Identify Meteors in Radio Data

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Methods of STEM Education

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July 5th, 2020

In my high school physics classes, I have the ability to design my own curriculum and choose the content that I teach. The class is not a Regents based class like the majority of New York City physics classes. I chose to work at the school for that reason and to have a flexible curriculum that I design. I have spent 5 years creating and adapting the current two-year curriculum. The first year focuses on how to use the engineering design process through energy, sound waves, renewable energy sources, and a few other changing topics. The second year looks at the pendulum, electricity, kinematics, forces, and more thru the lens of the scientific method. This way my students get a look at both processes and how to use them while also learning the physics content.

In the past five years I have only used data gathered by the students. Using data in the classroom is important whether it be collected by the students or data from outside sources. Analyzing data is a way to come to conclusions and share what was learned which is an integral part of science. In the classroom these discussions generally start with the students wanting to know if they are right or wrong. I am working on avoiding the use of right or wrong when referring to students' data and instead pushing for, "what's your evidence?" Classroom data provides a common set of information that all students can access and interpret to for a discussion. It allows presents a platform to come up with uniform definitions and terminology for the class.

This spring one of the ways I have been looking to change my curriculum is to adapt it to the remote setting or social distanced group work. We do not know what next school year will bring, but it is likely that the students will not be able to work closely together. This changes how I can teach, the materials I can use, and the activities to plan for the students. If we do not have the materials to design experiments within the classroom, we can instead access data that was gathered by scientists that we can analyze, interpret, and discuss as a class. There are a plethora of resources available via NASA data, recent space station launches, trying to get to

Mars, and learning more about the universe we live in. My students are always interested in space and mini units I have taught about space.

As I am deciding what to teach for next year I plan to spend a trimester, two units, teaching about space. One of the data sources I found and want to use is identifying meteors in radio data (https://www.zooniverse.org/projects/zooniverse/radio-meteor-zoo). This would allow a unit on light and the electromagnetic spectrum which I have barely taught in the past. First the students would learn about visible light and the electromagnetic spectrum. They have some background on waves from our unit on sound this past year. We would then highlight the different types of waves which leads into radio waves and using them to identify meteors. The use of this data source allows the students to better understand different types of waves, how they are used, and why they are important.

The identification of meteors using radio waves is a way for the students to participate in citizen science by doing science. They would be interpreting data on meteors. With the advancement of technology, scientists are sometimes able to gather more data than they can analyze. The meteor detectors can identify meteors, but the human eye does a better job detecting where they are in each image. This website gathers data of meteors using radio waves and the students would help identify where the meteors are located. As the data is saved graphs are created showing when there is more meteor activity. As the Earth orbits it crosses different comets and meteoroid streams like the Gemenids meteor shower which happens every year around early to mid December. The data from the Gemenids and other meteor showers show a surplus of meteors that anyone can help identify.

The meteor data and graphs, as most quantitative data, can be analyzed incorporating math. I often push the students to think of their math classes and how they would describe a graph or an equation to their math teacher. This involves being aware of what content the math department is doing and when they are learning certain topics. It has been hard to find the time

to sit down with the math department and look for connections, but I can find the time to inquire about what they are learning.

In the past the English class has read Hidden Figures which provides an excellent tie in. Last year I had a unit about famous scientists and most of the students chose Mary Jackson or Katherine Johnson because of how much they enjoyed reading Hidden Figures. It is an important connection to highlight women of color, their role in the space race, and how little they were initially recognized for their work. This unit also can look briefly at the history of comets and when they were first discovered. Another interesting link is to look at comets by seeing what ancient cultures thought of them which could pertain to the students' history classes.

The hardest part of this assignment was selecting a data source. I started looking at resources and websites and found that my initial idea of what data to use changed multiple times before selecting one. This proves how much information is out there and the number of great resources that can be incorporated as major projects or minor activities in a class. I chose zooniverse.org for the collaborative nature to additional connect to the nature of science. The students would be participating in the collaborative aspect of science. It is important for them to see that not only do we collaborate on science in the classroom, but real scientists also collaborate on data, experiments and information.