Fourth Grade Companion Document
4-Unit 3: Relationships and Requirements of Living Things

Table of Contents Page 1

Introduction Page 2

Curriculum Cross Reference Guide Page 4

Unit 3: Relationships and Requirements of Living Things Page 6

- Big Ideas (Key Concepts) Page 6
- Clarification of Content Expectations Page 6
- Inquiry Process, Inquiry Analysis and Communication, Reflection and Social Implications Page 13
- Vocabulary Page 14
- Instruments, Measurements, and Representations Page 15
- **Instructional Framework:** Requirements and Survival Page 16
- Enrichment: Requirements and Survival Page 20
- Intervention: Requirements and Survival Page 20
- Examples, Observations and Phenomena (Real World Context): Requirements and Survival Page 21
- Literacy Integration: Requirements and Survival Page 22
- Mathematics Integration: Requirements and Survival Page 23
- **Instructional Framework:** Fossils Page 24
- Enrichment: Fossils Page 27
- Intervention: Fossils Page 27
- Examples, Observations, and Phenomena (Real World Context): Fossils Page 27
- Literacy Integration: Fossils Page 28
- Mathematics Integration: Fossils Page 29

Introduction to the K-7 Companion Document
An Instructional Framework

Overview

The Michigan K-7 Grade Level Content Expectations for Science establish what every student is expected to know and be able to do by the end of Grade Seven as mandated by the legislation in the State of Michigan. The Science Content Expectations Documents have raised the bar for our students, teachers and educational systems.

In an effort to support these standards and help our elementary and middle school teachers develop rigorous and relevant curricula to assist students in mastery, the Michigan Science Leadership Academy, in collaboration with the Michigan Mathematics and Science Center Network and the Michigan Science Teachers Association, worked in partnership with Michigan Department of Education to develop these companion documents. Our goal is for each student to master the science content expectations as outlined in each grade level of the K-7 Grade Level Content Expectations.

This instructional framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet the instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting findings and expanding thinking beyond the classroom.

These companion documents are an effort to clarify and support the K-7 Science Content Expectations. Each grade level has been organized into four teachable units- organized around the big ideas and conceptual themes in earth, life and physical science. . The document is similar in format to the Science Assessment and Item Specifications for the 2009 National Assessment for Education Progress (NAEP). The companion documents are intended to provide boundaries to the content expectations. These boundaries are presented as “notes to teachers”, not comprehensive descriptions of the full range of science content; they do not stand alone, but rather, work in conjunction with the content expectations. The boundaries use seven categories of parameters:

a. **Clarifications** refer to the restatement of the “key idea” or specific intent or elaboration of the content statements. They are not intended to denote a sense of content priority. The clarifications guide assessment.
b. **Vocabulary** refers to the vocabulary for use and application of the science topics and principles that appear in the content statements and expectations. The terms in this section along with those presented

within the standard, content statement and content expectation comprise the assessable vocabulary.

c. **Instruments, Measurements and Representations** refer to the instruments students are expected to use and the level of precision expected to measure, classify and interpret phenomena or measurement. This section contains assessable information.
d. **Inquiry Instructional Examples** presented to assist the student in becoming engaged in the study of science through their natural curiosity in the subject matter that is of high interest. Students explore and begin to form ideas and try to make sense of the world around them. Students are guided in the process of scientific inquiry through purposeful observations, investigations and demonstrating understanding through a variety of experiences. Students observe, classify, predict, measure and identify and control variables while doing “hands-on” activities.
e. **Assessment Examples** are presented to help clarify how the teacher can conduct formative assessments in the classroom to assess student progress and understanding
f. **Enrichment and Intervention** is instructional examples the stretch the thinking beyond the instructional examples and provides ideas for reinforcement of challenging concepts.
g. **Examples, Observations, Phenomena** are included as exemplars of different modes of instruction appropriate to the unit in which they are listed. These examples include reflection, a link to real world application, and elaboration beyond the classroom. These examples are intended for instructional guidance only and are not assessable.
h. **Curricular Connections and Integrations** are offered to assist the teacher and curriculum administrator in aligning the science curriculum with other areas of the school curriculum. Ideas are presented that will assist the classroom instructor in making appropriate connections of science with other aspects of the total curriculum.

This Instructional Framework is NOT a step-by-step instructional manual but a guide developed to help teachers and curriculum developers design their own lesson plans, select useful portions of text, and create assessments that are aligned with the grade level science curriculum for the State of Michigan. It is not intended to be a curriculum, but ideas and suggestions for generating and implementing high quality K-7 instruction and inquiry activities to assist the classroom teacher in implementing these science content expectations in the classroom.

