Grade 7 Science, Quarter 4, Unit 4.1

Biodiversity and Evolution

Overview

Number of instructional days: 27 (1 day = 50 minutes)

Content to be learned

- Illustrate, compare, or interpret possible relationships among groups of organisms.
- Sort organisms with similar characteristics into groups based on internal and external structures.
- Explain how species with similar evolutionary histories and characteristics are classified more closely together with some organisms than others.
- Recognize the classification system used in modern biology.
- Understand natural selection and evolution by differentiating between acquired and inherited characteristics.
- Make predictions or draw conclusions about how the diversity of an ecosystem contributes to the stability of the ecosystem.
- Give examples of adaptations and behaviors that are specific to a niche within an ecosystem.
- Explain how organisms with different structures and behaviors have roles that contribute to each other's survival and the stability of the ecosystem.

Science processes to be integrated

- Use a classification system.
- Use models.
- Relate form and function.
- Identify patterns of change.
- Provide examples of organisms and their niches.
- Explain relationships among organisms and classify organisms based on outcomes.

Essential questions

- What kinds of relationships can be identified among different groups of organisms?
- What internal and external features can be used as a basis for classifying organisms?
- How can the classification of organisms be used to explain evolutionary histories?
- What is the basis for the classification system used in modern biology?
- What do acquired and inherited characteristics compare to each other?

- How does an understanding of the difference between acquired and inherited characteristics contribute to an understanding of natural selection and evolution?
- What is an example of a behavior that is specific to a niche within an ecosystem and how does that role affect the stability of the ecosystem?
- What is an example of an adaptation that is specific to a niche within an ecosystem and how does that role affect the stability of the ecosystem?

Written Curriculum

Grade-Span Expectations

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (5-8) – INQ+ SAE- 1

Using data and observations about the biodiversity of an ecosystem make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem.

LS1 (7-8) – 1 Students demonstrate understanding of biodiversity by…

1a giving examples of adaptations or behaviors that are specific to a niche (role) within an ecosystem.

1b explaining how organisms with different structures and behaviors have roles that contribute to each other's survival and the stability of the ecosystem.

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. Students identified and sorted based on similar or different external features. They sequenced the life cycle of a plant or animal when given a set of pictures. Students acted out or constructed diagrams that showed a simple food web. They used information about a simple food web to determine how basic needs are met by the habitat or environment. Students observed and compared their physical features with those of parents and classmates. They cited evidence to draw conclusions explaining why organisms are or are not grouped together. Students identified that some behaviors are learned.

In grades 3–4, students cited evidence to distinguish between living and nonliving things. They identified, sorted, and compared these things based on similar and/or different external features; they compared and analyzed external features and characteristics of humans and other animals. Students cited evidence to draw conclusions, explaining why organisms are or are not grouped together. They observed that plants need water, air, food, light, and space to grow and reproduce. They identified and explained how the physical structures/characteristics of an organism allow it to survive and defend itself. Students analyzed the structures needed for populations of plants and animals to survive in a particular habitat/environment.

They identified the sources of energy necessary for organisms to survive and explained the ways that plants and animals in that habitat depend on each other. Students used information about organisms to design a habitat and explained how the habitat provides for the needs of the organisms that live there.

Students explained how the balance of an ecosystem might be disturbed. They identified that some behaviors are learned while some behaviors are instinctual.

In grades 5–6, students recognized that organisms have different features and behaviors for meeting their survival needs, describing structures or behaviors that help organisms survive in their environment.

Students identified and defined an ecosystem and the variety of relationships within it. They defined reproduction as a process through which organisms produce offspring and recognized it as essential for the continuation of a species.

Current Learning

The instruction is at a drill and practice level when students sort and organize organisms with similar external characteristics. The developmental level content is when students are sorting the organisms according to their internal structures. Students explain how species with similar evolutionary histories/characteristics are classified more closely in comparison to other organisms. They demonstrate their understanding of classification with examples like: a fish and a human have more in common with each other than a fish and jellyfish. Students recognize the classification system used in biology and are able to use a dichotomous key or model to illustrate, compare and make interpretations about different organisms.

Students will differentiate between acquired and inherited characteristics in organisms to demonstrate their understanding of Natural Selection and evolution. For example Pavlov's dog experiment is an acquired characteristic compared to a trait that is passed on from parent to offspring through genes.

