

# Standard 6—Interconnectedness: Common Themes Elementary

## Systems Thinking

1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Students:

- observe and describe interactions among components of simple systems.
- identify common things that can be considered to be systems (e.g., a plant population, a subway system, human beings).

## Models

2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Students:

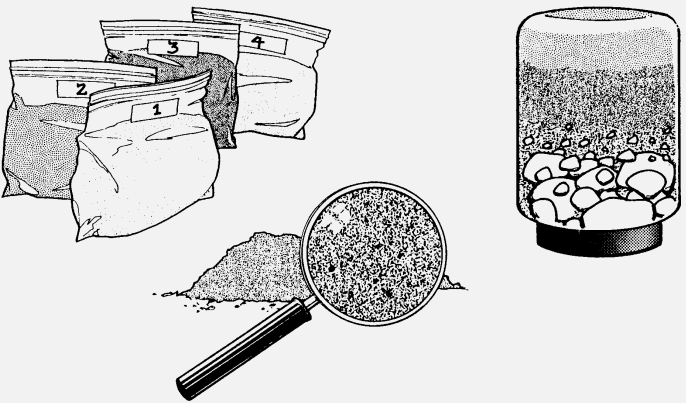
- analyze, construct, and operate models in order to discover attributes of the real thing.
- discover that a model of something is different from the real thing but can be used to study the real thing.
- use different types of models, such as graphs, sketches, diagrams, and maps, to represent various aspects of the real world.

*This is evident, for example, when students:*

- ▲ compare toy cars with real automobiles in terms of size and function.
- ▲ model structures with building blocks.
- ▲ design and construct a working model of the human circulatory system to explore how varying pumping pressure might affect blood flow.
- ▲ describe the limitations of model cars, planes, or houses.
- ▲ use model vehicles or structures to illustrate how the real object functions.
- ▲ use a road map to determine distances between towns and cities.

### Sample Problem/Activity

**WHAT ARE SOME IMPORTANT PROPERTIES OF SOILS?**



Key ideas are identified by numbers (1).  
Performance indicators are identified by bullets (•).  
Sample tasks are identified by triangles (▲).

**Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.**

## Magnitude and Scale

**3. The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.**

**Students:**

- provide examples of natural and manufactured things that belong to the same category yet have very different sizes, weights, ages, speeds, and other measurements.
- identify the biggest and the smallest values as well as the average value of a system when given information about its characteristics and behavior.

*This is evident, for example, when students:*

- ▲ compare the weight of small and large animals.
- ▲ compare the speed of bicycles, cars, and planes.
- ▲ compare the life spans of insects and trees.
- ▲ collect and analyze data related to the height of the students in their class, identifying the tallest, the shortest, and the average height.
- ▲ compare the annual temperature range of their locality.

## Equilibrium and Stability

**4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).**

**Students:**

- cite examples of systems in which some features stay the same while other features change.
- distinguish between reasons for stability—from lack of changes to changes that counterbalance one another to changes within cycles.

*This is evident, for example, when students:*

- ▲ record their body temperatures in different weather conditions and observe that the temperature of a healthy human being stays almost constant even though the external temperature changes.
- ▲ identify the reasons for the changing amount of fresh water in a reservoir and determine how a constant supply is maintained.

### Sample Problem/Activity

## What can I learn about my body?

- > How do your results compare to your classmates' results?
- > What factors do you think could account for the differences?
- > Who would benefit from the information you gathered and how?
- > What other information do you think would complete your knowledge of your body?
- > Are there some data on your form that you would rather keep confidential? Which data?
- > Who should and should not have access to this information? Give reasons for your answers.

#### CONTENT UNDERSTANDINGS

- Soil consists of weathered rock fragments that contain organic material

**MEASURING ME**

Name: \_\_\_\_\_

Blood Pressure: \_\_\_\_\_

Pulse Rate: \_\_\_\_\_

Respiration Rate: \_\_\_\_\_

Temperature: \_\_\_\_\_

Long Capacity: \_\_\_\_\_

Reaction Time: \_\_\_\_\_

Visual Acuity: \_\_\_\_\_

Blind Spot: \_\_\_\_\_

Near Point Determination: \_\_\_\_\_

Hearing Test: \_\_\_\_\_

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## Patterns of Change

**5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.**

**Students:**

- use simple instruments to measure such quantities as distance, size, and weight and look for patterns in the data.
- analyze data by making tables and graphs and looking for patterns of change.

