The Study of Systems

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Handouts
  “My School as a System”
  “My School as a Subsystem”
  “School System and Digestive System Student Sheet”
  “School System and Digestive System Teacher Sheet”
Introduction

Grade Level

These activities are intended for an eighth grade classroom.

Discipline

These activities have a science and social studies focus.

TEKS

Content:
In studies of living systems, students explore the interdependence between these systems. Interactions between organisms in ecosystems, including producer/consumer, predator/prey, and parasite/host relationships, are investigated in aquatic and terrestrial systems. Students describe how biotic and abiotic factors affect the number of organisms and populations present in an ecosystem. In addition, students explore how organisms and their populations respond to short- and long-term environmental changes, including those caused by human activities. TEKS §112.20. Science, Grade 8. (a)(4)(A)(i)

Throughout social studies in Kindergarten-Grade 12, students build a foundation in history; geography; economics; government; citizenship; culture; science, technology, and society; and social studies skills. The content, as appropriate for the grade level or course, enables students to understand the importance of patriotism, function in a free enterprise society, and appreciate the basic democratic values of our state and nation as referenced in the Texas Education Code (TEC), §28.002(h). TEKS §113.20. Social Studies, Grade 8. (a)(5)

Skills:
The student knows that interdependence occurs among living systems and the environment and that human activities can affect these systems. TEKS §112.20. Science, Grade 8. (b)(11)(A)(B)(C)(D)


National Education for Sustainability K-12 Student Learning Standards

2.1 ~ Interconnectedness ~ Interdependency
2.2 ~ Ecological Systems ~ Nature as Model and Teacher
Objective

Students will learn about systems and their parts as well as how they relate to broader systems.

Key Words

System
Subsystem

Description of Activities

The following activities have been compiled to address the topic of “Studying Food” in eighth grade classrooms. The activities meet the state and national education standards for eighth grade, and are intended to supplement pre-existing curricula, with a focus on integrating sustainability topics. The activities can be used in conjunction or alone.
Activities

Activity 1: What is a System

Introduction

In this activity, students will gain a basic understanding of systems. They will better understand what makes a system.

Materials

Bicycle

Products

Definition(s) of system

Process

1. The purpose of this section of the lesson is to get students to agree on a common definition of the term, “system.” Ask students what words or images come to mind when they hear the word “system”? Some possible responses include the solar system, digestive system, school system, stereo system, respiratory system, and muscular system.

2. Accept and record all responses. If students didn’t mention a bicycle as an example of a system, ask them if they think a bicycle is a system, and why. If possible, have a bicycle in the classroom for students to view/manipulate.

3. Guide students to the understanding that the bicycle is a system, made up of many parts (e.g., the wheels, gears, brakes, and frame).

4. Ask students the following question to summarize this section of the lesson:

   • Considering the bicycle, as well as other examples of systems we came up with, how would you define "system"? Guide students to create a general definition/understanding of systems. Possible responses could include: a system is made up of different parts that come together to form a whole; a system is a collection of things and processes [and often people] that interact to perform some function.)
Activity 2: The School as a System

Introduction

Using the definition from the previous section students will explore their school as a system, as well as part of a larger system.

Materials

Handout- “My School as a System”
Handout- “My School as a Subsystem”
Handout- “School System and Digestive System Student Sheet”
Computer(s)

Products

Handouts

Process

1. Distribute the “My School as a System” Handout. Have students work in small groups to brainstorm as many components/parts of their school as possible. Some components or parts that students could come up with are: principal, vice principal, administrative staff, teachers, students, the building, buses, bus drivers, custodians, cafeteria staff, media specialists, guidance counselors, nurses, and books/supplies.

2. Facilitate a discussion to help students begin to understand how every part of this system relates to the others. Ask questions such as:

   • What if one component of the system weren’t there? For example, what if there weren’t any teachers? How would this impact the system? (Possible responses include: If there weren’t any teachers, the students wouldn’t have guidance/supervision or be able to learn new things; confusion would most likely result because the teachers wouldn’t be available to direct the students. The non-teaching staff [e.g., principal, media specialists, guidance counselors] wouldn’t be able to manage the large number of students, and they would be unable to perform their own jobs. The books/supplies wouldn’t be used properly, if at all. The building, itself, may also become damaged because of the large number of students using the building unsupervised.)

   • What if a nearby school closed down and all students had to join our school, giving us many more students? (Possible responses include: The administrative staff would be overloaded with all of the tasks associated with inputting new students into the computer system. The classrooms would be overloaded, the teachers wouldn’t be able to teach as effectively, and the students wouldn’t get as much attention from the teachers and therefore would not learn as well. The building would be overcrowded. The bus drivers would have to work longer hours to be able to pick up all of the students, and the custodians would have to deal with cleaning more trash and spend longer hours maintaining the property.)
3. Once you are satisfied that students are thinking about their school as a system, in terms of how every part relates to others, distribute the “My School as a Subsystem” Handout. Use this student sheet to facilitate a discussion to help students understand that any system is usually connected to other systems. First, introduce the term, “subsystem,” and ask students to define it. Some of their responses could be: a subsystem is part of a larger system, or connected to a larger system.