Students give examples of adaptations or behaviors that are specific to a niche (role) within an ecosystem. They explain how organisms with different structures and behaviors have roles that contribute to each other's survival and the stability of the ecosystem. Students explain how the cell, as the basic unit of life, has the same survival needs as an organism (e.g., obtaining energy, growing, eliminating waste, reproducing).

Processes in this unit include: providing examples of organisms and their niches, explaining relationships among organisms and classifying them based on outcomes, differentiating between the survival needs of a cell and the survival needs of an organism,

Common classroom dynamics may include collaborative learning, discussion, student investigation, and inquiry. Some strategies to help students and teachers overcome the challenges presented by this unit of study would be the use of graphic organizers, frequent assessments, hands-on activities, pictures, and slides.

Future Learning

Students will use their knowledge of biodiversity, adaptations, niches, and ecosystems as a foundation to acquire new knowledge related to the balance of nature.

Additional Findings

Middle school students should distinguish between evolution and natural selection. "Students should first be familiar with the evidence of evolution so that they will have an informed basis for judging different explanations" regarding natural selection. Students should be familiar with Darwin's thinking that differences between generations are cumulative. By the end of eighth grade, students should know that individual organisms with certain traits are more likely than others to survive and give rise to offspring. Changes in the environment can affect the survival of individual organisms and entire species (*Benchmarks for Science Literacy*, p. 122).

"Middle school students hold a much more restrictive meaning for the word 'plant.' Students often do not recognize trees, vegetables, and grass as plants" (*Benchmarks*, p. 341).

Middle school provides an understanding of natural selection, but because of the complexity of scientific evidence and arguments that must be examined, a thorough understanding of species and evolution probably cannot be achieved earlier than high school (*Atlas of Science Literacy, Volume 2*, p. 84).

Sexual reproduction is not recognized as a source of variation in a population … students attribute observable variation to environmental factors (*Making Sense of Secondary Science*, p. 52).

Students rely on everyday use of common names to determine which species belong in which group (e.g., jellyfish and starfish are fish) (*Making Sense*, p. 25).

"Students had difficulty classifying plants and thought that a tree was not a plant except when it was little" (*Making Sense*, p. 23).

Grade 7 Science, Quarter 4, Unit 4.2

Processes Within an Ecosystem

Overview

Number of instructional days: 23 (1 day = 50 minutes)

Content to be learned

- Identify which biotic and abiotic factors affect a given ecosystem.
- Analyze how biotic and abiotic factors affect a given ecosystem.
- Predict the outcome of a given change in biotic and abiotic factors in an ecosystem.
- Use visual models to track population changes in an ecosystem.
- Explain the transfer of the sun's energy through living systems.
- Explain the effect of the transfer of the sun's energy on livings systems.
- Diagram and sequence a series of steps to show how matter cycles among and between organisms and the physical environment.
- Develop a model for a food web of local aquatic and terrestrial environments.
- Show the total amount of matter is conserved when its form and location changes as a result of the transfer of matter among and between organisms and the physical environment.

Science processes to be integrated

- Make observations.
- Analyze data.
- Make predictions.
- Use, develop, and interpret models.
- Examine the flow of energy through systems.
- Analyze scenarios.
- Create diagrams.
- Conduct controlled investigations.

Essential questions

- How do biotic and abiotic factors affect an ecosystem?
- What could the outcome be if biotic or abiotic factors were changed in an ecosystem?
- How can population changes in ecosystems be tracked?
- How does the energy from the sun make its way throughout an ecosystem?
- What kind of evidence from an investigation can be used to show that matter cycles among and between organisms and their physical environment?
- What would a food web of local aquatic and terrestrial environments look like?
- Why does matter remain constant even though its form and location change as matter is transferred among and between organisms and the physical environment?

Written Curriculum

Grade-Span Expectations

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (5-8) INQ+SAE -5

Using data and observations, predict outcomes when abiotic/biotic factors are changed in an ecosystem.

LS2 (7-8) –5 Students demonstrate an understanding of equilibrium in an ecosystem by …

5a identifying which biotic (e.g., bacteria, fungi, plants, animals) and abiotic (e.g., weather, climate, light, water, temperature, soil composition, catastrophic events) factors affect a given ecosystem.