Fourth Grade Unit 3:
Relationships and Requirements of Living Things

Content Statements and Expectations

Code	Statements & Expectations	Page
L.OL.E.1	**Life Requirements – Organisms have basic needs. Animals and plants need air, water, and food. Plants also require light. Plants and animals use food as a source of energy and as a source of building material for growth and repair.**	1
L.OL.04.15	Determine that plants require air, water, light, and a source of energy and building material for growth and repair.	1
L.OL.04.16	Determine that animals require air, water and a source of energy and building material for growth and repair.	2
L.EV.E.2	**Survival – Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.**	2
L.EV.04.21	Identify individual differences (color, leg length, size, wing size, leaf shape) in organisms of the same kind.	2
L.EV.04.22	Identify how variations in physical characteristics of individual organisms give them an advantage for survival and reproduction.	3
L.EC.E.1	**Interactions – Organisms interact in various ways including providing food and shelter to one another. Some interactions are helpful; others are harmful to the organism and other organisms.**	3
L.EC.04.11	Identify organisms as part of a food chain or food web.	3
L.EC.E.2	**Changed Environment Effects – When the environment changes, some plants and animals survive to reproduce; others die or move to new locations.**	5
L.EC.04.21	Explain how environmental changes can produce a change in the food web.	5

Code	Statements & Expectations	Page
E.ST.E.3	**Fossils – Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.**	6
E.ST.04.31	Explain how fossils provide evidence of Earth's past.	6
E.ST.04.32	Compare and contrast life forms found in fossils and organisms that exist today.	6

4 – Unit 3: Relationships and Requirements of Living Things

Big Ideas (Key Concepts)

- Plants and animals have basic requirements for maintaining life, which include the need for air, water and a source of energy (food).
- Organisms have observable traits and physical characteristics that help them survive and reproduce in their environments.
- Organisms are a part of a food chain or food web where food/energy is supplied by plants, which need light to produce food/energy.
- Plants and animals can be classified by observable traits and physical characteristics.
- Fossils provide evidence that life forms have changed over time and were influenced by changes in environmental conditions.

Clarification of Content Expectations

Standard: Organization of Living Things

Content Statement – L.OL.E.1

Life Requirements – Organisms have basic needs. Animals and plants need air, water, and food. Plants also require light. Plants and animals use food as a source of energy and as a source of building material for growth and repair.

Content Expectations

L.OL.04.15 Determine that plants require air, water, light, and a source of energy and building material for growth and repair.

Instructional Clarifications

1. Determine means to conclude or ascertain, as after reasoning, observation, etc. the requirements of plants.
2. Plants and animals have almost the same requirements for growth and repair. The one difference is light. Light is necessary for plants to be able to produce their own food. Sunlight is the initial energy source.
3. Fourth graders do not need to know or understand the process of photosynthesis. They need to know that plants are capable of producing their own food and animals are not. The food that the plant produces is its source of energy and building material.
4. Building materials include the food that the plant makes in its leaves plus the nutrients taken in by the plant's roots.
5. A common misconception is that stronger organisms have more energy.
6. A common misconception is that plants get food from the ground.

7. A common misconception is that plants make food for other organisms and not for themselves.
8. A common misconception is that plants need dirt or soil to grow.

Assessment Clarification

1. Plants need air, water, light, a source of energy, food and nutrients for growth and repair.

L.OL.04.16 Determine that animals require air, water and a source of energy and building material for growth and repair.

Instructional Clarifications

1. Determine means to conclude or ascertain, as after reasoning, observation, etc. that animals have requirements for growth and repair.
2. Animals have similar requirements to plants. The major difference is that animals do not require light because they do not make their own food. Animals have to get their energy and building materials from the food they eat.
3. Animals can only survive in environments in which their needs can be met.

Assessment Clarification

1. Animals need air, water, and food for growth and repair.

Content Statement – L.EV.E.2

Survival – Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

Content Expectations

L.EV.04.21 Identify individual differences (color, leg length, size, wing size, leaf shape) in organisms of the same kind.

Instructional Clarifications

1. Identify means to recognize individual differences in organisms of the same kind (species).
2. Organisms have individual differences within their own kind. Examples of these differences include: color, leg length, size, wing size and leaf shape.

Assessment Clarification

1. Organisms have individual differences within their own kind. Examples of these differences include: color, leg length, size, wing size and leaf shape.

L.EV.04.22 Identify how variations in physical characteristics of individual organisms give them an advantage for survival and reproduction.

Instructional Clarifications

1. Identify means to recognize physical characteristics for survival and reproduction.
2. Plants and animals have a variety of physical characteristics that enable them to survive and reproduce.
3. Some kinds of organisms and individuals have advantages in particular environments.
4. One animal whose coloring is more similar to its environment is better camouflaged and therefore less likely to be eaten. An animal with longer legs may be able to run faster than another and therefore is able to catch more prey or escape being caught. The larger babies in a litter are stronger and can get more food than smaller litter mates and therefore having a stronger chance of survival. The tree that grows the tallest in a crowded forest receives the most sunlight.
5. When the environment changes, variations in physical characteristics allow some organisms to survive and reproduce while others die or move to new locations.