4. Next, encourage students to think of their school as a subsystem of the broader educational system. As a large group, brainstorm other components (i.e., subsystems) of a broader educational system and record responses on the student sheet. Students’ responses could include preschools, elementary schools, high schools, colleges/universities/vocational schools, superintendent, and school board.

5. Ask questions such as the following:

   • How are all of these subsystems related? (Each subsystem functions to support education in some way.)

   • How does one subsystem affect the other subsystems? (One example would be that without preschools and elementary schools to start the learning process, the schools with older students wouldn’t be as effective.)

   • How is the broad educational system a subsystem of an even larger system? (One example could be that when students leave the educational system, they enter and contribute to other parts of society. For example, they enter the workforce, and the knowledge and skills they gained in the educational system are used there. And, there is a broad government-supported social system that takes care of citizens. This social system is made up of many subsystems [e.g., educational system, health care system, welfare system].)

6. Either independently or as a group, have students navigate the websites provided (or choose a new website, if necessary). Students will use and record their answers on the “School System and Digestive System” Handout to compare a school system to the digestive system. You should assess their understanding of systems based on their ability to apply their knowledge and understand a new system. Direct students to access the following websites regarding digestive systems:
   - http://kidshealth.org/kid/htbw/digestive_system.html
   - http://kidshealth.org/misc/movie/bodybasics/digestive_system.html
Activity 3: Fitting Systems Together

Introduction

Students will research a system and present it. This activity allows for creative freedom on the students’ part. It encourages them to look at systems from different perspectives and look at how interconnected they can be.

Materials

Computers or books (nonfiction)

Products

Presentations

Process

1. Encourage students to research a system that is of interest to them and create a presentation describing that system. Allow them to be creative and choose whichever system they prefer, regardless of the scale, complexity, etc. of their chosen system. They should be able to describe all of the parts of their system, as well as the way that their system fits into a larger one. They should also understand what happens to the system if one part is not working properly or is removed all together.

2. Once students have created a presentation about their system, they should discuss, as a class, how all of their systems fit together and interact as part of a larger system. They should be able to name the large system that all of theirs fit into, and they should be able to explain how all of their individual systems function as a part of this larger one.

3. Encourage students to discuss the teamwork they engaged in when trying to decide on which large system all of theirs fit into. The following questions can be used to guide the discussion:

   • How is their class a system?
   • What are the parts of that system?
   • What can be accomplished if all of the parts of their class system work together?
   • Is that what happened in the previous activity?
   • Was it successful?
   • What would happen if parts of the system stopped working or didn’t perform their functions properly?
Additional Resources

Online Resources

Primary Source
http://sciencenetlinks.com/lessons/my-school-as-a-system/

Reference Resources
http://kidshealth.org/kid/htbw/digestive_system.html
http://kidshealth.org/misc/movie/bodybasics/digestive_system.html
http://www.brainpop.com/games/buildabodydigestivesystem/
INTRODUCTION
Based on what you read on the resources from the School System worksheets and Digestive System websites, answer the questions on this sheet.

1. Based on what you know about systems, explain why the digestive system is a "system."

2. Choose three parts of the digestive system and describe their functions.

3. Now, choose one part of the digestive system and describe how it affects other parts of the digestive system.

4. Describe how a school system and a digestive system are similar.

5. Describe how a school system and digestive system are different.

6. We discussed how a school system is actually a subsystem of a larger educational system. Is the digestive system also a subsystem of a larger system? How so?
School System and Digestive System Teacher Sheet

INTRODUCTION
Based on what you read on the resources found on the School System and Digestive System student esheet, students should answer the questions on this sheet.

1. Based on what you know about systems, explain why the digestive system is a “system.”
   Possible response: There are many parts that make up one large part of the body—the digestive part, or digestive system.
2. Choose three parts of the digestive system and describe their functions.
   Note: Possible responses found on the website.
3. Now, choose one part of the digestive system and describe how it affects other parts of the digestive system.
   Possible responses found on the website.
4. Describe how a school system and a digestive system are similar.
   Possible response: Each is made up of several parts; if one of these parts changes, it impacts the entire system.
5. Describe how a school system and digestive system are different.
   Possible response: The purpose of the systems, and their inputs and outputs, are different.
6. We discussed how a school system is actually a subsystem of a larger educational system. Is the digestive system also a subsystem of a larger system? How so?
   Possible response: The digestive system is part of a larger system—the human body. The digestive system impacts other subsystems of the body, for example, the respiratory system. As part of the digestive system, the epiglottis helps to keep food and liquid out of the lungs (part of the respiratory system) when you swallow. If the epiglottis didn’t work, the lungs could potentially stop working efficiently. The important tasks of the lungs (storing energy, removing poisons from the body) might stop, and this could ultimately prevent other parts of the body from functioning properly.
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