Data… and Math Are Everywhere **Assignment by Soyoung Chon**

As a gifted and talented program (grade 3~8) coordinator, I have been exploring ideas and lessons on how to motivate and challenge advanced learners. I have used interesting current or historic events to captivate students' curiosity and engagement. I love to use phenomena – using photos or a short video clips – to capture students' attention.   Over the last couple of weeks, I have explored SpaceMath@NASA and read the assigned readings.   I found International Space Station (ISS) very interesting. I believe the data and photographs collected from ISS can be used for my lesson plans in various ways.

- **Data (Include image, NASA source, and other information)**

The data that I chose for my lesson are the *Earth observation images* from the NASA International Space Station (ISS) (https://eol.jsc.nasa.gov/). Students can engage with the website by exploring the collection and analyzing geographic features in the images. Further, students can examine the metadata associated with the images to assess what information they can use from the images.

The specific images I chose are the ***Fires from California (08/05/2021***) images from the ***Natural Hazard and Disaster Imagery Collection of the ISS (https://eol.jsc.nasa.gov/SearchPhotos/ShowQueryResults-SlideshowGallery.pl? results=Collections_NDP_Fires_in_California_Aug2021).*** These seven photos have geospatial information (latitude & longitude), temporal data, and metadata (focal lengths and resolutions) as below (Figure 1).

As supplementary data for this lesson, I can also use https://www.fire.ca.gov/incidents/2021/8/4/river-fire (Source: *California Department of Forestry and Fire Protection***).**

- **Engaging Context (How does the data serve as an engaging context for the math concept you teach?)**

These images serve as phenomena that can show students how math concepts are applicable and relevant to their everyday lives and capture their interests. Last week (June 5~8), NYC and NJ suffered from extremely hazardous air quality due to the Canadian wildfires. This event affected the students' lives and makes the issue real to them, increasing their interest.

These images from ISS highlight how impactful major forest fires are – they can even be seen from space! Measuring features in the images will provide the students with a unique mathematical and scientific perspective on the value of the images. This analysis will help students to build and enhance the foundation of *quantitative reasoning*. I can encourage students to adopt this mathematical critical thinking concept in my role as the gifted and talented program teacher. As today's reading (*Principles for Quantitative Reasoning and Modeling* by Eric Weber) points out, quantitative reasoning is the key element that supports students in the mathematical modeling of phenomena.

- **Measurable Objectives (What is the measurable objective of the activity?)**

I will show students seven images of the California Wildfire from ISS to students as below (Figure 2).

These ISS images contain geospatial information (latitude & longitude) and metadata (focal lengths and resolutions) as you can see in Figure 1. For younger grades (3~6th), I can ask them to arrange images and collect *geospatial and temporal data* by distributing copies of the seven images. By comparing images taken at different times, the students can measure the number of fires, the size of the smoke plumes (length, width, and area), and the affected area by using a ruler and grid. If I can find the data on the observed number of fires and the size of the smoke plums, and the burnt areas, students can use scale/ratio equations. For the upper-grade students (7~8th), I can explore how the image processing algorithms can extract quantitative information from these images. I need to do further research and consult with scientists to understand the latest approaches. I could also consider inviting a guest speaker for the class.

- **Evidence (Plan for the next year)**

My gifted and talented classes ended on May 24. So, I was not able to implement this lesson in the class or see if this lesson could enhance the understanding of the concept. However, I am very excited to try out this lesson in the Fall. I will use the following evaluation strategies for the next year to collect the evidence.
1. Ask the students to create their own tables and graph by using their collected data;
2. Ask the students to summarize what they learned from the analysis of the data;
3. Ask the students what math concepts they use to collect data (e.g., geometric techniques to calculate the size of the smoke plumes)
4. Ask the students what other possible data could be derived from those images;
5. Group students to compare their answers and analysis; and
6. Presentations and discussions

- **Standards**

My school follows Archdiocese of Newark's curriculum maps. I will apply the following standards for my lesson.

<u>Science:</u>
Standard 5.1 (Scientific Processes)
Standard 5.3 (Mathematical Applications)
Standard 5.9 (Astronomy and Space Science) All students will gain an understanding of the origin, evolution, and structure of the universe.
NGSS- Using Phenomena

<u>Math:</u>
4.MD.S4 Graphing: Draw conclusions and make predictions based on representations of data sets
4.G.1-Polygons: Identify, compare, and analyze attributes of two-dimensional geometric shapes
4.MD.1-Measurement: Know relative sizes of measurement units (length, distance, etc.)
4. MD.S2- Graphing & Data: Collect data through observation and measurement
5. OA. S11-Ratio and Proportions: Solve problems involving proportional relationships
5.MD.S4 – Data, Tables and Graphs
6.RP.1- Ratio/ Proportions, Measurement
6.SP.1- Data Analysis
7.G.6- Perimeter and Area: Solve real world and mathematical problems involving area, volume
7.RP.2- Ratios and Proportions
7.SP.2- Data and Graphing