Assessment Clarifications

1. Plants and animals have a variety of observable characteristics that help them survive and reproduce.
2. One animal whose coloring is more similar to its environment is better camouflaged and therefore less likely to be eaten. An animal with longer legs may be able to run faster than another and therefore is able to catch more prey or escape being caught. The larger babies in a litter are stronger and can get more food than smaller litter mates and therefore having a stronger chance of survival. The tree that grows the tallest in a crowded forest receives the most sunlight.

Content Statement – L.EC.E.1

Interactions – Organisms interact in various ways including providing food and shelter to one another. Some interactions are helpful; others are harmful to the organism and other organisms.

Content Expectation

L.EC.04.11 Identify organisms as part of a food chain or food web.

Instructional Clarifications

1. Identify means to recognize that organisms are part of a food chain or food web.
2. All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants.

3. The sun's energy is the basis for almost all life on Earth. The producers, or plants, use the sun's energy to make their own food.
4. Some animals eat only plants (herbivores), some eat only animals (carnivores), and some eat both plants and animals (omnivores). All of these animals are called consumers. Consumers cannot make their own food.
5. Dead plants and animals are broken down into materials that are retuned to the soil, air and water. Organisms that break down waste or plant and animal remains are called decomposers.
6. Energy and building materials from food is moved through food chains and food webs.
7. The arrows in a food chain diagrams can be confusing to students. Arrows show the energy flow in the system from producers to consumers.
8. Some animals (predators) hunt other animals (prey).
9. Some interactions between organisms are beneficial and some are detrimental.
10. A common misconception is that there are more herbivores because they have more offspring.
11. A common misconception is that not all animals need plants for survival.
12. A common misconception is that soil is not made from dead plants and animals.
13. A common misconception is that decomposition occurs naturally without the help of other organisms.

Assessment Clarifications

1. The sun's energy is the basis for almost all life on Earth. The producers, or plants, use the sun's energy to make food.
2. All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants.
3. Some animals eat only plants, some eat only animals, and some eat both plants and animals. All of these animals are called consumers. Consumers cannot make their own food.
4. Dead plants and animals need to be broken down into materials that are retuned to the soil, air and water. Organisms that break down waste or plant and animal remains are called decomposers.

Content Statement: - L.EC.E.2

Changed Environment Effects – When the environment changes, some plants and animals survive to reproduce; others die or move to new locations.

Content Expectation

L.EC.04.21 Explain how environmental changes can produce a change in the food web.

Instructional Clarifications

1. Explain means to clearly describe by means of illustrations (drawing), demonstrations, written reports, or verbally that environmental changes can produce a change in the food web.
2. Changes in the environment (temperature, shelter, light, food sources, and water) can affect survival of plants and animals. A forest fire destroys shelter and food for animals but also encourages the reproduction of some plants such as the jack pine.
3. The introduction of a new plant or animal species may become invasive and disrupt the food chain/web, if there is not a natural competitor and/or predator present (zebra mussels, quagga mussels, emerald ash borer, purple loosestrife).
4. Human interaction or interference can have both positive and negative effects on the food chain or web. Human interaction, such as a factory dumping wastes, can raise the temperature of a lake that will affect the amount of oxygen in the water needed by the fish and other animals for survival.
5. When a change is severe a species may become threatened, endangered or extinct.
6. When the environment changes, some plants and survive and reproduce and others die out or move to new locations.

Assessment Clarifications

1. Changes in the environment (temperature, shelter, light, food sources, and water) can affect the survival of plants and animals
2. When the environment changes, some plants and survive and reproduce and others die out or move to new locations.

Content Statement – E.ST.E.3

Fossils – Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.

Content Expectations

E.ST.04.31 Explain how fossils provide evidence of Earth's past.

Instructional Clarifications

1. Explain means to clearly describe by means of illustrations (drawing), demonstrations, written reports, or verbally that fossils provide evidence of Earth's past.
2. Fossils are important because scientists cannot actually observe the Earth's past. Fossils provide evidence that change has occurred in life forms over a time span of millions of years.
3. Fossils are just a sample of plants and animals that existed long ago.
4. A common misconception is that dinosaurs and cavemen lived at the same time.
5. A common misconception is that humans are responsible for the extinction of dinosaurs.
6. A common misconception is that all fossils were created at the same time in history.

Assessment Clarifications

1. Fossils provide evidence that change has occurred in life forms over a time span of millions of years.
2. Fossils are just a sample of plants and animals that existed long ago.

E.ST.04.32 Compare and contrast life forms found in fossils and organisms that exist today.

