide level comparisons for the same years.

This is the final grouping of each decade. Students worked individually to graph their own assigned decade. They found their matching decade to then analyze the data with. At the end, the class created two identical graphs from 1880-2016.

Students showing their efforts!

Global temperatures have increased since the late 1950s. Global CO_2 levels have increased during this same time period.

Are these 2 just randomly correlated or is there a cause/reason for their correlation?

How does E from the sun warm Earth?

What happens to solar radiation?

What affects how much heat stays within Earth?

What affects the amount of greenhouse gases in the atmosphere?

Are we causing/contributing to global climate change?

What do we do to stop global warming?

These posters summarize several days of class discussion after completing the Graphing Global Temperature Trends Activity. After making their claims (first two sentences), the students generated questions they then wanted to explore (rest of poster).

Student work to process how Earth's atmospheric layers can trap more energy and cause global temperature increases.

Summary:
This activity was outstanding for engaging students and letting them come to the claim that global temperatures have risen over the past century. Students were initially frustrated by learning how to create graphs (mainly scale) by hand but I thought it was important to teach them the skill so I did not use the graph paper provided and students did not try the graphing digitally.

I loved that the lesson background includes the vocabulary distinctions between weather and climate and global warming and climate change. Both sets of vocabulary became a focus of lessons even though I did not share with students the background information from the activity. The explanation of temperature anomaly was very helpful to me. I did not have students graph the temperature anomaly data but I did show the anomaly graph at the top of the activity once students had analyzed their own work and seeing the anomaly data/graph added to student understanding and explanations.

The discussion questions in the activity were in line with ones that I have asked students in previous years. The only change I made to the activity directions was to have students graph with own decade (due to my class sizes, there were 2-3 students who graphed each decade). They then found their partner(s) who also graphed the same decade and discussed what they thought the graph line showed. This also worked as a formative assessment to determine if anyone had graphing difficulty. Students wrote their ideas in their notebook. Next they did a gallery walk of everyone's graphs and again wrote down what they thought about the graph line. At this point, we discussed what students thought and the consensus was that all the decades showed very little change. Finally, we taped together consecutive decades. The energy in the room was incredible as we added 1980 and the last decades. Several students exclaimed their mind was blown! We then had a class discussion and students ended with an additional notebook reflection on the combined data.

After the students analyzed their graphs and made their conclusion that Earth's temperature is increasing, they graphed carbon dioxide levels and placed that graph under the temperature graph for the matching years. From there, they generated a list of questions to investigate. Finally, I showed students the video that is linked in the activity, "NASA's Earth Minute: Earth Has a Fever." Students really appreciated the connection to them having a fever; especially since we oftentimes discuss that a small difference in temperature in our lab work is not significant, students were not originally convinced that the small temperature increase over 136 years was something to be concerned about. The video made a great connection to an idea they do understand (themselves) and also introduced results of this temperature increase. Next year, I would like to have students also complete the Sea Rise activity to add to the display of graphs.

This activity opened the unit on global climate change. As we finished the unit, I revisited this activity to show students the graph in step 17 of the 8th grade and up section (flat line using a scale of 10 degrees). The students were so intrigued by their new interpretation of the data just by changing the scale that I think they really learned a lot more about scale as a result.

This activity definitely worked well to introduce the NGSS standard MS-ESS3-5 factors causing rise in global temperatures over the past century. It incorporated not only a DCI, but also involved SEPs and CCCs for a three dimensional lesson, and the students enjoyed it!

References:
Graphing Global Temperature Trends Activity | NASA/JPL Edu. (2018). *NASA/JPL Edu*. Retrieved 16 August 2018, from https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/