Creating the Systems Thinking Web

Description:

By discussing the features of a system, students should begin to link different aspects of our climate and environment together as interconnected parts. This lesson will help frame the scientific basis for systems thinking and bring students closer to connecting their actions and the actions of others to the health of our global system.

Objectives:

- Demonstrate a basic understanding of Earth systems and how humans impact them
- Identify the systems that are a part of our daily lives

Vocabulary:

Ecosystem, food chain, systems thinking

Materials:

- Large square labels for each student
- A long piece (or ball) of string or yarn
- Markers or crayons for decorating labels
- Optional: sticker paper for printing labels or lanyards for wearing labels

Background Information:

Simply put, everything is connected. Consider baking a cake. All of the ingredients needed to bake a cake rely on each other. If you don't have one ingredient, you can't make the cake as planned and altering one ingredient will alter the entire cake. This means that all ingredients are connected. This same principle can be applied to the Earth. Earth systems work in tandem to create environments conducive for life. Earth's four major systems include air, water, land, and life, "You, the climate, and the Earth are all systems of systems. Understanding systems—the connections among individual components—is as important as understanding those components in isolation."[1] In other words, we can get a better "understanding of a system by examining the linkages and interactions between the components that comprise the entirety of that defined system."[2] It might be easier to understand Earth systems when we situate humans within them.

For the purpose of this lesson, we will model a system using an animal food chain. You can easily replace the food chain theme with any other relevant system. Some systems to model with your class include: your school community (with different stakeholders, including students, parents, teachers, and some natural components—air, trout tank, school garden), a local food system, a water supply or wastewater treatment system (see DEP's Navigating New York City's Wastewater System lesson), New York's harbor, the list goes on!

Method:

- Start by defining your chosen model as a system. Ask students to consider what the term "system" means to them, and define ecosystem as a class.
- Make a list of organisms that exist within this chosen system as a class, then add important features, such as the sun, the atmosphere, land, water and humans to that list. The list

[1] The Teacher-Friendly Guide to Climate Change

[2] The Institute for Systemic Leadership

will be used to make labels for the activity, with each student representing one of the identified organisms within your system.

- Make the labels for each student or provide materials for students to make the labels themselves. The labels should include the name of the organism and a picture or drawing displaying its features. Below is a sample set of student labels that includes 11 organisms native to New York State that can be printed as labels on sticker paper or on cardstock to be worn using lanyards.
- Give one label to each student and have them display it on their person. Optional: if you have a larger group or full class of students, have students break into groups of about 10 students to model the same system or different system examples.
- Have the students form a circle, close enough that they will be able to pass around a string for each student to hold onto at least once.
- Starting with any student, ask them to find a "connection" with a different student in the circle. A connection can be anything that the student's organism or feature affects or is affected by.
- The first student should demonstrate this connection by holding onto one end of the string and passing the remaining ball of string to their connecting organism. Now, both students should be holding a piece of the string. The student who just received the string should then find a different organism in the circle that connects to them and pass them the ball of string. Continue this until every organism has been passed a piece of the string at least once.
- Eventually, this will create a web that intricately spans throughout the circle. All students should be included in the web at least once, if not multiple times or until the piece of string is tangled and visibly linked to each part of the system.
- Pick one student to share their observations of the web formation process. What did they notice? Which organisms were the last to be connected to the rest of the system? Which were the first and most common connecting points? Why?
- Then, select a student and describe a scenario that eliminates that organism from the system. That student should then drop their string. An example of a scenario related to organisms might be, "A group of hunters entered our ecosystem, which significantly decreased the black bear population." The student assigned to the black bear should drop their piece of string.
- Notice as a class how one student's disappearance from the circle can change the entire web and ask students how the scenario affects the rest of the organisms in the ecosystem.
- Go through the system and have students describe how they were affected. Give students more scenarios, or go straight into the discussion portion of the lesson.

Discussion:

- Why is it essential to include humans in our systems? How much of this system is impacted by human activity?
- Why is it more effective to think of Earth as a system as opposed to an entity completely separate from humans?
- Where do you see systems thinking in your own lives every day? Where do you think there is room for more?

Extension:

- Before assigning organisms to your students, ask them to research an organism that is native to a specific New York ecosystem (e.g., Jamaica Bay or the Croton Watershed). Give them label stickers and have them draw their organism. Encourage them to be creative by including organisms at each trophic level.
- After the activity is complete, ask students to research how their organism is being affected by climate change. Re-form the circle and ask students to show how climate change is affecting their organisms with the string. For example, the trout population is projected to decrease due to warming water temperatures, which can be modeled in the string system by the student assigned to trout either dropping out of the circle, or visibly decreasing its involvement in the system overall. How does the system shift?
- Learn more about the food web with New York State's Department of Environmental Conservation's activity, "Food Web & Bioaccumulation."

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For more information visit www.nyc.gov/dep

Oak Tree

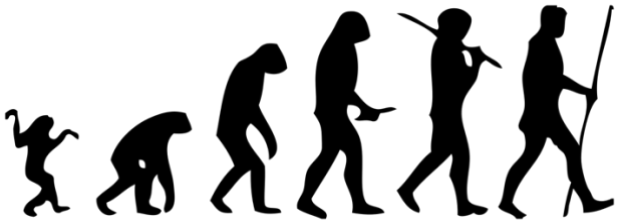
White Tailed Deer

Trout

Squirrel

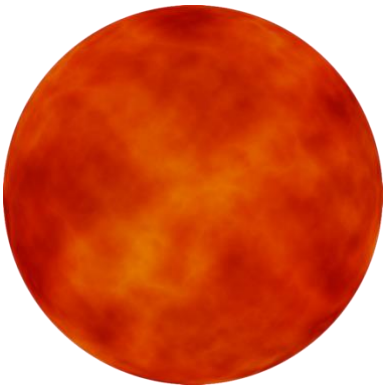
Red Tailed Hawk

Black Bear



Humans

The Atmosphere



The Sun

Water

Land

Algae