



NASA Food Technology Commercial Space Center

Plants in Space by Craig Dilley

BACKGROUND Human survival outside the protective biosphere of Earth is a challenging proposition. Knowledge of horticulture has many applications for creating a habitable environment for humans in space.

LESSON SUMMARY This lesson is designed for college students in a 100-level horticulture course. No background in horticulture is required for this course.

The class will compare living in their houses to living in the nearly “closed-system” of a space capsule. The goal is to have the class develop a functional “closed-system” capsule for a team of astronauts that will be leaving for Mars in one year. Divide the class into mini-teams (pairs) that will work on small parts of the project. Then integrate the ideas of all the mini-teams into an overall plan for the project.

Ask the students, “Based on what you have learned in Hort 121 this semester, how would you address the following concerns?”

1. Oxygen supply
2. Water supply
3. Food supply
4. Waste management
5. Mental health
6. Physical health

Each pair of students will be assigned one of the six problems to solve. The success of the overall mission will depend on the ability of the mini-teams to integrate their ideas into a cohesive whole.

The exercise will require students to:

1. Apply course content in a problem-solving exercise – Problem solving skills
2. Work within a small group to address the problem – Small group skills
3. Present information to a large group – Large group presentation skills
4. Integrate ideas of several groups into an overall solution to the proposed problem – cooperation skills, planning skills, goal achievement skills

Space Food

Through this exercise, students will learn the requirements for survival in space.

Students will also understand how their horticultural knowledge can be applied to their homes as well as to a space capsule.

Students will be able to apply this knowledge and understanding when they are exposed to information about space food issues as well as other issues related to food production and the benefits plants have for human existence.

STUDENT LEARNING OUTCOMES

Communication

Students will learn how to divide a larger problem into small parts, find solutions, and then integrate their ideas with a larger group where their ideas may or may not be accepted

Students will learn methods of solving larger problems, including the lesson that good communication is essential for group work.

Students will be able to apply this knowledge and understanding when they are exposed to problem solving situations that they will encounter in the future. They will find ways to be able to teach these skills to others.

Learning

Through this group work, students will learn how think quickly and manage time while under pressure.

Students will learn during the problem solving process that they can apply new knowledge immediately. They will learn to keep an open mind, to treat partners respectfully, and to think critically and efficiently about all ideas that are proposed.

Students will be able to apply this knowledge and understanding when they are at their jobs in the future and are asked to solve a complicated problem with little time available.

ASSESSMENT/ EVALUATION

Students will complete worksheet about Plants in Space.

MATERIALS

Plants in Space worksheet

INSTRUCTIONS GIVEN TO STUDENTS

You are in Horticulture 121 class for a special Saturday session. During class you hear a loud noise outside and discover that a massive meteor has hit Earth. You and your fellow students are among the only surviving humans on the planet. The atmosphere is filling with dust and it is likely that most non-microbial life forms on Earth will be wiped out. A spaceship has been discovered in the Aerospace

Engineering Building and is almost ready to go except the life support system has not been completed. You realize that in order to save the human race, all the students in the Hort 121 class must finish the life support system.

Based on what you have learned in Hort 121 thus far, how would you design a life support system for the spaceship?

In order to solve the mission efficiently, you have decided to break the problem down into six pieces. You need to supply the following six services if you are to have a successful voyage to another planet:

1. Oxygen supply
2. Water supply
3. Food supply
4. Waste management
5. Mental health
6. Physical health

The class will be divided up into small groups to work on the six aspects separately. Once the groups have brainstormed solutions, the class will come together as a whole to discuss the feasibility of the survival strategy. While working to solve the six aspects, it is important for students to know:

1. You have access to all the plants and equipment in the Horticulture Building
2. You have 40 minutes to develop a plan and one month to complete the project
3. A few engineers and mechanics have survived to help implement the life support system
4. The spaceship is as large as two football fields

Group Roles

1. Team leader – Keeps team focused on solving the problem
2. Facilitator – Insures that everyone is represented in problem-solving process
3. Time keeper – Keeps track of time and alerts team members of time
4. Recorder – Writes team solution on blackboard
5. Team members – Contribute ideas and participate in problem-solving
6. *Spokesman – Explains team solution to class

* The spokesman is chosen randomly by the instructor after the solution is written on the board.

**NOTES FOR
FACILITATOR**

Have students form mini-teams of two. The teams will then count off 1-6 to determine which problem they will be working on. Students will work together to brainstorm solutions for their problem.

Mini-teams should join others with the same problem. Once in the larger group, students should number off. Tell students which numbers mean what role (i.e.: team leader, presenter, facilitator, etc.). Each role will be filled, except the spokesperson role, which will be chosen at random after the group has solved the problem. This holds all members of group accountable for knowing the information.

The group discusses possible solutions and finally agrees on the most feasible solution. The recorder from each group writes their solution on the board. Once all solutions are on the board, the instructor randomly chooses a spokesperson from each group to discuss their mission solution and how it relates to the other solutions.

After all solutions have been explained, the class discusses the feasibility of the plan and votes whether it will work or not.

To follow up on the lesson, the instructor can ask for comments about how knowledge from Horticulture 121 helped in finding solutions to mission challenges.

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LEGEND:

—COMMUNICATION MATERIALS

—PROJECT LEARN MATERIALS

—INSTRUCTOR MATERIALS