Grade 5 Science, Quarter 4, Unit 4.1

Processes within an Ecosystem

Overview

Number of instructional days: 12 (1 day = 45 minutes)

Content to be learned

- Identify the sun as the major source of energy for life on earth.
- Beginning with the sun, sequence the flow of energy in an ecosystem.
- Explain the processes of precipitation, evaporation, and condensation as parts of the water cycle.
- Trace how water cycles through the environment.

Science processes to be integrated

- Identify sources of energy within a system.
- Sequence the flow of energy throughout a system.
- Identify and explain processes within a system.
- Trace changes that occur within a system.

Essential questions

- How does the sun's energy flow throughout an ecosystem?
- How does water cycle through an ecosystem?

Written Curriculum

Grade Span Expectations

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (5-8) SAE– 6

Given a scenario trace the flow of energy through an ecosystem, beginning with the sun, through organisms in the food web, and into the environment (includes photosynthesis and respiration).

LS2 (5-6) –6 Students demonstrate an understanding of energy flow in an ecosystem by …

6a identifying the sun as the major source of energy for life on earth and sequencing the energy flow in an ecosystem.

LS2 (5-8) SAE-7

*Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, recycling but **not** carbon cycle or nitrogen cycle).*

LS2 (5-6)-7 Students demonstrate an understanding of recycling in an ecosystem by …

7a explaining the processes of precipitation, evaporation, condensation as parts of the water cycle.

Clarifying the Standards

Prior Learning

In grades K–2, students cared for plants and animals by identifying and providing for their needs. They experimented with growing plants in varying conditions, such as light versus no light. Students acted out and constructed simple diagrams that show a simple food web, and they used information about a simple food web to determine how basic needs are met by the habitat/environment.

In grades 3–4, students demonstrated an understanding of energy flow in an ecosystem by identifying sources of energy for survival of organisms, including light and food, and they demonstrated in a food web that all animals' food begins with the sun. Students used information about organisms to design a habitat and explain how the habitat provides for the needs of the organisms that live there. They explained the way that plants and animals in a habitat depend on each other. When studying weather, students in grades 3–4 described water as it changes into vapor in the air and reappears as a liquid when it is cooled, and explained how this cycle of water relates to weather and the formation of clouds.

During the unit on weather, fifth-graders demonstrated an understanding of processes and change over time within earth systems by diagramming, labeling, and explaining the processes of the water cycle including evaporation, transpiration, condensation, precipitation, run-off, and groundwater.

Current Learning

In this unit of study, grade 5 students identify the sun's role as the major source of energy for life on earth and sequence the flow of energy in an ecosystem. The sun provides energy for the plants to grow, and fuels the water cycle for the earth. With energy from the sun, plants are able to make their food and then be a food supply in the food web. Ecosystems are comprised of many cycles that give the environment

distinctive characteristics. In addition, the flow of energy in an ecosystem includes several components (plants, animals, and water sources) and processes (photosynthesis and decomposition).

During this unit, students also trace how water, like all matter, recycles within an ecosystem, and they explain the processes of evaporation, condensation, and precipitation as part of the water cycle. Since all concepts have been previously introduced, the concepts in this unit of study should be taught at the reinforcement to drill-and-practice level of instruction.

At this grade level, students identify and explain processes and cycles in an ecosystem. Students entering grade 5 have had opportunities to discuss and study simple food chains, and to combine two or more food chains to make a food web. Students in this grade level, however, must identify the sun's role in the food web. They should identify sources of energy and sequence the flow of energy throughout an ecosystem using drawings, diagrams, and hands-on activities. Students can identify and role-play the various parts of a food web, then can use pictures and yarn to visually sequence the flow of energy from one organism to another. They should also draw, diagram, and label food webs, and should have additional opportunities to observe multimedia examples of the flow of energy through ecosystems.

The following scientific terms should be taught and used during this unit: ecosystem, photosynthesis, respiration, food web, food chain, precipitation, evaporation, condensation, and water cycle. Students can also learn the terms consumer, decomposer, and producer; however, they are not assessed on this vocabulary until sixth grade. In addition, students should understand that a food chain shows a flow of energy in one direction, whereas a food web is much more complicated.

