Tammi Deines 5E Lesson Plan
Topic: Mars Spirit Rover
Grade: 4th grade
Time: 5-7 days

Background:

One of two rovers launched in 2003 to explore Mars and search for signs of past life, Spirit far outlasted her planned 90-day mission. Among her myriad discoveries, Spirit found evidence that Mars was once much wetter than it is today and helped scientists better understand the Martian wind.

In May 2009, the rover became embedded in soft soil at a site called "Troy" with only five working wheels to aid in the rescue effort. After months of testing and carefully planned maneuvers, NASA ended efforts to free the rover and eventually ended the mission on May 25, 2011.

Standards:

NGSS:

4-ESS2-1. Make observations and/or measurements to provide evidence of

the effects of weathering or the rate of erosion by water, ice, wind, or vegetation

4-ESS2-2 Earth's Systems

Analyze and interpret data from maps to describe patterns of Earth’s features.

4-ESS1-1 Earth's Place in the Universe

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time

Math Standards:

MP.2 Reason abstractly and quantitatively.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.

ELA Standards:

RI.4.7 Interpret information presented visually, orally, or quantitatively.
W.4.8 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Objectives:

The students will to learn about the challenges faced while trying to operate a planetary rover. ·

The students will learn to work within a mission team setting, working together to problem solve and accomplish a common goal.

The students will learn to operate a robotic vehicle while it is not directly in view of the driver or operations team.

Materials:

Remote control car for each 4 to 6 member team (borrow from students)
Measuring devices (meter stick or tape measure - Can change units to yards) 2 per team

Rocks or other marking devices to- set up 'way points' in which to drive car
Background information on planetary rover teleoperation
Student calibration and mission planning sheets
Stopwatches
Compasses
Popsicle sticks
Pencils
Masking tape for marking starting lines
Calculators (optional)
Video camera and monitor (optional)

5E Lesson Plan	
Engage (Day 1) The purpose for the ENGAGE stage is to pique student interest and get them personally involved in the lesson, while pre-assessing prior understanding.	At the beginning of class I will show this picture of the Mars Rover Spirit. I will have the students quietly observe the picture and write one I notice and I wonder statement for the picture. https://cdn.britannica.com/93/93293-050-92D12F74/Artist-conception-Mars-Exploration-Rover.jpg After 5-7 minutes of observation I will then have the students share with a partner what they noticed and what they wondered. I will then explain that we will be looking at the Mars Exploration Rover Spirit. We will also be trying to operate a planetary rover without being able to directly see the rover in person.
Explore (Day 2-3) The purpose for the EXPLORE stage is to get students involved in the topic; providing them with a chance to build their own understanding.	The students will choose and research one rover that has been to Mars and whether or not they successfully completed their mission. If there were problems they can then try to determine what went wrong and what could possibly be changed to make it more successful.

5E Lesson Plan	
Explain (Day 4-6) The purpose for the EXPLAIN stage is to provide students with an opportunity to communicate what they have learned so far and figure out what it means.	1. I will set up an all terrain course for the class to observe. I will have them pretend that they are going to be in charge of running a rover on Mars to look for other signs of life. 2. Brainstorm whether or not they can just start driving or if they have to make up a plan of some sort. After discussion of having a plan is a better route to go we will brainstorm how we should go about doing this. I will have the students in groups of 3-4 decide or make a plan that we will test out. 3. We will test out each group's ideas. After all groups have shared we will discuss the pros and cons of each plan. Day 5: 1. I will divide the class into groups of 4. In each group the students will first design a course for another group to test out. 2. In each group they will decide who will be the drivers first and the direction makers. 3. The direction makers will make directions for the drivers to follow to make it through the course. They will have 3 tries to get from the start to the finish. Each time they will record if they were a success or not. They can then rewrite the directions to help get the driver to the end. 4. After the three tries the groups will write a summary of their experience. Day 6: They will share their results and show the class how their rover went through the best set of directions. Then there will be a whole group discussion of what their results were.

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Elaborate/Extend The purpose for the EXTEND stage is to allow students to use their new knowledge and continue to explore its implications.	To extend the activity I would then have the students switch roles and have them run through another course that is more difficult and which the directions get them stuck like the Spirit rover. They will then need to try to get out of their predicament.
Evaluate The purpose for the EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.	Assessment will be based on observation, summaries on experience and sharing of their results.

Resources:

Mars Activities. (1997). Retrieved October 18, 2020, from https://mars.nasa.gov/files/mepjpl/MSIP-MarsActivities.pdf

Mars Exploration Rover - Spirit. (n.d.). Retrieved October 18, 2020, from https://www.jpl.nasa.gov/missions/mars-exploration-rover-spirit-mer-spirit/