Instructional Clarifications

1. Compare and contrast means to note similarities and differences between fossils and present day organisms.
2. Fossils provide evidence that change has taken place over time in organisms.
3. There are many similarities in life forms found in fossils and organisms that exist today (cockroaches, crocodiles, ferns).
4. There are many differences in life forms found in fossils and organisms that exist today (horses, elephants). Some life forms are not alive today (dinosaurs).
5. The fossil record is incomplete and represents only a small sample of life forms that existed.

Assessment Clarifications

1. There are many similarities in life forms found in fossils and organisms that exist today (cockroaches, crocodiles, ferns).
2. There are many differences in life forms found in fossils and organisms that exist today (horses, dinosaurs). Some life forms are not alive today (dinosaurs).

Inquiry Process, Inquiry Analysis and Communication, Reflection and Social Implications

Inquiry Processes
S.IP.03.11 Make purposeful observations of plant and animal requirements and relationships.
S.IP.03.12 Generate questions based on observations of living things, their requirements and relationships.
S.IP.03.13 Plan and conduct simple and fair investigations to compare and contrast the needs of plants and animals requirements and their relationships.
S.IP.03.14 Manipulate simple tools (for example ruler, meter stick, balance scales) to determine the growth and change of living things.
S.IP.03.15 Make accurate measurements with appropriate units (centimeters, meters, grams, kilograms) of the growth and change of living things.
S.IP.03.16 Construct simple charts and graphs from data and observations of living things.
Inquiry Analysis and Communication
S.IA.03.11 Summarize information from charts and graphs to answer questions about plants and animal requirements and their relationships.
S.IA.03.12 Share ideas about plants and animals and their relationships through purposeful conversation in collaborative groups.
S.IA.03.13 Communicate and present findings of investigations that describe plants and animal requirements and their relationships.
S.IA.03.14 Develop research strategies and skills for information gathering and problem solving about plants and animal requirements and their relationships.
S.IA.03.15 Compare and contrast sets of data from multiple trials of an investigation about plants and animal requirements and their relationships to explain reasons for differences.
Reflection and Social Implications
S.RS.03.11 Demonstrate similarities and differences of plants and animal requirements and their relationships through various illustrations, performances or activities.
S.RS.03. 14 Use data/samples as evidence to separate fact from opinion about plants and animal requirements and their relationships.
S.RS.03.15 Use evidence when communicating, comparing and contrasting plants and animal requirements and their relationships.
S.RS.03.16 Identify technology used in everyday life to help plant and animal requirements and their relationships.
S.RS.03.17 Identify current problems about changes in plant and animal requirements and their relationships that may be solved through the use of technology.
S.RS.03.19 Describe how people such as Charles Darwin, Rachel Carson, Luther Burbank, George Washington Carver, Ibn Al-Baitar, Charles Turner and others have contributed to science throughout history and across cultures.

Vocabulary

Critically Important – State Assessable	Instructional
plants animals source of energy building material requirements for life repair individual differences organisms observable features enable obtain coloring similarities and differences in organisms camouflage predator prey litter food chain food web producers consumers decomposers populations environment affect survival reproduce fossil evidence variations physical characteristics survival reproduction advantage location compare contrast	produce food nutrients physical characteristics advantages beneficial detrimental mold cast imprint

Instruments, Measurement, Representations

The study of plants and animals in this unit relies closely on observation skills using the hand lens and possibly microscopes. Plants and animals are best observed in their natural environment over a period of time. In the classroom and laboratory setting, models of habitats provide a means to observe the growth, behavioral characteristics and structural or physical characteristics that help them to survive. The controlled environment of the model habitat gives the observer the opportunity to determine the balance in the food web within the environment through manipulation of the needs of organisms.

Representations of the food chain or food web within an environment are made using diagrams that demonstrate the direction of the flow of energy in the environment. For example: plant -> rabbit -> owl

Measurements within an ecosystem include collecting data on population shifts within different species, measurement of food consumption, and growth of organisms.

Instructional Framework

Instructional Examples

The following Instructional Framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting, findings, and expanding thinking beyond the classroom. The Instructional Framework is NOT a step-by-step instructional manual, but a guide intended to help teachers and curriculum developers design their own lesson plans, select useful and appropriate resources and create assessments that are aligned with the grade level science curriculum for the State of Michigan.

Organization of Living Things
Life Requirements: L.OL.04.15, L.OL.04.16
Evolution
Survival: L.EV.04.21, L.EV.04.22
Ecosystems
Interactions: L.EC.04.11
Changed Environment Effects: L.EC.04.21

Objectives

- Determine that plants require air, water, light, and a source of energy and building material for growth and repair.
- Determine that animals require air, water, light, and a source of energy and building for growth and repair.
- Identify individual differences in organisms of the same kind.
- Identify variations in physical characteristics that help individual animals survive and reproduce.
- Identify plants and animals as part of a food chain or food web.
- Explain how changes in an environment can produce a change in the food web.

