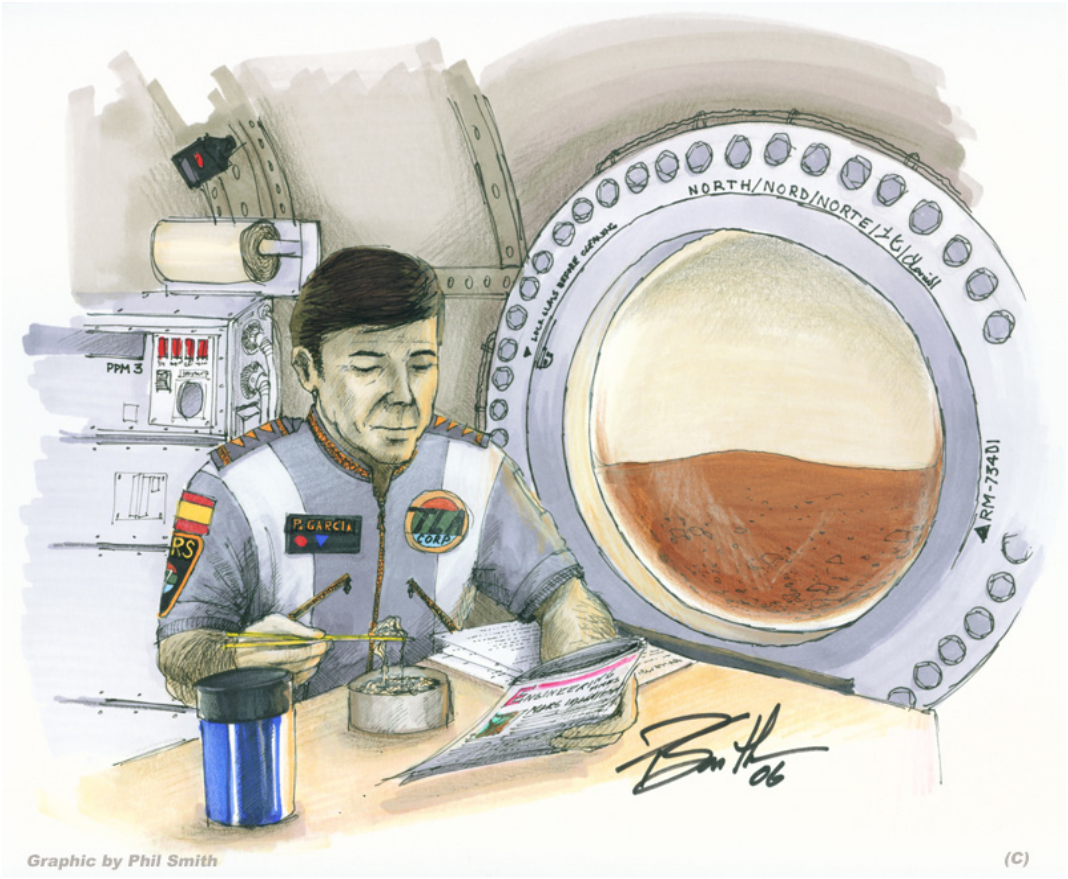
Living on Mars: Living in a Habitat



Student Level:
Middle School (6-8)

Objectives:

- Students will think critically about the basic needs of Martian explorers, and how to meet those needs.
- Students will make connections between how those same needs are met in their own lives, and the lives of those about them.

Resources:

- grid paper
- masking tape
- meter sticks (or other such measuring devices)
- poster paper (optional)

Outcomes:

- Students will create a list of required functions for a habitat, including the recycling of air, water, and food.
- Students will create a scaled plan, on paper, of their habitat design, and then mark out the full-sized space in order to simulate a test of its effectiveness.
- Students will be able to orally describe how the explorers' interactions with and dependence on their environment is similar to that of people everywhere.

Assessment:

- Were the students able to list the basic needs that people have?
- Were the students able to make connections between different components of the system?
- Were the students able to create reasonable plans to scale?
- Were the students able to transfer the plans to full scale?
- Were the students able to think critically about the interactions of the explorers with their environment? Were they able to connect this with how other people interact with their environment?

