## OSU_COE_horizontal_2C_O_over_B.epsLesson Description

Emerging Occupations

Systems Thinking Skills

## Levels

Grades 6-8

## Content Areas

Systems Thinking

## Lesson Time

45 minutes

## Next Generation Science Standards

SEP – Practicing and Using Models  
DCI – ETS1B: Developing Possible Solutions  
CCC – Systems and System Models

## Learning Objectives

* Define *system*
* Recognize the basic elements of a system
* Describe the concepts of *emergence* and *submergence*

## Materials

* “Occupation Cards”
* Student worksheets
* PowerPoint presentation

This lesson exposes students to the basic concepts of a system and what a system does. Students are given a scenario in which they are being sent to start a colony on Mars. Each of the students are assigned a unique occupation, and they must figure out how the skill sets of their occupations will benefit the colony. Once they discover how they can help, students form pairs and must list out what kinds of things they can accomplish together as a pair. The goal of this exercise is to show students that people can be more effective if they work together.

## Using This Lesson

This lesson can be used as a part of the Systems Thinking Skills series, utilizing and building upon the skills developed in the other lessons, or it can be taught as a standalone lesson.

## Importance of This Lesson

Systems are formed when people or things work together. The outcome of a group working in conjunction is often greater than what one element could do alone. It is important to recognize that systems exist all around us and understanding how they work can be used to solve big and small problems.

# Content Background

## Systems Thinking

What is systems thinking? Systems thinking is the method of thinking used to think about systems. It is based in four basic rules, described below with their accompanying co-implication:

* **Distinctions Rule:** Any idea or thing can be distinguished from the other ideas or things it is with (thing-other).
* **Systems Rule:** Any idea or thing can be split into parts or lumped into a whole (part-whole).
* **Relationships Rule:** Any idea or thing can relate to other things or ideas (action-reaction).
* **Perspectives Rule:** Any thing or idea can be the point or the view of a perspective (point-view).

These four rules (abbreviated to DSRP) are applied in parallel in systems thinking and can be found as the basis for practically all forms of thinking and methodologies related to systems.

## Systems

Systems, the ‘S’ in DSRP, is the concept that things and ideas can be put together to form a broader meaning. The ways that systems are organized and the elements they contain will determine the meaning. Furthermore, systems can be broken down into smaller systems and also combined to create a larger system. Every element plays a role in a system. Understanding the systems rule will allow one to determine how elements fit into the big picture of systems.

Emerging Occupations

# Materials List

* “Occupation” activity cards (1 card per student. 6 unique cards exist)
* Student worksheets (1 copy per student)
* Computer and projector for PowerPoint presentation

# Preparation Instructions

1. Print copies of student worksheet for every student in the class
2. Divide the room in such a way that pairs of students can work together
   1. If the class is not divisible by 2, have one extra student join a pair to make a group of 3
3. Load lesson PowerPoint presentation
4. Have students keep their occupation cards face down until they are instructed to look at them

# Lesson Outline

## Introduction

* The S.M.I.L.E. Initiative is sending a colony to Mars
  + You have all been chosen as the first people to build a civilization there
* You are all “professionals” – people with trained skillsets who can work in special areas
* You have all been given unique pictures, and your picture with its subtitle will show you and tell you what your “profession” is and what that allows you to do
  + Students may now flip over their occupation cards

## Personal Occupation Skills

* Read through your occupation card. Ask your teacher if you don’t understand what a word means.
* Now elaborate on your skills. How will you use your skills to help the colony once you get to Mars? Think about how your profession can uniquely help the colony.
  + What are some special things that you can do with your professional skills for the Mars colony that most people can’t do? List at least 4 things.
  + If you went on the journey by yourself, how would being alone on Mars make those tasks difficult to accomplish?
    - Answers to this question can range from small problems like “who would the dentist operate on?” to large problems like “where would the oxygen come from?”

## Pair Occupation Skills A

* Research shows that if people put their skills together in a partnership, they will be able to accomplish things that they couldn’t do alone.
  + Get together with another person of a different profession and share what your professional skills are.
* What can you accomplish together? Write down at least four things your professional pair can do together.
  + An example might be needed, and in this case, use one of the student pairs and, in front of the class, help them discover their first relationship attribute.
    - Ex. Dentist-Civil Engineer: create a high-rise dentistry office
* What would make those tasks difficult to accomplish if you and your partner went to Mars alone?

## Lecture

* How has the strength of the colony changed now that people are working in pairs?
  + When two or more elements work together, they create a *system.*
* A system is a body of independent elements working together in relationships to achieve a goal.
  + What are some examples of systems?
    - Computer, computer network, football stadium and stadium operations, solar system, more examples can be added as needed.