Engage and Explore

- Walk around the playground. Students create a list of living things. (L.OL.04.15, L.OL.04.16, S.IP.04.11, S.IP.04.12)
- Using a plant (real or artificial), an animal (real or artificial) and a book, have students brainstorm how the plant and animal are alike and the book is different. (L.OL.04.15, L.OL.04.16, S.IP.04.11, S.IP.04.12)

- Using the schoolyard, a garden, park or nature area, identify plants and animals living there. How are the plants used? (food and shelter) How do the animals survive? (food and shelter) (L.OL.04.15, L.OL.04.16, S.IP.04.11, S.IP.04.12)
- Using the lists of plants and animals living in the nearby schoolyard, garden, park or nature area, brainstorm reasons why some of these plants and animals might not survive. (loss of habitat, too many predators, pollution, drought, flooding, etc.) Choose one plant or animal and write paragraph explaining what it needs to survive in its environment. (L.EV.04.21, L.EC.04.21, S.IP.04.12, S.IA.04.12, S.RS.04.12)
- Role-play a simple food chain such as a water flea, sunfish and heron. Have 1/2 of the class be water fleas, 3/8 of the class be sunfish and 1/8 of the class be herons. Scatter small pieces of paper on the floor that represent food. Half of the pieces should have an **X** on the back that represents food with toxins. First have the water fleas collect the food in a baggy. Then have the sunfish eat the water fleas (and food pieces) by taking their baggy. Last the herons can eat the sunfish (food pieces and water fleas). Students examine the herons' baggies, which represents their stomachs. The more papers with an **X** the more toxins they have eaten. Have a class discussion about how the toxins were passed through the food chain. What effects could they have on each species? Could humans also be getting toxins through our foods? (L.EC.04.21, S.IP.04.12, S.IA.04.12, S.RS.04.12)

Explain and Define

- Students identify the basic needs of plants and animals: air, water, light and a source of energy. Create a two-column list entitled "Needs of Living Things" with the subheadings: "Plants" and "Animals". Students list the needs of plants and animals.
- Students create a graphic organizer to compare and contrast the needs of plants and animals.

Elaborate and Apply

- In collaborative groups, students conduct a simple plant investigation. Each group is given four plants of the same kind. For each plant take away one requirement: light, water, soil and one plant that has all 3 taken away. Make a chart showing each plant and daily record observations. Compare and contrast the plants. Generate questions about the plants needs and other ways to meet these needs. How could students prove a plant's need for air? (L.OL.04.15, S.IP.04.13, S.IP.04.15, S.IP.04.16, S.IA.04.11, S.IA.04.12, S.IA.04.13, S.RS.04.12, S.RS.04.14, S.RS.04.15.)
- Students review the needs of a plant (air, water, light and materials for growth and repair). Each group is given a picture a different mammal. Discuss and present how this animal has these same needs and how they

take care of these needs. Use animals from other groups such as reptile, amphibian, insect, bird etc. Do these animals have the same needs? (L.OL.04.16, S.IP.04.11, S.IP.04.12)

- Make observations of the students in the classroom. List observable traits or physical characteristics that all fourth grade students have in common. Create a list of individual differences in traits and characteristics such as height, arm length, hand size, finger length, foot size, etc. Discuss that every species of animal has individual traits. Which student would be better at reaching the top shelf in the closet? Which student would be better at holding a large ball? Discuss the how individual differences may give an animal an advantage in its environment. (L.EV.04.21, L.EV.04.22, S.IP.04.11, S.IA.04.13)
- Teacher prep: Create die-cut butterflies from newspaper, wrapping paper, construction paper, and lined paper. The majority will be cut from newspaper. Tape sheets of newspaper to the board. Tape the butterflies to the newspaper. Cover the newspaper before students enter the room. Instruct students that they will have five seconds to count the number of butterflies hidden under the paper. Uncover the butterfly-covered newspaper for five seconds. Students record the number and color of the butterflies they observed. Discuss their findings as a group. Create a chart, then a graph, of the number and color of observed butterflies. As a class, uncover the butterflies and count how many and the color of butterflies present. Discuss the variations in observations. Relate the activity to a bird preying on butterflies. How does coloration give the butterflies an advantage or disadvantage? Conclude that individual differences or variations in physical characteristics give organisms an advantage for survival. (L.EV.04.21, L.EV.04.22, S.IP.04.11, S.IP.04.22, S.IP.04.16, S.IA.04.11, S.IA.04.13)
- Students understand a plant's needs. Next, they discuss that a plant makes its own food in its leave so is called a producer. Plants produce or make their own food. Animals depend on plants and other animals for food and are called consumers. Students use pictures or word cards of common plants and animals to construct food chains first and show the interconnections through food webs, using arrows to show the flow of energy. (seeds, grasses, trees, mice, rabbits, moles, raccoons, deer, coyotes, house cat, owls, etc.) Most food chains have 3-4 links. Draw pictures or develop an exhibit to show the food chain or food web. Note: the arrows show the direction that the energy flows through a food chain. (L.EC.04.11, S.IA.04.13, S.RS.04.13)
- Research different kinds of animals using books and Internet sources to find out the foods they eat. Determine from the foods if the animal is an herbivore, omnivore or carnivore. Make a poster showing the animal, its foods and a food chain or web that it is part of. (L.EC.04.11, S.IA.04.14, S.RS.04.12, S.RS.04.13, S.RS.04.14)
- In a cooperative group, research Michigan plants and animals that are on the threatened and endangered list. Using a chart, list the plant or animal and the reason or reasons it is on this list. What are the most common reasons? What is the human role in this plant or animal's reason