Future Learning

In grade 6, students will demonstrate an understanding of equilibrium in an ecosystem by identifying and defining an ecosystem and the variety of relationships within it, such as predator/prey, consumer/producer/ decomposer, host/parasite, and catastrophic events. They will demonstrate an understanding of energy flow in an ecosystem by describing the basic processes and recognizing the substances involved in photosynthesis and respiration. In addition, students will demonstrate an understanding of recycling in an ecosystem by completing a basic food web for a given ecosystem.

Students in grades 7–8 will demonstrate an understanding of equilibrium in an ecosystem by identifying which biotic and abiotic factors affect a given ecosystem; they will also analyze how biotic and abiotic factors affect a given ecosystem. Students will predict the outcome of a given change in biotic and abiotic factors in an ecosystem, and will use a visual model to track population changes. They will demonstrate an understanding of energy flow by explaining the transfer of the sun's energy through living things and its effect upon them. They will describe the basic processes and recognize the names and chemical formulas of the substances involved in photosynthesis and respiration, and explain the relationship between photosynthesis and respiration. Students demonstrate an understanding of food webs by creating or interpreting a model that traces the flow of energy in a food web. They demonstrate an understanding of recycling in an ecosystem by diagramming or sequencing a series of steps that show how matter cycles among and between organisms and the physical environments. Students will develop a model for a food web of local aquatic and terrestrial environments, and they will explain the inverse nature or complementary aspects of photosynthesis/respiration in relation to carbon dioxide, water, and oxygen exchange. In addition, students will conduct a controlled investigation that shows that the total amount of matter remains constant, even though its form and location change as matter is transferred among and between organisms and the physical environment.

Additional Research Findings

Organisms are linked to one another and to their physical setting by the transfer and transformation of matter and energy. The cycling of matter and flow of energy can be found at many levels of biological organization, from molecules to ecosystems. The study of food webs can start in the elementary grades with the transfer of matter, and continue in the middle grades with the flow of energy through organisms. The whole picture grows slowly over time for students (*Benchmarks for Science Literacy,* p. 118).

In grades K–2, children should begin to be aware of the basic parts of the food chain: Plants need sunlight to grow, some animals eat plants, and other animals eat both plants and animals. The key step that plants *make their own food* is very difficult for elementary students and should be saved for middle school. An awareness of recycling, both in nature and in human societies, may play a helpful role in the development of children's thinking. Familiarity with the recycling of materials fosters the notion that matter continues to exist even though it changes from one form to another (*Benchmarks,* p. 119).

In grades 3–5, students should begin to notice that substances may change form and move from place to place, but they never appear out of nowhere and never just disappear. Questions should encourage students to consider where substances come from and where they go and to be puzzled when they cannot account for the origin or the fate of a substance. By the end of grade 5, students should know that almost all kinds of animals' food can be traced back to plants. Some source of energy is needed for all organisms to stay alive and grow. Over the whole earth, organisms are growing, dying, and decaying, and new organisms are being produced by the old ones (*Benchmarks,* p. 119).

Students in grades 5–8 understand ecosystems and the interactions between organisms and environments well enough to introduce ideas about energy flow, although charts and flow diagrams might confuse some students. Some fundamental concepts include that a population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem. Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem. For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. Their energy then passes from organism to organism in food webs (*National Science Education Standards*, pp. 156–158).

According to the *Atlas of Science Literacy*, some students of all ages have difficulty in identifying the sources of energy for plants and also for animals. Students tend to confuse energy and other concepts such as food, force, and temperature. As a result, students may not appreciate the uniqueness and importance of energy conversion processes like respiration and photosynthesis (*Atlas of Science Literacy, Vol. 1*, p. 78). Some students also hold misconceptions about plant nutrition. They think plants get their food from the environment rather than manufacturing it internally, and that food for plants is taken in from the outside. These misconceptions are particularly resistant to change. Even after traditional instruction, students have difficulty accepting that plants make food from water and air, and that this is their only source of food. Understanding that the food made by plants is very different from other nutrients such as water or minerals is a prerequisite for understanding the distinction between plants as producers and animals as consumers (*Atlas, Vol. 1*, p. 76).