## Discussion

* List three ways that the colony is better off when you are working together. Pick one to explain in detail.
* Are the pairs systems?
  + Describe what makes your pair a *system*.
* Would a group that is larger than two people also be a system?
  + The entire colony is a system!
* Systems are used everywhere. Identify two more systems that a colony on Mars will have and explain what makes them systems.
* There are two more spots open on your voyage to Mars, which means that you can invite two more professionals.
  + Write down two new occupations that would help your colony if you were to bring them along. How will their profession contribute to the colony?
* Congratulations! Your group efforts have made you ready for your journey to Mars.
  + The colony is happy to see that you are working together, and you can now board the spaceship!

Emerging Occupations – Student Worksheet

**Your Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Your Occupation:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Personal Occupation Skills

What are some special things that you can do with your professional skills for the Mars colony that most people can’t do? List at least 4 things.

# If you went on the journey by yourself, how would being alone on Mars make those tasks difficult to accomplish? Hint: There are an infinite number of answers.

# Pair Occupation Skills

What profession did you team up with? What are some unique things that you can do together? List at least 4 things.

# What would make those tasks difficult to accomplish if you and your partner went to Mars alone?

# Final Reflections

Importance of systems in Mars colony

List three ways that the colony is better off when you are working together. Pick one to explain in detail.

Importance of systems in pairs

Is your pair a system? Describe what makes your pair a *system*.

More Systems

Identify two more systems that a colony on Mars will have and explain what makes them systems. Hint: Try to look beyond human systems.

Two Spots Left

There are two more spots open on your voyage to Mars, which means that you can invite two more professionals. Write down two new occupations that would help your colony if you were to bring them along. How will their profession contribute to the colony?

# Occupation Card A



Dentist

A dentist is a type of doctor who specializes in teeth. Their goal is to make people’s teeth function properly and prevent the spread of oral diseases.

A typical dentist will go to college for **8 years**.

Skills:

* Deep-clean teeth
* Fill cavities (tooth decay)
* Pull rotten teeth
* Educate people on oral hygiene (proper teeth and mouth care)

# Occupation Card B



Civil Engineer

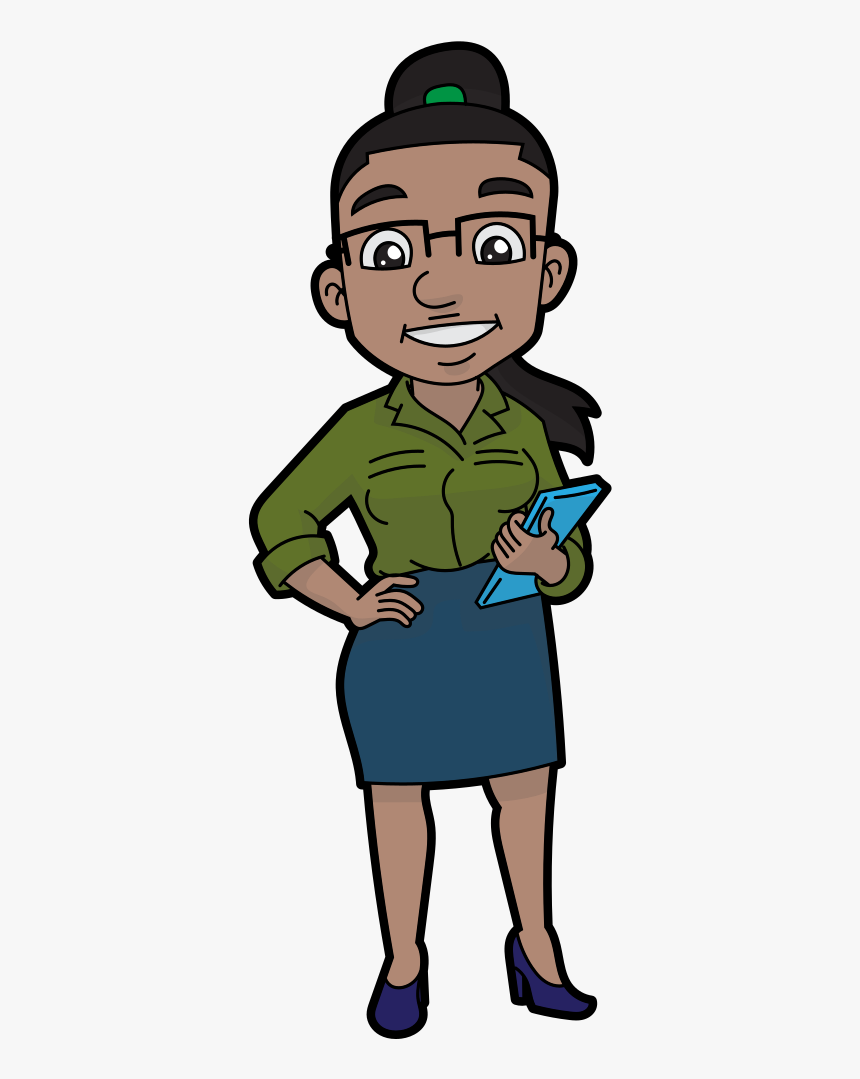
A civil engineer is a type of engineer who specializes in designing structures and city systems. Their goal is to help cities function by creating things such as buildings, roads, and bridges.