for being on this list? Rank the list in order of importance to save. Have a class discussion to compare the rankings and the reasons. (L.EC.04.21, S.IA.04.12, S.IA.04.13, S.IA.04.14, S.RS.04.12)

- Using information on invasive species of Michigan (zebra mussels, quagga mussels, round goby, ruffe, purple loosestrife, emerald ash borer, spiny water flea, sea lamprey, etc.) write and act out a simple play that shows the cause that brought these species and the effect on food chains. (L.EC.04.21, S.IA.04.14, S.RS.04.12)

Evaluate Student Understanding

Formative Assessment Examples

- Chart of results from an investigation of plants and their requirements. (L.OL.04.15)
- Draw a picture of an animal and plant comparing their basic needs. (L.OL.04.15, L.OL.04.16)
- Choose one plant or animal and write paragraph explaining how it is adapted to survive in its environment. (L.EV.04.21, L.EV.04.22)
- Create a food chain and a food web that includes water flea, sunfish and heron. (L.EC.04.11)
- Paragraph explaining the affects of a change in a food chain. (L.EC.04.21)

Summative Assessment Examples

- Draw or construct an environment for an imaginary plant or animal that meets all of its needs. Identify and describe how the organism's needs are met. (L.OL.04.15, L.OL.04.16)
- Draw food chains that include all levels (producers, consumers and decomposers) and indicate energy flow using arrows. Describe and draw the results of a flood, drought, fire, subdivision, etc. (L.EC.04.11)
- Write a paragraph explaining how individual differences among organisms give them an advantage for survival. (L.EV.04.21, L.EV.04.22)

Enrichment

- Research scientists such as Charles Darwin, Luther Burbank, Charles Turner and George Washington Carver to understand their contributions to scientific knowledge.
- Research Rachel Carson to understand how she discovered disruptions in our food chains and their effects.
- Visit the zoo or a botanical garden. Observe and describe how the animals/plants needs are met within the constructed environment. How is this different and the same as their natural environment? What are the advantages and disadvantages of each?
- Research the work of Dr. Robert Ballard and his investigations of ecosystems at the bottom of the ocean that do not use the sun as a source of energy.
- Study other ecosystems (rain forest, desert, mountain, prairie, tundra) and make a poster or diorama that shows the food chains or food web of that ecosystem.
- Investigate color phases among some animal species (squirrels, fox, etc.) to determine the advantages or disadvantages of coloration.
- Research the effects that global climate change, urban sprawl, deforestation, off shore drilling, etc. have on plant and animal populations.

Intervention

- Give students pictures of one plant and one animal. Students research their organisms on the Internet or media. Students draw a picture of one environment that meets the needs of both the plant and the animal.
- Observe a tank of different colored goldfish. Discuss the variation in color. Discuss how the color variations would affect their survival in certain environments, i.e. muddy pond, white pool, etc.
- Sort pictures of organisms into herbivores, omnivores, carnivores, producers, consumers, and decomposers. Create a match game.
- Make food chains and food webs with animals in the area or with pictures cut from magazines.
- Students look at different ecosystems and make simple food chains and food webs based on the ecosystem.

Examples, Observations, and Phenomena (Real World Context)

The National Wildlife Foundation and Environmental Protection Agency work together to keep track of populations and changes in populations of plants and animals. Organisms that become threatened by changes in the environment, hunting or poaching, disease, and other outside factors are placed on *threatened* or *endangered species* list. For example, the polar bear is an endangered species. The habitat of the polar bear is threatened by global warming. The main food source, the seal is more difficult for the polar bear to hunt due to the shifting and melting ice. There are dozens of endangered species. Some animals and plants have become extinct due to the destruction of habitat and interruption of the food web.

Human activities, such as land development, pollution, hunting and poaching, and careless use of natural resources are the main threat to habitats and environments that support diverse species on Earth.

