

TRB³

Elementary Science Teacher Resource Book

A PROFESSIONAL DEVELOPMENT
RESOURCE FOR TEACHING
CORE CURRICULUM

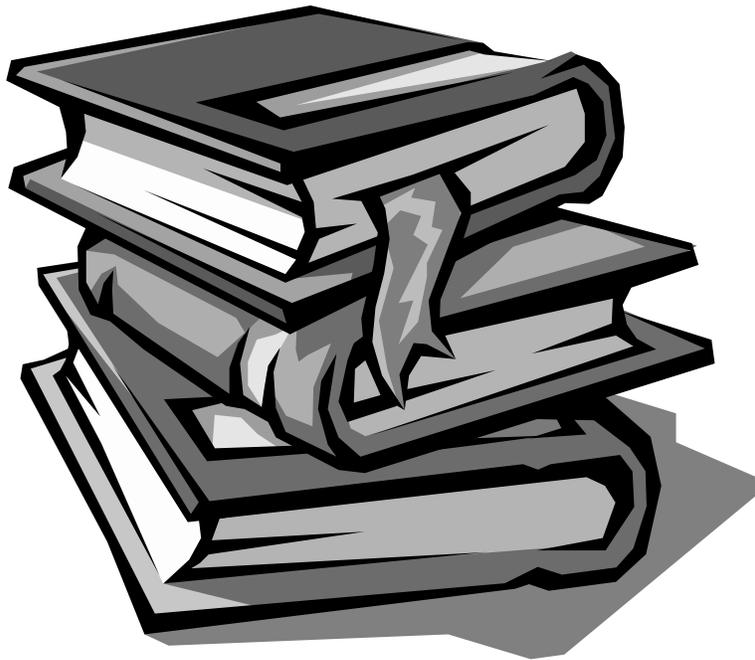
GRADE 6

LITERACY -- STRATEGIES – ASSESSMENT

Utah State Office of Education

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3. Sixth Grade Science Core Curriculum



Sixth Grade Science Core Curriculum

The theme for Sixth Grade Science is Scale, with Relative Position as an underlying concept. Sixth graders should begin to relate to the incredible size and distance of objects in the solar system, galaxy, and universe, as well as compare their world to the minuscule scale of microorganisms. Students will also understand how relative position affects such events as the appearance of the moon and the changing of the seasons. Students will experiment with heat, light, and sound, and begin to understand concepts of energy.

Students should begin to design and perform experiments and value inquiry as the fundamental scientific process. They should be encouraged to maintain an open and questioning mind as they plan and conduct experiments. They should be helped and encouraged to pose their own questions about objects, events, processes, and results. They should have the opportunity to plan and conduct their own experiments, and come to their own conclusions as they read, observe, compare, describe, infer, and draw conclusions. The results of their experiments need to be compared for reasonableness to multiple sources of information. It is important for students at this age to begin to formalize the processes of science and be able to identify the variables in a formal experiment.

Good science instruction requires hands-on science investigations in which student inquiry is an important goal. Teachers should provide opportunities for all students to experience many things. Sixth graders should experience the excitement to locating the North Star and Little Dipper, and the wonders of gazing into the night sky. They should find the fascination of peering into the world of microorganisms, experimenting and watching them as they move and feed and reproduce. Students should come to enjoy science as a process of discovering the natural world.

Science Core concepts should be integrated with concepts 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 theme of the sixth grade Science Core Curriculum is *Scale with Relative Position*.



The sixth 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 sixth grade; Sci-ber Text – an electronic science textbook 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 sixth grade Science Core. These resources are all available on the Utah Science Home Page at <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. Proper handling and disposal of microorganisms is crucial for a safe classroom. 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.

Science Benchmark:

The appearance of the lighted portion of the moon changes in a predictable cycle as result of the relative positions of Earth, the moon, and the sun.

STANDARD I

Students will understand that the appearance of the moon changes in a predictable cycle as it orbits Earth and as Earth rotates on its axis.

STANDARD I: Students will understand that the appearance of the moon changes in a predictable cycle as it orbits Earth and as Earth rotates on its axis.

Objective 1: Explain patterns of changes in the appearance of the moon as it orbits Earth.

- a. Describe changes in the appearance of the moon during a month.
- b. Identify the pattern of change in the moon's appearance.
- c. Use observable evidence to explain the movement of the moon around Earth in relationship to Earth turning on its axis and the position of the moon changing in the sky.
- d. Design an investigation, construct a chart, and collect data depicting the phases of the moon.

Objective 2: Demonstrate how the relative positions of Earth, the moon, and the Sun create the appearance of the moon's phases.

- a. Identify the difference between the motion of an object rotating on its axis and an object revolving in orbit.
- b. Compare how objects in the sky (the moon, planets, stars) change in relative position over the course of the day or night.
- c. Model the movement and relative positions of Earth, the moon, and the Sun.