A typical civil engineer will go to college for **4-6 years**.

Skills:

* Design high-rise buildings
* Design bridges
* City planning (decide what part of the city to build houses, businesses, water treatment plant, hospital, etc.)
* Create a water treatment plant (access to clean water)

# Occupation Card C



Industrial Engineer

An industrial engineer is a type of engineer who specializes in making processes run efficiently. Their goal is to improve quality, speed, and resourcefulness in any type of project.

A typical industrial engineer will go to college for **4 years**.

Skills:

* Oversee a supply-chain to obtain new materials
* Design a manufacturing plant that can produce new items from raw materials
* Run the *operations* of a project (operations refers to the schedule, finances, and communications of any type of project)
* Organize complex problems and processes to make them easy-to-use

# Occupation Card D



Plant Biologist

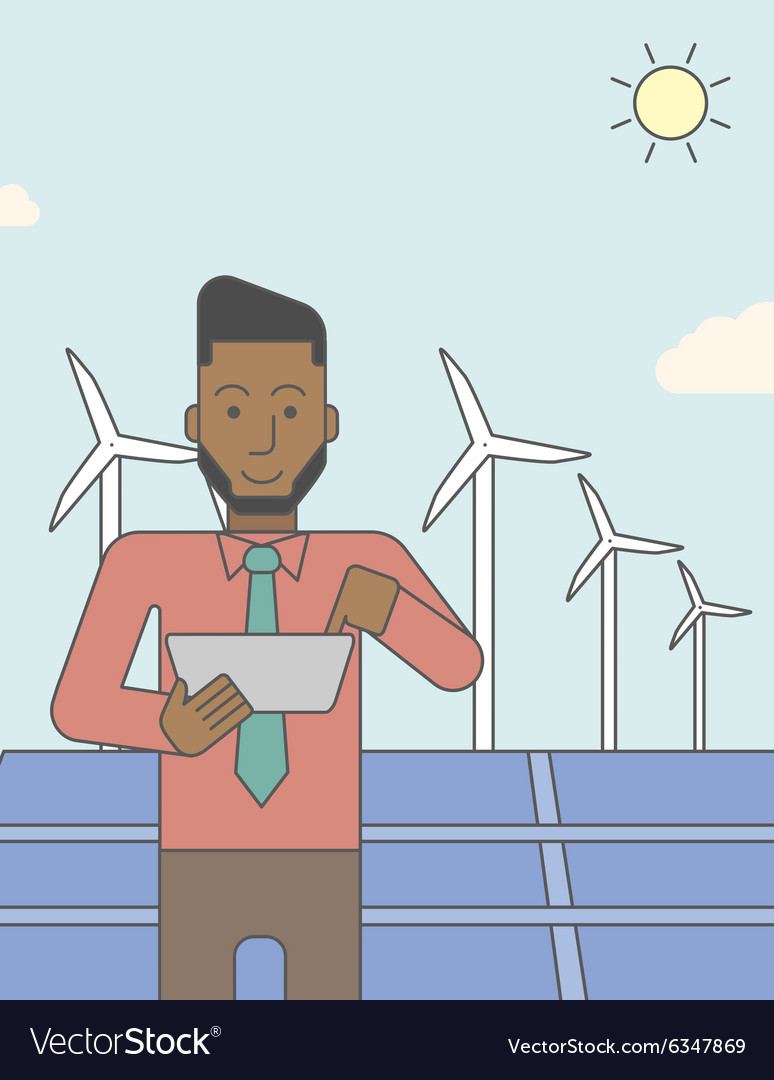
A plant biologist is a type of scientist who specializes in plants. Their goal is to understand how plants work in order to help ecosystems thrive, prevent diseases, and provide plentiful food sources. This field of study is also known as *botany*.

A typical plant biologist will go to college for **6-8 years**.

Skills:

* Document and conduct studies on new species of plants
* Cross-breed plants to create new species
* Teach college courses in biology
* Identify plants that can be used as human food

# Occupation Card E



Environmental Engineer

An environmental engineer is a type of engineer who specializes in the health of the world we live in. Their goal is to create new ways for people and businesses to have positive impacts on the environment.

A typical environmental engineer will go to college for **4 years**.

Skills:

* Design new ways to harvest renewable energy
* Research ways to recycle and reuse materials
* Improve existing inventions by making them positive contributors to the environment
* Develop solutions to reverse the damage done by environmental disasters such as oil spills and nuclear meltdowns

# Occupation Card F



Geologist

A geologist is a type of scientist who studies the rocks and other materials that planets are made of. Their goal is to understand how a planet was formed, how its material behaves, and what will happen to it in the future. Most geologist study Earth but some study the materials of other planets.

A typical geologist will go to college for **6-8 years**.

Skills:

* Research and explain how a planet works by studying the rocks, soils, gases, liquids, and many other materials that make up the planet
* Predict the times, places, and future damage of natural disasters such as earthquakes, landslides, floods, and volcano eruptions
* Develop uses for newly discovered rocks and minerals
* Teach college courses in geology