5b analyzing how biotic and abiotic factors affect a given ecosystem.

5c predicting the outcome of a given change in biotic and abiotic factors in an ecosystem.

5d using a visual model (e.g., graph) to track population changes in 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 (7-8) –6 Students demonstrate an understanding of energy flow in an ecosystem by …

6a explaining the transfer of the sun's energy through living systems and its effect upon them.

6d creating or interpreting a model that traces the flow of energy in a food web.

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 (7-8)-7 Students demonstrate an understanding of recycling in an ecosystem by …

7a diagramming or sequencing a series of steps showing how matter cycles among and between organisms and the physical environment.

7b developing a model for a food web of local aquatic and local terrestrial environments.

7d conducting 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 (e.g., bottle biology, mass of a closed system over time).

Clarifying the Standards

Prior Learning

In grades K–2, students diagrammed and used information from a food web to determine basic needs within each food web. They distinguished between living and nonliving things and identified the sun as a source of heat. In grades 3 and 4, students identified sources of energy for the survival of organisms such as light or food as well as demonstrated that all animals' food sources begin with the sun as the basis of the energy source. In grades 5 and 6, students defined an ecosystem and identified the sun as the major source of energy. They sequenced energy flow in an ecosystem and completed a food web for a given ecosystem.

Current Learning

The reinforcement level of instruction is used for this unit of study. This unit reinforces the importance of photosynthesis and how energy flows through an ecosystem. Students explain how matter cycles and energy flows through an ecosystem. Using data and observations, students predict outcomes when abiotic/biotic factors are changed in an ecosystem. Students demonstrate an understanding of equilibrium in an ecosystem by identifying which biotic (e.g., bacteria, fungi, plants, animals) and abiotic (e.g., weather, climate, light, water, temperature, soil composition, catastrophic events) factors affect a given ecosystem. Students analyze how biotic and abiotic factors affect a given ecosystem and predict the outcome of a given change in biotic and abiotic factors in an ecosystem. Students use a visual model (e.g., graph) to track population changes in an ecosystem.

Given a scenario, students 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). Students demonstrate an understanding of energy flow in an ecosystem by explaining the transfer of the sun's energy through living systems and its effect on them and by creating or interpreting a model that traces the flow of energy in a food web.

Given an ecosystem, students trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, and recycling but not carbon cycle or nitrogen cycle). Students demonstrate an understanding of recycling in an ecosystem by diagramming or sequencing a series of steps showing how matter cycles among and between organisms and the physical environment. Students develop a model for a food web of local aquatic and terrestrial environments and 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 (e.g., bottle biology, mass of a closed system over time).

Students must be able to analyze the slower processes and the effects of weathering, erosion, and mountain building. They analyze the rapid processes and effects of erosion, volcanoes, and earthquakes. Students investigate the effect of flowing water on landforms using a model or local environment. Students perform investigations that demonstrate understand weathering and erosion. They conduct research and read articles that detail the effects of volcanic and earthquake activity. Students build/use models to better understand the effects of flowing water over landforms. Students examine more comprehensive data from their investigations to make decisions about what they observe. Students use models and diagrams to understand the difference between fast and slow processes that shape the earth.

Future Learning

In grades and courses after grade 7, students will describe and predict how humans and natural events affect the equilibrium of ecosystems. They will explain how chemical elements and compounds cycle through all trophic levels. Students will evaluate evidence from multiple sources and then apply that information to environmental issues.

Additional Findings

By the end of the 5th grade should know that some source of "energy" is needed for all organisms to stay alive and grow (*Benchmarks for Science Literacy,* p. 119).

Students should know that almost all food energy comes originally from sunlight by the end of the 8th grade. They should also know that matter remains constant, even though its form and location change by the end of 8th grade (*Benchmarks,* p. 120).

Students think organisms and materials in the environment are very different types of matter and see these substances are not transformable into each other and tend to think that energy transformations involve only one form of energy at a time. Students do not realize that matter from dead organisms is converted into other materials in the environment. They seem to know that some kind of cyclical process takes place in an ecosystem (*Atlas of Science Literacy,* pp. 76, 78).