Notes About Resources and Materials

The Sun's Energy in an Ecosystem

From Houghton-Mifflin Discovery Works, Grade 5:

- The Sun: Life's Energy Supply D14–15
- What's to Eat? D16–17
- The Cycle of Food D27–29
- Energy Traps A21–23
- Plant Responses A24–25
- The Carbon Dioxide–Oxygen Cycle D32–33 (Omit the concept of the carbon dioxide cycle, and focus on the flow of the sun's energy through the ecosystem.)

Recycling Water in an Ecosystem

From Houghton-Mifflin Discovery Works, Grade 5:

- Where's all the Water? D30
- The Water Cycle D34–35
- Recycling Waste Water D36–38

Websites

- www.uwsp.edu/cnr/wcee/keep/Mod1/Flow/foodchains.htm
- www.naschools.net/teachers/ecosystems/ecosystems.htm
- http://urbanext.illinois.edu/world/foodchains.html (The energy ecosystem and food chains activity shows how energy flows and how energy is lost along the way.)

Grade 5 Science, Quarter 4, Unit 4.2

Biodiversity and Evolution

Overview

Number of instructional days: 12 (1 day = 45 minutes)

Content to be learned

- State the value of, and reasons for, classification systems.
- Explain how fossil evidence can be used to understand the history of life on earth.

Science processes to be integrated

- Describe, analyze, and compare various classification systems.
- Describe the purpose and value of various classification systems.
- Use evidence to draw conclusions.

Essential questions

- Why are classification systems important?
- How can evidence from the fossil record be used to trace the history of life on earth?

Written Curriculum

Grade Span Expectations

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).

LS3 (5-8) MAS+FAF – 8

Use a model, classification system, or dichotomous key to illustrate, compare, or interpret possible relationships among groups of organisms (e.g., internal and external structures, anatomical features).

LS3 (5-6) – 8 Students demonstrate an understanding of classification of organisms by …

8a stating the value of, or reasons for, classification systems.

LS3 (5-8) POC-9

Cite examples supporting the concept that certain traits of organisms may provide a survival advantage in a specific environment and therefore, an increased likelihood to produce offspring.

LS3 (5-6) -9 Students demonstrate an understanding of Natural Selection/evolution by …

9c explaining how fossil evidence can be used to understand the history of life on Earth.

Clarifying the Standards

Prior Learning

In grades K–2, students distinguished between living and nonliving things; they observed and recorded the external features that make up living things; and they identified and sorted organisms based on their external features. Students also identified the specific functions of the physical structures of a plant or an animal.

In grades 3–4, students cited evidence to distinguish between living and nonliving things, and they recorded and analyzed observations and data about external features. They identified, sorted, and compared organisms based on external features, and cited evidence to draw conclusions explaining why organisms are grouped/not grouped together. Students identified and explained how the physical structures/characteristics of an organism allow it to survive and defend itself, and they analyzed the structures needed for survival of populations of plants and animals in a particular habitat/environment. In addition, students explained what plants or animals might do if their environment changes (e.g., changing food supply or habitat due to fire, human impact, or sudden weather-related changes), and how the balance of the ecosystem can be disturbed (e.g., how overpopulation of a species affects the rest of the ecosystem).

When learning about the characteristics of living organisms in unit 3.3, fifth-grade students recognized that organisms have different features and behaviors for meeting their needs to survive, and they described the structures and behaviors that help organisms survive in their environment. When learning about geological processes that shape the earth in unit 3.1, fifth-grade students identified and described the layers of the earth, and represented the processes of the rock cycle in order to understand how rocks are formed. It is important to note, however, that students in grade 5 have *not* learned about fossils and their formation.

Current Learning

In this unit of study, grade 5 students learn to state the value of and give reasons for classification systems. Students describe, analyze, and compare various classification systems in order to understand the purpose and value of classification systems. Students also explain how fossils can provide evidence about the history of life on the earth. By examining fossil evidence, students learn that the fossil record gives evidence about which organisms have survived over time, which organisms have lived in a particular area, and how the habitat and organisms have changed over time. Since this content is new to grade 5, all concepts in this unit should be taught at the developmental level of instruction.

