Utah Elementary Science Core Curriculum
Fourth Grade
Adopted by Utah State Board of Education
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Introduction

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands–on, active experiences throughout the instruction of the science curriculum.

The Elementary Science Core describes what students should know and be able to do at the end of each of the K–6 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert national consultants, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of science education that is expressed in national documents developed by the American Association for the Advancement of Science, the National Academies of Science. This Science Core has the endorsement of the Utah Science Teachers Association. The Core reflects high standards of achievement in science for all students.

Organization of the Elementary Science Core

The Core is designed to help teachers organize and deliver instruction.

The Science Core Curriculum's organization:

- ✓ Each grade level begins with a brief course description.
- ✓ The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for science skills and attitudes. They are found at the beginning of each grade, and are an integral part of the Core that should be included as part of instruction.
- ✓ The SCIENCE BENCHMARKS describe the science content students should know. Each grade level has three to five Science Benchmarks. The ILOs and Benchmarks intersect in the Standards, Objectives and Indicators.
- ✓ A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- ✓ An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they are judged to have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- ✓ An INDICATOR is a measurable or observable student action that enables one to judge whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Eight Guidelines Were Used in Developing the Elementary Science Core

Reflects the Nature of Science: Science is a way of knowing, a process of gaining knowledge and understanding of the natural world. The Core is designed to produce an integrated set of Intended Learning Outcomes (ILOs) for students. Please see the Intended Learning Outcomes document for each grade level core.

As described in these ILOs, students will:

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.

Coherent: The Core has been designed so that, wherever possible, the science ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of science concepts, skills, and content. This spiraling is intended to prepare students to understand and use more complex science concepts and skills as they advance through their science learning.

Developmentally Appropriate: The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core describes science language students should use that is appropriate to each grade level. A more extensive vocabulary should not be emphasized. In the past, many educators may have mistakenly thought that students understood abstract concepts (such as the nature of the atom), because they repeated appropriate names and vocabulary (such as electron and neutron). The Core resists the temptation to tell about abstract concepts at inappropriate grade levels, but focuses on providing experiences with concepts that students can explore and understand in depth to build a foundation for future science learning.

Encourages Good Teaching Practices: It is impossible to accomplish the full intent of the Core by lecturing and having students read from textbooks. The Elementary Science Core emphasizes student inquiry. Science process skills are central in each standard. Good science encourages students to gain knowledge by doing science: observing, questioning, exploring, making and testing hypotheses, comparing predictions, evaluating data, and communicating conclusions. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should connect lessons with students' daily lives. The Core directs experiential science instruction for all students, not just those who have traditionally succeeded in science classes. The vignettes listed on the "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science for each of the Core standards provide examples, based on actual practice, that demonstrate that excellent teaching of the Science Core is possible.

Comprehensive: The Elementary Science Core does not cover all topics that have traditionally been in the elementary science curriculum; however, it does provide a comprehensive background in science. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts.

Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible: Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Resource Book (TRB) is available for elementary grades and has sample lessons on each topic for each grade level. The TRB is a document that will grow as teachers add exemplary lessons aligned with the new Core. The middle grade levels have electronic textbooks available at the Utah State Office of Education's "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science.

Useful and Relevant: This curriculum relates directly to student needs and interests. It is grounded in the natural world in which we live. Relevance of science to other endeavors enables students to transfer skills gained from science instruction into their other school subjects and into their lives outside the classroom.

Encourages Good Assessment Practices: Student achievement of the standards and objectives in this Core are best assessed using a variety of assessment instruments. One's purpose should be clearly in mind as assessment is planned and implemented. Performance tests are particularly appropriate to evaluate student mastery of science processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform their instruction. Sample test items, keyed to each Core Standard, may be located on the Utah Science Home Page. Observation of students engaged in science activities is highly recommended as a way to assess students' skills as well as attitudes in science. The nature of the questions posed by students provides important evidence of students' understanding of science.

The Most Important Goal

Elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. Effective elementary science instruction engages students actively in enjoyable learning experiences. Science instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or holding a toad. Science is not just for those who have traditionally succeeded in the subject, and it is not just for those who will choose science–related careers. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of doing science.

Fourth Grade Science Core Curriculum

The theme for the fourth grade Science Core curriculum is **Utah natural history.** Students will learn about Utah environments including; weather, water cycle, rocks, fossils, soils, plants and animals. Understanding the concepts of **cycles** is an essential component of science literacy and is introduced at this grade level. Emphasis should be placed on skills to classify many things. Students should come to value and use science as a process of obtaining knowledge based on observable evidence, and their curiosity should be encouraged and sustained as they develop the abilities associated with inquiry in science.