The term “survival of the fittest” is a real world application of the survival of animals and plants in their environment. Organisms with the strongest features that help them to get food, maintain body temperature, escape danger, build homes or nests, and reproduce survive at a greater rate in their environment. Organisms that display weakness in their physical characteristics that help them to survive become prey to other animals or die from lack of nutrition.

Scientists who have contributed to the study of plants and animals are Luther Burbank, Ibn Al-Baitar, Charles Turner and George Washington Carver.

Literacy Integration

Reading

R.CM.04.01 connect personal knowledge, experiences, and understanding of the world to themes and perspectives in text through oral and written responses.

R.CM.04.02 retell through concise summarization grade-level narrative and informational text.

R.CM.04.04 apply significant knowledge from grade-level science, social studies, and mathematics texts.

Examples of trade books available for learning about plants and animals:

Woods Walk, Henry W. Art and Michael W. Robbins, 2003
Food Chains and Webs: What are They and How Do They Work?, Andrew Solway, 2007.
Forest Food Chains, Bobbie Kalman, 2004
Food Chains, Peter Riley, 1999
How Animals Live, Bernard Stonehouse and Esther Bertram, 2004
Can We Save Them?, David Dobson, 1997

Writing

W.PR.04.01 set a purpose, consider audience, and replicate authors' styles and patterns when writing a narrative or informational piece.

W.PR.04.02 apply a variety of pre-writing strategies for both narrative and informational writing (e.g., graphic organizers such as maps, webs, Venn diagrams) in order to generate, sequence, and structure ideas (e.g., plot, setting, conflicts/resolutions, definition/description, or chronological sequence).

W.PR.04.03 draft focused ideas using a variety of drafting techniques composing coherent and mechanically sound paragraphs when writing compositions.

Mathematics Integration

Measurement

M.UN.04.01 Measure using common tools and select appropriate units of measure.

M.PS.04.02 Give answers to a reasonable degree of precision in the context of a given problem.

Data and Probability

D.RE.04.01 Construct tables and bar graphs from given data.

Instructional Examples

Earth in Space and Time

Fossils: E.ST.04.31, E.ST.04.32

Objectives

- Explain how fossils provide evidence of Earth's past.
- Compare and contrast life forms found in fossils and organisms that exist today.

Engage and Explore

- Draw sets of tracks on the board, such as dog, cat, a bicycle, two children, an adult. The tracks cross each other and go in different directions. Students make up scenarios to fit the tracks and defend their versions. (S.IP.04 11, S.IP.04.12)
- Students look at two different rocks. One of the rocks has clear fossil evidence and the other rock has no fossil evidence. Students make observations and generate questions about the pictures of the fossils in the rock. (E.ST.04.31, E.ST.04.32, S.IP.04 11, S.IP.04.12)
- Students make their own fossil by using plaster of Paris or drywall plaster. First flatten a circle of clay of 3-4 inch diameter. Cover the clay with a light coat of petroleum jelly and press shells into the clay leaving the print. Remove the shell and put a ring of poster board around the clay. Fill the clay with the plaster mix to about 1-1 ½ inch thickness. Mix the plaster in small amounts as it will solidify quickly and be difficult to pour into the mold. Let the plaster set for at least a day. Remove the clay and ring and see the shell prints left in the plaster. Which is the mold and which is the cast? Discuss how the print of the shell is left, not the real shell. Discuss how finding shell fossils tell us that at one time water covered that area. (E.ST.04.31, E.ST.04.32, S.IP.04 11, S.IP.04.12, S.RS.04.12)
- Find a spot where students are able to dig in the ground. Look for examples of dead leaves, twigs and insects. Remove them carefully and clean up with a toothbrush. Did the things leave an imprint in the soil? Discuss how this is similar to what a paleontologist does as he/she studies fossils in rocks. (E.ST.04.31, E.ST.04.32, S.IP.04 11, S.IP.04.12)

Explain and Define

- Students develop a definition that a fossil is evidence of what lived in the past. Students develop an understanding that some animals are similar to what exists today such as shellfish; and other animals, such as dinosaurs, no longer exist. Evidence of their existence is shown in fossils.

