Mandatory 3:
Data...and Math Are Everywhere
MPaul_Finding Speed_Grade7

Data:
NASA Space Math Resources
Apollo 17 - Launch from the Moon's Surface

▶️ Apollo 17 Lunar Liftoff Youtube video actually showing the lunar liftoff which was a resource from NASA Space Math. .

I researched and found an engaging Youtube video to introduce the Apollo 17 crew and that it was the final mission of the Apollo missions to explore the Moon. Watch 1:42-4:02 minute mark
▶️ Apollo 17: The Last Men on the Moon (Space Documentary) | Real Stories

📄 Kami Export - Walk and Scooter Activity.pdf
The first page here is the sheet that I used to gather the Walk and Scooter Speeds. It is from FOSS (Full Option Science System) resources. I had to replace the "Runner" with a student on a scooter because we performed the activity in the school hallway outside of my classroom, due to the heat, and the rule that there is no running in the halls.

Engaging Context:
The individual student data collection for speed was meaningful and engaging because all students participated in collecting the data whether recording times, using a stopwatch to time the participants, or actually participating as a "Walker" or "Scooterist". Three timed trials occurred moving at a distance of 20 meters to discover the speed equation and later to create an average speed graph. The Apollo 17: Launch From the Moon's Surface data was a way to reinforce the speed equation. None of the students knew that Apollo 17 was the last mission to the Moon. This activity was a clever way to formatively assess student's understanding of the average speed of the Apollo 17 Lunar Module. Data from images of the lunar liftoff with two astronauts was given and a chart for speed and a problem on average speed was to be completed. All students worked diligently on their tasks at hand and I was super proud of their level of interest for the month of June.

Measurable Objective:

My objectives for this lesson follow the I can statements as follows:
I can…
-Acquire distance and time data to determine speed.
-Solve an equation where the average speed is the total distance traveled by an object divided by the total time from initial to final time.
-Discover the slope of the line on a distance-versus-time graph indicates speed where the steeper the slopes represent faster speeds.

Standards:

Mathematics

MP.2   Reason abstractly and
          quantitatively.

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio

a:b with b ≠ 0, and use rate language in the context of a ratio relationship.

NGSS

MS-PS3-1.

Construct and interpret graphical displays of data to describe the

relationships of kinetic energy to the mass of an object and to the speed

of an object.

Evidence:

The data I collected was authentic data from student participation in an introduction to Physics exercise on motion for finding their average speed as a "Walker" or "Scooterist". Students were given a measured out distance of 10 meters from cone to cone for a total distance traveled of 20 meters. Two students were given the task of timing the "Walker" or "Scooterist". After each trial, each student was to record their data in the chart under Part C. Students performed a total of three trials out in the hallway. Students switched back and forth between timing trials and participating in the activity. Students that were on medical leave from gym were given the automatic job as "Timer".   They chose a peer to copy data in their own chart. This activity took about a half an hour in the hallway after the directions were explained, questions were answered, and materials were gathered in the classroom. Students from other grade levels were jealous that we got to have so much fun in the hallway with their comments and whines to their teachers walking by. Secretly, that made me smile to myself!

The next day in class students used calculators to calculate the average time it took the "Walker" and "Scooterist" to complete their distance of 20 meters. The average time and distance data was used to calculate the average speed of each student. Discovering the speed equation wasn't easy at first. I had to reference a speed limit sign outside the school building that stated 25 mph. Reviewing that miles meant distance, per meant divided by, and hours were units of time helped

students discover that the speed equation equals distance divided by time. We then used the average time and distance data to create a graph of the average walking speed and the average scooter speed. Students plotted a point at the origin to represent the initial time of 0 seconds at a distance of 0 meters. They then plotted a point on the graph of the average time on the X-axis and the distance traveled on the y-axis to connect to the origin. This created two different slopes, one for the "Walker" and the other for the "Scotterist". With my prompting, students could see on the graph that the steeper the slope the faster the student traveled. I compared the slopes to composite volcanoes, which are steep, and shield volcanoes, which are broad and gentle slopes to understand that the steeper slopes have lava running down faster and therefore the steeper slope represents the faster student.   We have already covered volcanoes so this was a great connection for students to interpret the graph. I collected their sheets and looked over the math to find the average times and the construction of the two slopes for the average speed graph.

Next I introduced the Apollo 17: Launch from the Moon's Surface activity to formatively assess student understanding of finding the average speed of an object. We watched a brief introduction to the Apollo 17 mission. Then I handed out the worksheet of a time-lapsed image of a Lunar Module during liftoff for the Apollo 17 mission provided by NASA's Space Math. There was a chart students had to fill out where they were given the time, in seconds, and the height, in meters, of the Lunar Module that carried two astronauts, Eugene Cernan and Harrison Schmidt, safely back to the spaceship. I showed an engaging video of the actual Apollo 17 liftoff from the point of view of the camera left behind at the landing site which was also provided by NASA's Space Math. Students were then given the rest of the class time to complete the speed chart of the seven images of the liftoff time and height data. Students also were asked to complete only Problem 1 below the chart on finding the average time of the Lunar Module due to time constraints. I collected the worksheet to assess student understanding of implementing the speed equation.

I truly feel that adding the NASA Space Math activity to enhance the speed equation Physics lesson was successful and enhanced student's understanding that the average speed is the total distance traveled by an object divided by the total time from initial to final time. The behavior for a Monday in June was phenomenal. Not one student was fooling around and everyone took the assignment seriously.

While reviewing the two forms of formative assessment I would say 95% of students understood how to discover the speed equation when given data and to create a distance-versus-time graph of speed.   My general education students mastered the objective, while my special education students still need more practice to display their understanding of the subject matter.

📄 Student Data Mandatory 3.pdf

The link above is actual student data that I obtained from two of my seventh grade students in period 1, Earth Science. It includes the Walk and Scooter Data, the Average Speed graph, and the Apollo 17: Launch from the Moon's Surface which I used as formative assessment for finding the speed of the Lunar Module at seven different locations above the surface of the Moon. Students filled out a chart and answered Problem 1 of finding the average speed of the entire image sequence. Time constraints did not allow us to complete Problem 2.