*This is evident, for example, when students:*

- ▲ compare shoe size with the height of people to determine if there is a trend.
- ▲ collect data on the speed of balls rolling down ramps of different slopes and determine the relationship between speed and steepness of the ramp.
- ▲ take data they have collected and generate tables and graphs to begin the search for patterns of change.

## Optimization

**6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.**

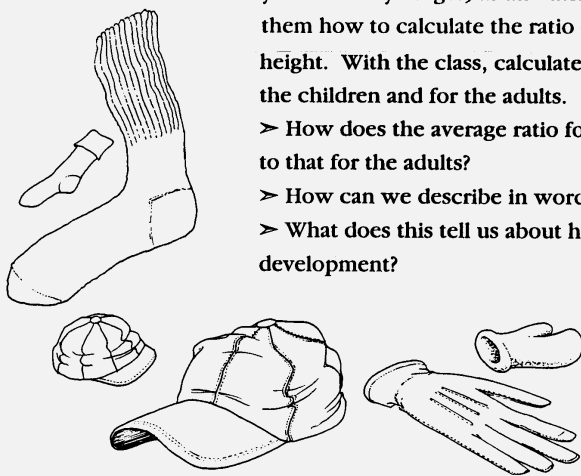
**Students:**

- determine the criteria and constraints of a simple decision making problem.
- use simple quantitative methods, such as ratios, to compare costs to benefits of a decision problem.

*This is evident, for example, when students:*

- ▲ describe the criteria (e.g., size, color, model) and constraints (e.g., budget) used to select the best bicycle to buy.
- ▲ compare the cost of cereal to number of servings to figure out the best buy.

### Sample Problem/Activity



Ask each student to measure the length of the head and the height of three adults and three children (two years old or younger) as an outside assignment. Show them how to calculate the ratio of head length to height. With the class, calculate the average ratio for the children and for the adults.

- > How does the average ratio for the children compare to that for the adults?
- > How can we describe in words the change in ratios?
- > What does this tell us about human growth and development?

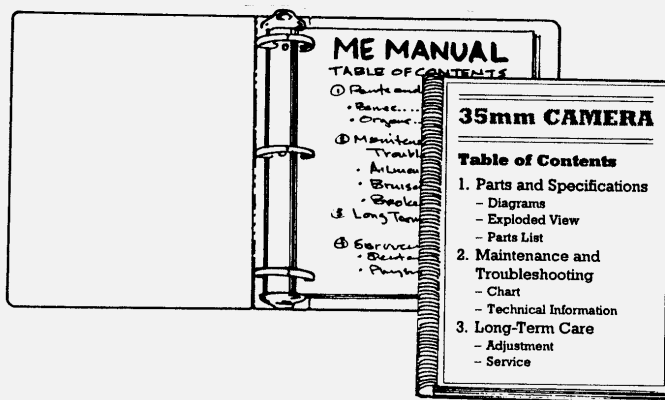
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### Sample Problem/Activity

## Why would I need an owner's manual?

Students will be able to describe similarities and differences between a manual they create for a device and a personal manual they will create throughout the course of this module and perhaps beyond.



### Interdisciplinary Connections

These activities focus on devices as technologies:

► **Technology:** Compare electronics information about several types of devices, and account for their similarities and differences.

► **Social Studies:** Talk to a lawyer, paralegal, or representative of the Better Business Bureau about written and implied warranties.

► **Language Arts:** Develop a second version of your manual that contains a limited number of technical words. Consult your language arts teacher, a children's writer, or a technical writer for assistance in using this kind of controlled approach to manual writing.

► **Mathematics:** Locate and read selected magazine articles to determine the nature and extent of the market in various devices. Prepare graphs and charts that show relative percentages of kinds of goods sold and other pertinent information.

► **Health:** Interview a nurse, audiologist, pediatrician, or other health specialist regarding hearing losses associated with one or more entertainment devices.

► **Home and Career Skills:** Conduct a survey of the electronic devices in your home, including entertainment and nonentertainment devices. Compare your results with an

informal survey of one or more older persons regarding electronic devices used in a typical home in the early sixties.

► **Foreign Languages and Cultures:** Look through a number of owners' manuals at home or at a car dealership or electronics store. Note whether these manuals are written only in English or in other languages as well. Try to explain why the manufacturer chose certain languages.