Science language students should use:

axis of rotation, orbits, phases of the moon, revolution, reflection

Science Benchmark:

Earth turns on an axis that is tilted relative to the plane of Earth's yearly orbit. The tilt causes sunlight to fall more intensely on different parts of the Earth during various parts of the year. The differences in heating of Earth's surface and length of daylight hours produce the seasons.

STANDARD II

Students will understand how Earth's tilt on its axis changes the length of daylight and creates the seasons.

STANDARD I: Students will understand how Earth's tilt on its axis changes the length of daylight and creates the seasons.

Objective 1: Describe the relationship between the tilt of Earth's axis and its yearly orbit around the sun.

- a. Describe the yearly revolution (orbit) of Earth around the sun.
- b. Explain the Earth's axis is tilted relative to its yearly orbit around the sun.
- c. Investigate the relationship between the amount of heat absorbed and the angle to the light source.

Objective 2: Explain how the relationship between the tilt of Earth's axis and its yearly orbit around the sun produces the seasons.

- a. Compare Earth's position in relationship to the sun during each season.
- b. Compare the hours of daylight and illustrate the angle that the sun's rays strike the surface of Earth during summer, fall, winter, and spring in the Northern Hemisphere.
- c. Use collected data to compare patterns relating to seasonal daylight changes.
- d. Use a drawing and/or model to explain that changes in the angle at which light from the sun strikes Earth, and the length of daylight, determine seasonal differences in the amount of energy received.
- e. Use a model to explain why the seasons are reversed in the Northern and Southern Hemispheres.

Science language students should use:

Earth's tilt, seasons, axis of rotation, orbits, revolution

Science Benchmark:

The solar system consists of planets, moons, and other smaller objects including asteroids and comets that orbit the sun. Planets in the solar system differ in terms of their distance from the sun, number of moons, size, composition, and ability to sustain life. Every object exerts gravitational force on every other object depending on the mass of the objects and the distance between them. The sun's gravitational pull holds Earth and other planets in orbit. Earth's gravitational force holds the moon in orbit.

STANDARD III

Students will understand the relationship and attributes of objects in the solar system.

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Objective 1: Describe and compare the components of the solar system.

- a. Identify the planets in the solar system by name and relative location from the sun.
- b. Using references, compare the physical properties of the planets (e.g., size, solid or gaseous).
- c. Use models and graphs that accurately depict scale to compare the size and distance between objects in the solar system.
- d. Describe the characteristics of comets, asteroids, and meteors.
- e. Research and report on the use of man-made satellites orbiting Earth and various planets.

Objective 2: Describe the use of technology to observe objects in the solar system and relate this to science's understanding of the solar system.

- a. Describe the use of instruments to observe and explore the moon and planets.
- b. Describe the role of computers in understanding the solar system (e.g., collecting and interpreting data from observations, predicting motion of objects, operating space probes).
- c. Relate science's understand of the solar system to the technology used to investigate it.
- d. Find and report on ways technology has been and is being used to investigate the solar system.

Objective 3: Describe the forces that keep objects in orbit in the solar system.

- a. Describe the forces holding Earth in orbit around the sun, and the moon in orbit around Earth.
- b. Relate a celestial object's mass to its gravitational force on other objects.
- c. Identify the role gravity plays in the structure of the solar system.

Science language students should use:

Asteroids, celestial object, comets, planets, satellites, star, distance, force, gravity, gravitational force, mass, scale, solar system, telescope, sun

Science Benchmark:

The sun is one of billions of stars in the Milky Way Galaxy that is one of billions of galaxies in the universe. Scientists use a variety of tools to investigate the nature of stars, galaxies and the universe. Historically, cultures have observed objects in the sky and understood and used them in various ways.

STANDARD IV:

Students will understand the scale of size, distance between objects, movements, and apparent motion (due to Earth's rotation) of objects in the universe and how cultures have understood, related to and used these objects in the night sky.

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Objective 1: Compare the size and distance of objects within the systems in the universe.

- a. Use the speed of light as a measuring standard to describe the relative distances to objects in the universe (e.g., 4.4, light years to Star Alpha Centauri; 0.00002 light years to the sun).
- b. Compare the distances between objects in the solar system.
- c. Compare the size of the Solar System to the size of the Milky Way Galaxy.
- d. Compare the size of the Milky Way Galaxy to the size of the known universe.

Objective 2: Describe the appearance and apparent motion of groups of stars in the night sky relative to Earth how various cultures have understood and used them.

- a. Locate and identify stars that are grouped in patterns in the night sky.
- b. Identify ways people have historically grouped stars in the night sky.
- c. Recognize that stars in a constellation are not all the same distance from Earth.
- d. Relate the seasonal change in the appearance of the night sky to Earth's position.
- e. Describe ways that familiar groups of stars may be used for navigation and calendars.

Science language students should use:

galaxy, constellation, Milky Way Galaxy, speed of light, universe, light years, distance, star, sun.