In order to learn the value of classification systems, students should first understand the value of a classification system as it applies to personal life. They can practice sorting and classifying everyday items (e.g., categorizing clothing in the closet, organizing the pantry, sorting and classifying school supplies), and use a variety of graphic organizers to represent the ways in which they sorted the items. In sixth grade, students will use and extend their learning to classify organisms into different categories (e.g., kingdoms, classes, and species).

Fossils help tell earth's history. Students should learn that fossils give clues about the environment, the organisms that lived there, and how long ago they lived. In this unit, students should view pictures of fossils, as well as actual examples of fossils. They can also create models of the sedimentary layers and fossils of a particular habitat. Students observe, write, and discuss which fossils are oldest and what they tell us about the environment at the time when the organism lived there.

In prior grade levels and prior grade 5 units, students sorted and classified items using similar and different characteristics. The terms *classify* or *classification*, however, may be new to students. It is also important to note that prior to grade 5, students did not learn about fossils or their formation. By the end of this unit, students should know the following terms: classify, classification, organism, fossil, and fossil record.

Future Learning

In grade 6, students will demonstrate an understanding of classification of organisms by following a taxonomic key to identify a given organism. Students will demonstrate an understanding of natural selection/evolution by explaining how the traits of a population or species affect their ability to survive over time, and researching and reporting on possible causes for the extinction of an animal or plant.

In grades 7–8, students will continue to demonstrate an understanding of classification systems by sorting organisms with similar characteristics into various groups based on internal and external structures, and will explain how species with similar evolutionary histories/characteristics are classified more closely together with some organisms than others. Students will demonstrate an understanding of natural selection/evolution by explaining how the balance of the ecosystem can be disturbed. They will gather evidence that demonstrates evolutionary relationships among organisms, and will differentiate between acquired and inherited characteristics. They will explain how natural selection leads to evolution, and will describe how scientists' understanding of the way species originate or become extinct has changed over time.

Additional Research Findings

In the past century, no scientific theory has been more difficult for people to accept that biological evolution by natural selection. It goes against some people's strongly held beliefs about when and how the world and the living things in it were created, and it flies in the face of what people can plainly see—namely that generation after generation, life forms don't change; roses stay roses, worms stay worms. To appreciate how natural selection can account for evolution, students have to understand the important distinction between the selection of an individual with a certain trait and the changing proportions of that trait in populations. Their ability to grasp this distinction requires some understanding of the mathematics of proportions and opportunities for them to reflect on the individual-versus-population distinction in other contexts (*Benchmarks for Science Literacy*, p. 122). Therefore, the foundation for understanding these concepts is laid in the elementary grades.

Students in grades 3–5 should look for ways in which organisms in one habitat differs from those in another and consider how some of those differences are helpful to survival. The focus should be on the consequences of different features of organisms for their survival and reproduction. The study of fossils that preserve plant and animals structures is one approach to looking at characteristics of organisms. By the end of grade 5, students should know that individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing. Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different (*Benchmarks*, p. 123).

As students become more familiar with the characteristics of more and more organisms, they should be asked to invent schemes for classifying them—but without using formal classification systems. Hopefully, their classification schemes will vary according to the uses made of them as well as according to features such as gross anatomy, behavior patterns, and habitats. The aim is to move students toward the realization that there are many ways to classify things, but how good any classification is depends on its usefulness. A scheme is useful if it contributes either to making decisions on some matter or to a deeper understanding of the relatedness of organisms. By the end of fifth grade, students should know that a great variety of kinds of living things can be sorted into groups in many ways using various features to decide which things belong to which group, and the features used for grouping depend on the purpose of the grouping (*Benchmarks for Science Literacy*, p. 103).

According to some research, upper elementary students tend to use a number of mutually exclusive groups rather than a hierarchy when asked to group organisms. Some groups are based on observable features, and others on concepts. By middle school, students can group organisms hierarchically when asked to do so, whereas high school students use hierarchical taxonomies without prompting (*Benchmarks*, p. 340).