Good science instruction requires that attention be paid to providing students with hands–on science investigations in which student inquiry is an important goal. Their curiosity should be encouraged and sustained. Teachers should provide opportunities for all students to experience many things. Fourth graders should feel the excitement of a rainstorm, hunt for fossils in rocks, observe the patterns in a spider web, and teach their parents to recognize the song of the lark. They should have many opportunities to observe and predict, to infer and to classify. They should come to enjoy science as a process of learning about their world.

Science Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing and mathematics skills should be emphasized as integral to the instruction of science. Technology issues and the nature of science are significant components of this Core. Personal relevance of science in students' lives is always an important part of helping students to value science and should be emphasized at this grade-level.

This Core was designed using the American Association for the Advancement of Science's Project 2061: Benchmarks For Science Literacy and the National Academy of Science's National Science Education Standards as guides to determine appropriate content and skills.

The fourth grade Science Core has three online resources designed to help with classroom instruction; they include Teacher Resource Book –a set of lesson plans, assessment items and science information specific to fourth grade; the Sci-ber Text –an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the fourth grade Science Core. These resources are all available on the Utah Science Home Page. http://www.usoe.k12.ut.us/curr/science

SAFETY PRECAUTIONS:
The hands–on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Fourth Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of fourth grade students will be able to:

1. **Use Science Process and Thinking Skills**
   a. Observe simple objects and patterns and report their observations.
   b. Sort and sequence data according to a given criterion.
   c. Make simple predictions and inferences based upon observations.
   d. Compare things and events.
   e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
   f. Conduct a simple investigation when given directions.
   g. Develop and use simple classification systems.
   h. Use observations to construct a reasonable explanation.

2. **Manifest Scientific Attitudes and Interests**
   a. Demonstrate a sense of curiosity about nature.
   b. Voluntarily read or look at books and other materials about science.
   c. Pose questions about objects, events, and processes.

3. **Understand Science Concepts and Principles**
   a. Know science information specified for their grade level.
   b. Distinguish between examples and non-examples of science concepts taught.
   c. Explain science concepts and principles using their own words and explanations.

4. **Communicate Effectively Using Science Language and Reasoning**
   a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
   b. Report observation with pictures, sentences, and models.
   c. Use scientific language appropriate to grade level in oral and written communication.
   d. Use available reference sources to obtain information.

Science Benchmark

Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on Earth.

STANDARD I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation and condensation of water on Earth.

a. Identify the relative amount and kind of water found in various locations on Earth (e.g., oceans have most of the water, glaciers and snowfields contain most fresh water).
b. Identify the sun as the source of energy that evaporates water from the surface of Earth.
c. Compare the processes of evaporation and condensation of water.
d. Investigate and record temperature data to show the effects of heat energy on changing the states of water.

Objective 2: Describe the water cycle.

a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).
b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.
c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).
d. Construct a model or diagram to show how water continuously moves through the water cycle over time.
e. Describe how the water cycle relates to the water supply in your community.

Science language students should use:	vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

Science Benchmark

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

STANDARD II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Objective 1: Observe, measure, and record the basic elements of weather.

a. Identify basic cloud types (i.e., cumulus, cirrus, stratus clouds).
b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).
c. Investigate evidence that air is a substance (e.g., takes up space, moves as wind, temperature can be measured).
d. Compare the components of severe weather phenomena to normal weather conditions (e.g., thunderstorm with lightning and high winds compared to rainstorm with rain showers and breezes).

Objective 2: Interpret recorded weather data for simple patterns.

a. Observe and record effects of air temperature on precipitation (e.g., below freezing results in snow, above freezing results in rain).
b. Graph recorded data to show daily and seasonal patterns in weather.
c. Infer relationships between wind and weather change (e.g., windy days often precede changes in the weather; south winds in Utah often precede a cold front coming from the north).

Objective 3: Evaluate weather predictions based upon observational data.

a. Identify and use the tools of a meteorologist (e.g., measure rainfall using rain gauge, measure air pressure using barometer, measure temperature using a thermometer).
b. Describe how weather and forecasts affect people's lives.
c. Predict weather and justify prediction with observable evidence.
d. Evaluate the accuracy of student and professional weather forecasts.
e. Relate weather forecast accuracy to evidence or tools used to make the forecast (e.g., feels like rain vs. barometer is dropping).