Elaborate and Evaluate

- Use the chart to complete the activity. Footprint size gives a good idea of overall size and height. Scientists have determined that the length of a footprint is generally equal to one-quarter the length of the hind-leg bone of the animal that made it. The length of the bone gives a good idea of the animal's overall size. In this activity, use numbers to determine the approximate lengths of dinosaur leg bones. (E.ST.04.31, E.ST.04.32, S.IA.04.11, S.IA.04.12, S.IA.04.13, S.RS.04.12)

Name of Dinosaur	Length of footprint	Probable length Of Hind-leg Bone (4 X footprint)	Probable Rank in Probable Size
Triceratops	15 inches (1 1/2 feet)		
Tyrannosaurus	30 inches (2 ½ feet)		
Stegosaurus	18 inches (1 ½ feet)		
Velociraptor	6 inches (1/2 foot)		
Compsognathus	3 inches (1/4 foot)		
Ultrasaurus	78 inches (6 ½ feet)		

- Fossil teeth are evidence of the animal's size and diet. Using pictures of different sizes and kinds of teeth, students identify whether the teeth belonged to an herbivore, omnivore, or carnivore and whether the animal was small, medium, or large. Write a paragraph supporting each decision. (E.ST.04.31, E.ST.04.32, S.IP.04.11, S.IP.04.12, S.RS.04.12)
- Use fossil prints or pictures of plants that show different types of ecosystems (ferns-wetland, pine cone-coniferous forest, maple leaves-deciduous forest, coral-ocean, etc.). Match the picture with the kind of ecosystem. (E.ST.04.31, E.ST.04.32, S.IP.04.11, S.IP.04.12, S.RS.04.12)
- Students draw an underground picture showing what might be found in the schoolyard by a future paleontologist. Plants, animals and humans would leave what items? What could they tell about the environment? (E.ST.04.31, E.ST.04.32, S.IP.04.11, S.IP.04.12, S.RS.04.12)

Evaluate Student Understanding

Formative Assessment Examples

- Discuss the scenario based on animal interaction evidenced through tracks. (E.ST.04.31)
- Discuss the difference between mold and cast fossils. (E.ST.04.31)

- Review the numbers on the table from the dinosaur size activity; and review the dinosaur ranking by size. (E.ST.04.31)
- Match plant fossil print and the kind of ecosystem in which it would be found. (E.ST.04.32)

Summative Assessment Examples

- Paragraph using supporting evidence about teeth to determine the size and type of consumer. (E.ST.04.31)
- Picture and a paragraph that has supporting details describing future evidence of today's environment. (E.ST.04.31, E.ST.04.32)

Enrichment

- Using animal footprints, students create their own story on a slab of clay. Have another student or group of students interpret the picture.
- Take a field trip to a Natural History Museum that has displays of dinosaurs.
- Research the Michigan state fossil, the mastodon, and the Michigan state stone, the Petosky stone.
- Research the dinosaur fossil, Sue, at the Chicago Field Museum. Write a report telling about the finding and restoration of this dinosaur.
- A paleontologist studies fossils. Find out the kind of tools needed to recover fossils from rocks.
- A baby mammoth was found preserved in ice in Siberia. Find current information on this type of fossil.
- The Tuatara Lizard is a living fossil. Research this lizard.
- Research crocodiles, cockroaches and ferns to discover the similarities and differences between ancient and present life forms.

Intervention

- Make a handprint or footprint in plaster. Discuss how this is similar to finding a footprint fossil of an animal. This fossil can be used to identify the kind of animal that lived in that area.
- Bury artifacts, bones, etc. in sand. Students act as paleontologists to uncover evidence. Students create a story based on the evidence.
- Using a fossil collection, students determine whether the fossil originated from a plant or animal. Support ideas with evidence.

Examples, Observations and Phenomena (Real World Context)

Fossils are evidence that dinosaurs existed. Natural History Museums preserve and display dinosaur skeletons. The information archeologists and paleontologists learn from fossils gives evidence of once living organisms and the changes in climate over long periods of time.

Fossils of similar species of animals were found on different continents. Scientists use this evidence to show the continents were once connected.

Literacy Integration

Reading

R.CM.04.01 connect personal knowledge, experiences, and understanding of the world to themes and perspectives in text through oral and written responses.

R.CM.04.02 retell through concise summarization grade-level narrative and informational text.

R.CM.04.04 apply significant knowledge from grade-level science, social studies, and mathematics texts.

Examples of trade books available for learning about fossils:

A Dinosaur Named Sue by Fay Robinson, 1999
My Life as an Explorer (Hunt for the Past), Sue Hendrickson, 2001
New Dinos, Shelley Tanaka, 2003
Fossils, Melissa Stewart, 2002
Evolution, Linda Gamlin, 2000

Writing

W.PR.04.01 set a purpose, consider audience, and replicate authors' styles and patterns when writing a narrative or informational piece.

W.PR.04.02 apply a variety of pre-writing strategies for both narrative and informational writing (e.g., graphic organizers such as maps, webs, Venn diagrams) in order to generate, sequence, and structure ideas (e.g., plot, setting, conflicts/resolutions, definition/description, or chronological sequence).

W.PR.04.03 draft focused ideas using a variety of drafting techniques composing coherent and mechanically sound paragraphs when writing compositions.

Mathematics Integration

Data and Probability

D.RE.04.01 Construct tables and bar graphs from given data.

Number and Operations

N.MR.04.14 Solve contextual problems involving whole number multiplication and division.