Science Benchmark:

Microorganisms are those living things that are visible as individual organism only with the aid of magnification. Microorganisms are components of every ecosystem on Earth. Microorganisms range in complexity from single to multi-cellular organisms. Most microorganisms do not cause disease and many are beneficial. Microorganisms require food, water, air, ways to dispose of waste, and an environment in which they can live. Investigation of microorganisms is accomplished by observing organisms using direct observation with the aid of magnification, observation of colonies of these organisms and their waste, and observation of microorganisms' effects on an environment and other organisms.

STANDARD V:

Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

STANDARD V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

Objective 1: Observe and summarize information about microorganisms.

- a. Examine and illustrate size, shape, and structure of organisms found in an environment such as pond water.
- b. Compare characteristics common in observed organisms (e.g., color, movement, appendages, shape) and infer their function (e.g., green color found in organisms that are producers, appendages help movement).
- c. Research and report on a microorganism's requirements (i.e., food, water, air, waste disposal, temperature of environment, reproduction).

Objective 2: Demonstrate the skills needed to plan and conduct an experiment to determine a microorganism's requirements in a specific environment.

- a. Formulate a question about microorganisms.
- b. Develop a hypothesis for a question about microorganisms based on observations and prior knowledge.
- c. Plan and carry out an investigation on microorganisms. (Note: Teacher must examine plan and procedures to ensure the safety of students; for additional information, you may wish to read microbe safety information on Utah Science Home Page).
- d. Display results in an appropriate format (e.g., graphs, tables, diagrams).
- e. Prepare a written summary or conclusion to describe the results in terms of the hypothesis for the investigation on microorganisms.

Objective3: Identify positive and negative effects of microorganisms and how science has developed positive uses for some microorganisms and overcome the negative effects of others.

- a. Describe in writing how microorganisms serve as decomposers in the environment.
- b. Identify how microorganisms are used as food or in the production of food (e.g., yeast helps bread rise, fungi flavor cheese, algae are used in ice cream, bacteria are used to make cheese and yogurt).
- c. Identify helpful uses of microorganisms (e.g., clean up oil spills, purify water, digest food in digestive tract, antibiotics) and the role of science in the development of understanding that led to positive uses (i.e., Pasteur established the existence, growth, and control of bacteria; Fleming isolated and developed Penicillin).
- d. Relate several diseases caused by microorganisms to the organism causing the disease (e.g., athlete's foot-fungi, streptococcus throat – bacteria, giardia – protozoa).
- e. Observe and report on microorganisms; harmful effects on food (e.g., causes fruits and vegetables to rot, destroys food-bearing plants, makes milk sour).

Science language students should use:

algae, fungi, microorganism, decomposer, single-celled, organism, bacteria, protozoan, producer, hypothesis, experiment, investigation, variable, control, culture

Science Benchmark:

Heat, light, and sound are all forms of energy. Heat can be transferred by radiation, conduction and convection. Visible light can be produced, reflected, refracted, and separated into light of various colors. Sound is created by vibration and cannot travel through a vacuum. Pitch is determined by the vibration rate of the sound source.

STANDARD VI: Students will understand properties and behavior of heat, light, and sound.**STANDARD VI:**

Students will understand properties and behavior of heat, light, and sound.

Objective 1: Investigate the movement of heat between objects by conduction, convection, and radiation.

- a. Compare materials that conduct heat to materials that insulate the transfer of heat energy.
- b. Describe the movement of heat from warmer objects to cooler objects by conduction and convection.
- c. Describe the movement of heat across space from the sun to Earth by radiation.
- d. Observe and describe, with the use of models, heat energy being transferred through a fluid medium (liquid and/or gas) by convection currents.
- e. Design and conduct an investigation on the movement of heat energy.

Objective 2: Describe how light can be produced, reflected, refracted, and separated into visible light of various colors.

- a. Compare light from various sources (e.g., intensity, direction, color).
- b. Compare the reflection of light from various surfaces (e.g., loss of light, angle or reflection, reflected color).
- c. Investigate and describe the refraction of light passing through various materials (e.g., prisms, water).
- d. Predict and test the behavior of light interacting with various fluids (e.g., light transmission through fluids, refraction of light).
- e. Predict and test the appearance of various materials when light of different colors is shone on the materials.

Objective 3: Describe the production of sound in terms of vibration of objects that create vibrations in other materials.

- a. Describe how sound is made from vibration and moves in all directions from the source in waves.
- b. Explain the relationship of the size and shape of a vibrating object to the pitch of the sound produced
- c. Relate the volume of a sound to the amount of energy used to create the vibration of the object producing the sound.
- d. Make a musical instrument and report on how it produces sound.

Science language students should use:

angle of incidence, angle of reflection, absorption, conduction, conductor, convection, medium, pitch, prism, radiation, reflection, refraction, spectrum, vibration.