High school students and college students, even after some years of biology instruction, have difficulties understanding the notion of natural selection. A major hindrance appears to be students' inability to integrate two distinct processes in evolution, the occurrence of new traits in a population and their effect on long-term survival. Many students believe that environmental conditions are responsible for changes in traits, or that organisms develop new traits because they need them to survive, or that they over-use or under-use certain bodily organs or abilities. In addition, some students believe that a mutation modifies an individual's own form during its life rather than only its germ cells and offspring. Students also have difficulties understanding that changing a population results from the survival of a few individuals that preferentially reproduce, not from the gradual change of all individuals in the population. Explanations about "insects or germs becoming more resistant" rather than "more insects or germs becoming resistant" may reinforce these misunderstandings (*Benchmarks*, p. 343).

Notes About Resources and Materials

Teaching About Classification

Houghton Mifflin Discovery Works—Grade 4

- Activity: Animals are Different, C6–7
- Variety of Life on Earth, C8–11

Discover Science by Scott Foresman, Grade 5 (old science books)

- How Do Scientists Classify Living Things into Kingdoms? pp. 18–22
- Activity: Using Features to Classify Object, p. 23

Teaching About Fossil Evidence of Life on Earth

Houghton Mifflin Discovery Works—Grade 5

- Activity: Layering Fossils, E72-73
- Fossils tell Tales, E75-77

Reading Street Leveled Readers that accompany *The Dinosaurs of Waterhouse*

- Hawkins
- Green – Paleontology
- Yellow – Searching for Dinosaurs
- Blue – What's New With Dinosaur Fossils

Grade 5 Science, Quarter 4, Unit 4.3

Heredity and Human Development

Overview

Number of instructional days: 12 (1 day = 45 minutes)

Content to be learned

- Differentiate between inherited and acquired traits.
- Observe, record, and compare differences in inherited traits (e.g., connected earlobe, tongue rolling).
- Use data provided to select evidence that supports the concept that traits are passed on from parents to offspring.

Science processes to be integrated

- Make and record observations.
- Identify similarities and differences.
- Use data and cite evidence to support conclusions.

Essential questions

- What is the difference between traits that are inherited and those that are acquired?
- How can data provide evidence that traits are passed on from parents to offspring?

Written Curriculum

Grade Span Expectations

LS 4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

LS4 (5-8) INQ+POC-11

Using data provided, select evidence that supports the concept that genetic information is passed on from both parents to offspring.

LS4 (5-6)-11 Students demonstrate an understanding of human heredity by …

11a differentiating between inherited and acquired traits.

11b observing, recording and comparing differences in inherited traits (e.g. connected earlobe, tongue rolling).

Clarifying the Standards

Prior Learning

In grades K–2, students observed and compared their physical features with those of parents, classmates, and other organisms, and they identified that some behaviors are learned. In grades 3–5, students identified similarities that are inherited from a biological parent, and they identified that some behaviors are learned and some behaviors are instinctive.

Current Learning

In grade 5, students will need to understand that inherited traits are passed on from parents to offspring. Students observe, record, and compare differences in inherited traits, and differentiate between inherited and acquired traits. They use data provided to select evidence that supports the concept that traits are passed on from parents to offspring.

Students have prior knowledge of inherited traits, instinctive behaviors, and learned behaviors, and have identified that some similarities are inherited from parents. In grades K–2, students explore how certain human characteristics are learned. In grades 3–4, students learned that certain characteristics are inherited. In grade 5, students expand on this previous knowledge by observing, recording, and comparing different inherited traits. Therefore, the concepts in this unit should be taught at the reinforcement level of instruction.

During this unit, students will need time to observe a variety of human traits and record their observations. Furthermore, students will need additional time to analyze their data in order to compare similarities and differences to differentiate between inherited and acquired traits. Some examples of acquired traits include calluses on fingers, larger muscles from exercise, and behaviors that help an organism survive. On the other hand, inherited traits are those passed from ancestors or parents. They can skip a generation or two, and include such examples as hair color, eye color, nose shape, and muscle or bone structure.

You can have students complete a checklist of a partner's traits. When completed, they can combine their data into class chart, or graphing the results. If possible, also have students examine family member

photographs to determine similarities/differences. Students might use generic photographs of families in order to observe inherited traits. They can also use video clips to observe similarities and differences with behavioral and personality traits.

Future Learning

In sixth grade, students will demonstrate an understanding of human body systems by identifying the biotic and abiotic factors that have an effect on human body systems, cause disease, and affect human health.

