

Living on Mars: Communicating with People on Mars and on Earth



Student Level:
Middle School (6-8)

Objectives:

- Students will learn about the distances and units of measurement for bodies in the solar system.
- Students will think critically about the difficulties of communicating over great distances.

Resources:

- string
- three balls (perhaps one large playground ball and two small tennis balls)
- poster paper
- markers

Outcomes:

- Students will orally evaluate the communication challenges faced by explorers on Mars.
- Students will create posters that demonstrate their understanding of the communication challenges and possible solutions.

Assessment:

- Were the students able to use the model to develop an understanding about interplanetary distances?
- Were the students able to think critically about the effect of time delays in communication between Earth and Mars?
- Were the students able to think critically about the communication difficulties on the Martian surface?
- Were the students able to, in their posters, describe the communication challenges and create reasonable solutions?

Time:

About 60 minutes.

Procedure:

~5 minutes:

Begin by explaining that telecommunications are mostly based on signals sent by some form of electromagnetic radiation, such as radio waves, microwave beams, or light in a fiber-optic cable, all of which moves at the speed of light (approximately 300,000 km/sec or 186,000 miles/sec). Because of the highly developed telecommunication networks in place (i.e., satellite, fiber-optic, etc.), communication around the world can be nearly instantaneous. On Mars, however, with it being so far from Earth and without such networks, communication can be much more challenging.

~5 minutes:

Continue by explaining that interplanetary and interstellar distances (the space between planets and between stars, respectively) are so large as to require special units of measurements: the astronomical unit (AU) and the light year (LY). Define an AU as the average distance between the Earth and the Sun (about 150 million km or 93 million miles). Define a light year as the distance that light travels in one year (about 63 thousand AU). An AU is can also be defined as approximately eight light minutes (that is, the sunshine reaching the Earth left the Sun eight minutes earlier).

~20 minutes:

In a large space, such as on a playground or in a gym, have the students create a scale model of Earth and Mars in orbit about the Sun, using the balls to represent the planets and star. Mars orbits at an average distance of 1.5 AU, so the string used to represent the distance of Mars from the Sun should be half again as long as the string used to represent the distance of Earth from the Sun (perhaps 30 feet and 20 feet, respectively). One student will stand at the Sun's location, holding one end of each string. Another student will stand at Earth's location, holding the other end of that string, while a third student will stand at Mars' location, holding the second string. A fourth student will represent the communication signal being sent between the two planets. The "signal" will walk, at an even pace, directly from one planet to another (just as EM signals travel directly); the student might carry a written message, or pass an oral message. Have the two planets at various points in their orbits to demonstrate the effect on communication time (i.e., Mars at 0, 90, and 180 degrees, relative to Earth). Remind the students that one AU is approximately eight light minutes, so when Mars is on the opposite side of the Sun, or 2.5 AU's away, one-way communication would take about 20 minutes (and may be subject to interference from the Sun).

~30 minutes:

Lead the students in a discussion about the effect that difficulties in communication with Earth would have on explorers on Mars. What sort of communications might work (such as email) and what might not (such as videoconferencing)? How might the explorers feel in regard to the isolation? Also discuss potential difficulties in communication between explorers on the surface, due to lack of communication infrastructure (i.e., phone lines, satellite networks, etc.). Then have the students create posters that, through pictures and writing, demonstrate understanding of the challenges and put forth possible solutions.

Standards Addressed:

California:

Science, Grade 8

4.c. Students know how to use astronomical units and light years as measures of distances between the Sun, stars, and Earth.

Florida:

Science, Grades 6-8, Earth and Space

1.1 The student understands the vast size of our Solar System and the relationship of the planets and their satellites.

New York:

Science, Physical Setting

1. The Earth and celestial phenomena can be described by principles of relative motion and perspective.

Texas:

Science, Grade 6

13. The student knows components of our solar system; the student is expected to: A) identify characteristics of objects in our solar system and B) describe type of equipment and transportation needed for space travel.