Science language students should use:	atmosphere, meteorologist, freezing, cumulus, stratus, cirrus, air pressure, thermometer, air temperature, wind speed, forecast, severe, phenomena, precipitation, seasonal, accuracy, barometer, rain gauge, components

Science Benchmark

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

STANDARD III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 1: Identify basic properties of minerals and rocks.

a. Describe the differences between minerals and rocks.
b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.
c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary–rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous–with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic –crystals/minerals, often in layers).
d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

Objective 2: Explain how the processes of weathering and erosion change and move materials that become soil.

a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).
b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).
c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).
d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

a. Observe and list the components of soil (i.e., minerals, rocks, air, water, living and dead organisms) and distinguish between the living, nonliving, and once living components of soil.
b. Diagram or model a soil profile showing topsoil, subsoil, and bedrock, and how the layers differ in composition.
c. Relate the components of soils to the growth of plants in soil (e.g., mineral nutrients, water).
d. Explain how plants may help control the erosion of soil.
e. Research and investigate ways to provide mineral nutrients for plants to grow without soil (e.g., grow plants in wet towels, grow plants in wet gravel, grow plants in water).

Science language students should use:	mineral, weathering, erosion, sedimentary, igneous, metamorphic, topsoil, subsoil, bedrock, organism, freeze, thaw, profile, nonliving, structural support, nutrients

Science Benchmark

Fossils are evidence of living organisms from the past and are usually preserved in sedimentary rocks. A fossil may be an impression left in sediments, the preserved remains of an organism, or a trace mark showing that an organism once existed. Fossils are usually made from the hard parts of an organism because soft parts decay quickly. Fossils provide clues to Earth's history. They provide evidence that can be used to make inferences about past environments. Fossils can be compared to one another, to living organisms, and to organisms that lived long ago.

STANDARD IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Objective 1: Describe Utah fossils and explain how they were formed.

a. Identify features of fossils that can be used to compare them to living organisms that are familiar (e.g., shape, size and structure of skeleton, patterns of leaves).
b. Describe three ways fossils are formed in sedimentary rock (i.e., preserved organisms, mineral replacement of organisms, impressions or tracks).
c. Research locations where fossils are found in Utah and construct a simple fossil map.

Objective 2: Explain how fossils can be used to make inferences about past life, climate, geology, and environments.

a. Explain why fossils are usually found in sedimentary rock.
b. Based on the fossils found in various locations, infer how Utah environments have changed over time (e.g., trilobite fossils indicate that Millard County was once covered by a large shallow ocean; dinosaur fossils and coal indicate that Emery and Uintah County were once tropical and swampy).
c. Research information on two scientific explanations for the extinction of dinosaurs and other prehistoric organisms.
d. Formulate questions that can be answered using information gathered on the extinction of dinosaurs.

Science language students should use:	infer, environments, climate, dinosaur, preserved, extinct, extinction, impression, fossil, prehistoric, mineral, organism, replacement, trilobite, sedimentary, tropical

Science Benchmark

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 1: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah's wetlands, forests, and deserts.
b. Describe Utah's wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment) forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided an environment where plants needing little water are a major feature of the environment).
c. Locate examples of areas that have characteristics of wetlands, forests, or deserts in Utah.
d. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.
e. Create models of wetlands, forests, and deserts.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

a. Identify common plants and animals that inhabit Utah's forests, wetlands, and deserts.
b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).
c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).
d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.
e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

Objective 3: Use a simple scheme to classify Utah plants and animals.

a. Explain how scientists use classification schemes.
b. Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

Objective 4: Observe and record the behavior of Utah animals.

a. Observe and record the behavior of birds (e.g., caring for young, obtaining food, surviving winter).
b. Describe how the behavior and adaptations of Utah mammals help them survive winter (e.g., obtaining food, building homes, hibernation, migration).
c. Research and report on the behavior of a species of Utah fish (e.g., feeding on the bottom or surface, time of year and movement of fish to spawn, types of food and how it is obtained).
d. Compare the structure and behavior of Utah amphibians and reptiles.
e. Use simple classification schemes to sort Utah's common insects and spiders.

Science language students should use:	wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration
Common plants:	sagebrush, pinyon pine, Utah juniper, spruce, fir, oak brush, quaking aspen, cottonwood, cattail, bulrush, prickly pear cactus
Common animals:	jackrabbit, cottontail rabbit, red fox, coyote, mule deer, elk, moose, cougar, bobcat, deer mouse, kangaroo rat, muskrat, beaver, gopher snake, rattlesnake, lizard, tortoise, frog, salamander, red–tailed hawk, barn owl, lark, robin, pinyon jay, magpie, crow, trout, catfish, carp, grasshopper, ant, moth, butterfly, housefly, bee, wasp, pill bug, millipede