Time:

About 90 minutes; this could be completed in one day or over several, whichever would work better for a class' schedule.

Procedure:

~5 minutes:
Introduce the lesson by explaining that explorers on Mars will have the same basic needs as anyone on Earth, but that a lot of careful thought will have to go into designing their habitat (the structure they live in), because the Martian environment is so different: the atmosphere is 95% carbon dioxide, only 1% as thick as Earth's, very cold, and carries extremely fine dust; the surface is barren and without any known life (this should be written down for the students). The students' task in this exercise is to identify what the explorers will need and design a habitat to accommodate those needs.

~20 minutes:
Have students describe the functions that the habitat would have to serve for the explorers; write the list on the board; use leading, open-ended questions to prompt the students as necessary (i.e., "What else might they need?" "What functions do various rooms in your house serve?"). The list should include such functions as providing a place to sleep, work, recreate, and take care of personal hygiene, as well as providing for air, water, and food. The habitat may include additional structures, such as an attached greenhouse for growing food, cleansing water, and recycling waste. Have students think about how various systems may interrelate (i.e., plants grown for food also help cleanse the air and water).

~5 minutes:
Because of the difficulties in launching the habitat from Earth, sending it through interplanetary space, and landing it on Mars, the habitat will be limited in size. It will probably be a cylinder (you may want to have the students speculate about why), perhaps 4-10 meters across and 3-10 meters tall. Lead the students in either demonstrating or describing the distances being discussed (i.e., "Three meters tall is as high as our ten-foot ceiling..."). For the exercise, establish the maximum diameter and number of stories that the students will use in designing their habitats (students can help define the parameters).

~20 minutes:
For designing the habitats, students should use a common scale, with each grid of the graph paper corresponding to a certain size. Students may work individually or cooperatively to start, but at the end of this phase of the exercise, the students should select two or three designs to mark out on the floor (use of a gym floor or outdoor pavement may be easier for the next phase).

~20 minutes:
Using the masking tape to delineate walls and other pieces of the habitat, the students should recreate the scaled plans as full-sized layouts. Check to make sure the transfer is done reasonably accurately, offering help as needed (i.e., "Did you double-check the diameter on your plans with the diameter of your layout?"). After the habitats are marked out on the ground, the students can test out their design, using different sized crews and trying different tasks (students should take notes, using the plan papers, about what appears to work and what doesn't).

~20 minutes:
To wrap up the lesson, lead students in a discussion as to what would happen if the habitat, or some piece of it, failed to function. Ask them to compare the issues that the explorers would face with issues people on Earth do face (i.e., "What challenges do the explorers face in acquiring clean water and sufficient food, and how is this similar to or different from the challenges people on Earth might have?").

As a follow-up task, students could make posters, demonstrating the flow of energy and nutrients between living and nonliving components of the habitat's ecosystem (such as oxygen from plants to people and carbon dioxide from people to plants).

Standards Addressed:

California:
Science, Grade 6
5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment.
Science, Grade 8
4.e. Students know the appearance, general composition, relative position and size, and motion of objects in the solar system.

Florida:
Science, Grades 6-8, How Living Things Interact with Their Environment
1.4 The student knows that the interactions of organisms with each other and with the nonliving parts of their environments result in the flow of energy and the cycling of matter throughout the system.
1.5 The student knows that life is maintained by a continuous input of energy from the sun and by the recycling of the atoms that make up the molecules of living organisms.
2.2 The student knows that all biotic and abiotic factors are interrelated and that if one factor is changed or removed, it impacts the availability of other resources within the system.
2.4 The student knows that humans are a part of the ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.

New York:
Science, The Living Environment
5. Organisms maintain a dynamic equilibrium that sustains life.
6. Plants and animals depend on each other and their physical environment.
7. Human decisions and activities have a profound impact on the physical and living environment.

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.
Science, Grade 7
12. The student knows that there is a relationship between organisms and the environment; the student is expected to: A) identify components of an ecosystem and B) observe and describe how organisms live together in an environment and use existing resources.
Science, Grade 8
6. The student knows that interdependence occurs among living systems; the student is expected to: C) describe interactions within ecosystems.