In grades 7–8, students will predict and explain the effects of biotic and abiotic factors on human body systems, and they will research and report on how biotic and abiotic factors cause diseases and affect human health. Students recognize that some characteristics result from inherited traits of one or more genes from the parents and others result from interactions with the environment. They will trace a genetic characteristic through a given pedigree to demonstrate the passage of traits, and will identify that genetic material is located in the cell's nucleus. Students will identify and sequence the stages of human embryonic development, describing the changes from one stage of embryonic development to the next. Students will also compare and contrast embryonic development in various life forms, and will compare the patterns of human development after birth to the life stages of other species.

Additional Research Findings

During middle school, students can develop the understanding that the body has organs that function together to maintain life. Teachers should introduce the general idea of structure-function in the context of human organ systems working together. Specific concrete examples can be used to help develop an understanding of structure-function in living systems. Students should learn that the human organism has systems that perform a variety of functions, like digestion, circulation, movement, and protection from disease. Concerning heredity, younger middle-school students tend to focus on observable traits, and older students have some understanding that genetic material carries information. Students should know that the characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment. All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment. Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many levels, and is determined in part by heredity and in part from experience (*National Science Education Standards*, pp. 156–157).

Children should begin their study of heredity by observing themselves, their classmates, and their pets. They can then compare their own physical appearance to that of their siblings, parents, and grandparents. Learning the genetic explanation for how traits are passed on from one generation to the next can begin in the middle years and carry into high school. In grades 3–5, students should move from describing individuals directly to naming traits and classifying individuals with respect to those traits. Students can be encouraged to keep lists of things that animals and plants get from their parents, things that they don't get, and things that the students are not sure about either way. This is also time to start building the notion of a population whose members are alike in many ways bus show some variation. Students should know that some likenesses between children and parents, such as eye color in human beings, or fruit or flower color in plants, are inherited. Other likenesses, such as people's table manners or carpentry skills, are learned. For offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next (*Benchmarks for Science Literacy*, pp. 106–107). Human behavior results from the interaction of inheritance and learning. Besides being a basic function of most animals, learning defines the most prominent way in which human beings are different from other species (*Benchmarks*, p. 139).

When asked to explain how physical traits are passed from parents to offspring, elementary school, middle school, and some high school students express the following misconceptions: Some students believe that traits are inherited from only one of the parent (for example, the traits are inherited from the mother because she gave birth or has the most contact as children grow up; or the same sex parent will be the determiner). Other students believe that certain characteristics are always inherited from the mother and others come form the father. Some students believe in a "blending of characteristics." It may not be until the end of fifth grade that some students can use arguments based on chance to predict the outcome of inherited characteristics from observing those characteristics in the parents. Early middle school students can explain inheritance only in observable features, but upper middle school and high school students have some understanding that characteristics are determined by a particular genetic entity which carries information translatable by the cell. Students of all ages believe that some environmentally produced characteristics can be inherited, especially over generations (*Benchmarks*, p. 341).

Most research studies in the area of variation and resemblance assume that the subjects grasp the concepts of variation within a species and of offspring resembling their parents. In one study, most students (94%) understood that one's characteristics come from parents, half understood that inheritance and reproduction occur together, and less than half (44%) understood that one gets a mixture of features from both parents. In a similar study, 52% of students recognized that variation between species occurs, but they regarded it as a response to environmental conditions rather than due to inheritance. Students had firm ideas of transmission of characteristics from generation to generation. Male students believed in blending inheritance and they regarded characteristics from the male parent as being stronger in their expression. Other studies have also found similar notions regarding lack of equality of parental contribution, including a tendency to favor the mother as providing the main contribution or to support same-sex inheritance (*Making Sense of Secondary Science*, p. 51).

Notes About Resources and Materials

Useful Websites

- www.uen.org/Lessonplan/preview.cgi?LPid=1997
- www.discoveryeducation.com/teachers/free-lesson-plans/unique-plants-of-the-biomes.cfm
- www.coolschool.ca/TC2/TC2_projects/TC2_09_files/Abiotic%20vs%20Biotic%20Factors%20Worksheet.pdf
- http://www.teachervision.fen.com/tv/printables/scottforesman/sci_5_ARS_A2_expr1.pdf (Includes worksheets to survey inherited traits.)