Google Mars

Objectives

Participants will:

- Learn about geologic features and processes on Earth that also exist on Mars.
- Compare and Contrast Earth and Mars' land features
- Identify the parts of the map
- Locate any point on the map using Latitude and Longitude
- Utilize critical thinking skills when analyzing terrain.
- Use map keys, scales, and symbols to get a more accurate picture of what they are looking at.

Suggested Grade Level

4^{th} -12^{th}

Subject Areas

Earth Science, Space Science, Language Arts

Timeline

45 Minutes

Standards

- **4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.**
- **4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.**
- **MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.**

Background

Humans want to know about our natural surroundings. It is important to be familiar with our world. Mapping it has evolved over time. We have keys, scales, symbols, latitude and longitude coordinates to pinpoint exact locations on the globe, and colors/lines to show elevation. With our current knowledge and understanding of map technology and the ability to read maps on earth, we are now able to relate this to Mars.

Starting with pure observation, that then led to orbiters gathering images of Mars. Now we even have rovers and landers on Mars. This reconnaissance is coupled with technology that allows us to push the limits of exploration. Maps are a huge part of this. They allow us to become familiar with the unfamiliar, to accurately scout out potential landing sites, and they give us the ability to "know before we go".

Connecting students with these concepts can be very powerful. Helping students acquire map reading skills, recognize land features, analyze the terrain, and utilize the keys and scales will give them critical thinking skills.

Vocabulary

cartography, legend, key, scale, latitude, longitude, coordinates, kilometers, meters, northern hemisphere, southern hemisphere, equator, prime meridian, sea level, (relevant **geographic terms – grade appropriate**, terrain, analyze, interpret, symbols, rover, lander, crater, atmosphere

Materials

- Computers and internet access with Google Earth download. (Google Mars automatically comes with Google Earth).
- Ideally you would want a big screen tv to mirror your Google Mars up in the front of the class to make it a guided exercise.
- iPads with downloaded app of "Mars Globe" (if available)
- Worksheets
- Pencils

Lesson

1. Check for background knowledge with regards to Google Earth. (**1 minute)**
2. Explain to the students that Google Earth is just another great step in the evolution of maps and visualizing our Earth. **(1-2 minutes)**
3. Guide the students to get on Google Earth and walk through a quick tutorial covering the basic movement functions. (including the quick key commands – flying forward/backward, rotating left, rotating right, zooming in/out, changing your vantage point from a satellite POV to an eye level POV, etc.…. NOTE: THE COMPASE ROSE, THE ELEVATION, AND THE LAT/LONG COORDINATES) **(3-4 minutes)**
4. Give them **5 minutes** to explore while having them focus on anything that catches their eye. Guide them to locate exciting land formations and zoom onto them. Keep them aware of the fact that land features we are recognizing are very similar to those on earth and Mars.
5. Have a conversation about earth's map making history and explain to them that Mars, although having a young map-making history, is on the verge of exploding in terms of allowing technology to aid us in mapping Mars. Couple this with our innate desire to explore and know more about the things around us. Site early explorers even! Lead into this new dawn of exploration. SPACE/OTHER PLANETS (**3 minutes**)
6. Model how to use the sidebar on Google Mars to check off particular "layers" that will allow you to highlight particular historical facts about Mars. Students are just listening to you and not yet using Google Mars themselves. **(1 minute)**
7. Begin asking questions to the students about what maps were like when humans began mapping our earth. Were they accurate? Were they specific? Were they hard to read?

Were people able to map the whole of earth when we knew so little about it? How can you map what you can't see? **(3-4 minutes)**

8. Explain to the students that you will enable a "layer" in the sidebar of Google Mars once students get an understanding that maps had to evolve to become the sophisticated tools that they are today. This will explain a brief history of the mapping of Mars and who the individuals were that made these significant contributions of the day. **(Historic Maps – click on the circle next to that and also click on each name so that you can read their Bio aloud.) - 5 minutes –**
9. Explain to the students that you will show them a quick "guided tour" narrated by Bill Nye, which will take them through a brief history of the robotic exploratory missions. This will also explain a little about the scientific attractions and significance of the areas that these rovers, landers, and orbiters are expected to uncover. **(In the sidebar click on the "Guided Tours" layer, open it up and double tap the "Mars Exploration" one.)** Feel free to interject small anecdotal recent missions, current/future missions to Mars. **(Time can vary…. I usually gauge how long I play this based off of the students' interest or disinterest. 4-7 minutes)**
10. Have them find the sidebar and the **"Rovers & Landers"** layer. Tell them to make sure that they click on all of them (including the panoramic photos) Explain to them that NASA and other agencies have spent a lot of time, money, resources, and energy to send these robots up to Mars. There must be something compelling enough for us to do so. Some don't work anymore; some still do. More are to come. Take some time to research some landers/rovers and find out what their mission was, where they landed, and where they went. Have them click on images along the way to get a sense of what things look like on Mars through the eyes of the rovers/landers. Give them some time to do this. **(10 minutes)**
11. Guide them to the sidebar and have them check off the layer known as **"Spacecraft Imagery"** When this is checked off and expanded, have them click on the "**HiRISE Image Browser"**. This will force red boxes to appear within long rectangular strips. These are the flight paths of orbiters. The significance of this is that a land feature or formation of some sort was scientifically attractive enough to capture a high-resolution image of in order to know more about the area. Did water have something to do with this? What geologic processes might have occurred here? Etc.….
12. Monitor students. If they click on the red box, an image will appear, and they can also have the option of clicking on a link that will lead them to more information about the significance of the image. **(5 minutes)**
13. Have the student locate the sidebar again. Guide them to the **"Global Maps"** layer. Expand this and click on the **"Colorized Terrain". This feature allows us to see elevation gain and decent by assigning colors to particular elevations.** Take the students to Olympus Mons and the other surrounding volcanoes. Note the red solid color surrounding the volcanoes. Tell them that this is a giant mesa. Change POV to eye level, travel around the region using the key commands, and have them note the topographical change in elevations through the region. Point out low points, points below sea level, and all other elevations. Give them time to explore the terrain. Have them look for similarities to the land features we know on earth. Give them some indications as to how big some particular features on Mars are by comparing them to land masses on earth. (Example: The great rift/canyon on Mars leading away from Olympus Mons is as long as

the U.S from the West to the East. Note how high the highest point is on Mars, and how it dwarfs Everest.

Extensions

- Have students go on a scavenger hunt on Mars. Students can look for specific geographical sites (i.e. lava tubes, craters, rover landing sites).
- Create a mission for the students. You are a NASA scientist and need to scout out 3 possible sites for our Mars habitat. Inform students that they need to consider factors like terrain, areas for research, available resources, etc.
- Design a habitat suitable for life on Mars. Have students research what is needed to create a structure on Mars. What is needed to sustain life on Mars?
- Develop an itinerary for NASA's next rover. Where will the rover land? What will it research? How long will it travel?
- Compare Earth and Mars. What are characteristics are similar? Different?