Grade 2 Science, Quarter 1, Unit 1.1

Weather

Overview

Number of instructional days: 8 (1 day = 40 minutes)

Content to be learned

- Use scientific tools to extend senses and gather data about weather.
- Observe and record seasonal changes throughout the school year.
- Explain how the use of scientific tools helps to extend senses and gather data about weather.

Science processes to be integrated

- Demonstrate and explain the use of scientific tools.
- Collect data using scientific tools.
- Observe and record changes that occur over time.

Essential questions

- How do scientific tools help to extend our senses?
- How do scientific tools help us gather data about weather?
- What seasonal changes can be observed throughout the year?

Written Curriculum

Grade-Span Expectations

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS 1 (K-4) NOS–3
Explain how the use of scientific tools helps to extend senses and gather data about weather. (i.e., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches).

ESS 1(K-2)–3 Students demonstrate an understanding of how the use of scientific tools helps to extend senses and gather data by…

3a using scientific tools to extend senses and gather data about weather (e.g., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches).

ESS1 (K-4) INQ+SAE–4
Explain how wind, water, or ice shape and reshape the earth.

ESS1 (K-2)–4 Students demonstrate an understanding of processes and change over time within earth systems by …

4a observing and recording seasonal and weather changes throughout the school year.

Clarifying the Standards

Prior Learning

Students in grades K–1 used scientific tools to extend senses and gather data about weather (e.g., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers: snow depth; rain gauges: rain amount in inches). Students observed, recorded, and summarized local weather data, and they observed and recorded seasonal and weather changes throughout the school year. Students also identified the sun as a source of heat energy, and described that the sun warms land and water. They demonstrated when a shadow will be created using sunny versus cloudy days, and observed how clouds are related to forms of precipitation (e.g., rain, sleet, snow).

Current Learning

Students in grade 2 use scientific tools to extend senses and gather data about weather (e.g., weather/wind vane: direction; wind sock: wind intensity; anemometer: speed; thermometer: temperature; meter sticks/rulers; snow depth; rain gauges: rain amount in inches). They also observe and record seasonal and weather changes throughout the school year. These concepts should be taught at a reinforcement level of instruction, since students have prior experience with these concepts. Students will also demonstrate and explain the use of scientific tools. This should be taught at a developmental level of instruction.

During this unit, students should have multiple opportunities to measure wind direction, intensity, and speed, temperature, and depth of snow/rain in inches. Students will use tools to observe and gather data, and will graph their findings. Students at this grade level are more proficient in collecting and recording data; however, the names of weather tools and instruments, as well as reading these tools may present a challenge for second graders. A visual reference for each tool should be available to students throughout the unit. In addition, students should be given opportunities throughout the school year to continue to collect weather data as they observe and describe weather and seasonal changes over time.

During this unit of study, students can

- Draw a daily weather picture based on their observations and data.
- Make simple charts and graphs from data collected (temperature, cloud cover, wind speed, wind direction, wind intensity).
- Keep a journal of weather data, and periodically examine and document patterns of change that are observed in the data.
- Set up and maintain a simple school weather station.
- Have discussions about what is observed outside of the classroom windows.

Future Learning

In grade 3, students will select appropriate tools for a given task and describe the information they will provide, and will also explain how the use of scientific tools helps to extend senses and gather data about weather. They will observe, record, compare and analyze weather data to describe weather changes or weather patterns. Students will describe water as it changes into vapor in the air and reappears as a liquid when it's cooled, and will explain how the water cycle relates to weather and the formation of clouds.

When students move to grade 4, their learning will no longer focus on weather, but on the bigger idea of earth processes that shape the surface of the earth. They will identify air and water as two of the four basic earth materials, and will investigate how wind, water, or ice have shaped and reshaped local landforms. Students will also conduct investigations and use observational data to describe how water moves rocks and soils, and they will use or build models to simulate the effects of how wind and water shape and reshape the land.

Additional Findings

Young children are naturally interested in everything around them—soil, rocks, streams, rain, snow, clouds, rainbows, sun, moon, and stars. During the first years of school, they should be encouraged to observe closely the objects and materials in their environment, note their properties, distinguish one from another and develop their own explanations of how things become the way they are. As children become more familiar with their world, they can be guided to observe changes, including cyclic changes, such as the seasons, predictable trends, such as growth and decay, and less consistent changes, such as weather. Children should have opportunities to observe rapid changes, such as daily weather, as well as gradual changes, such as the change of the seasons (*National Science Education Standards*, p. 130).

Students can discover patterns of weather changes during the year by keeping a journal. Younger students can draw a daily weather picture based on what they see out a window or at recess; older students can make simple charts and graphs from data they collect at a simple school weather station. Emphasis in grades K–4 should be on developing observation and description skills and the explanations based on

observations. Students should know that weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction, wind speed, and precipitation (*NSES*, p. 130).

An integrated picture of the earth has to develop over many years, with some concepts being visited over and over again in new contexts and greater detail. Perhaps the most important reason for students to study the earth repeatedly is that they take years to acquire the knowledge that they need to complete the picture. Understanding such concepts as the water cycle, temperature, gravity, states of matter, and energy transfer grows slowly as children mature and encounter them in different contexts. There are many ways to acquaint primary students with earth-related phenomena that they will come to understand as being cyclic. For instance, students can start to keep daily records of temperature (hot, cold, pleasant) and precipitation (none, some, lots), and plot them by week, month, and year. It is enough for students to spot the pattern of ups and downs, without getting deeply into the nature of climate (*Benchmarks for Science Literacy,* pp. 66-67).

The subject of heat is one of the most confused in science. The source of this confusion centers on the use of words such as *heat*, *heat flow*, and *heat capacity*. In addition, distinguishing between the concepts of heat and temperature is one of the most difficult tasks for children. Students view temperature of an object as a property of that object seeing it as related to its size, volume, or the amount of stuff present instead of as a means to measuring heat energy. This idea is difficult to teach because both heat and temperature are abstract concepts. Some strategies to help students overcome this challenge is to convey that heat is hot, but temperature can be hot or cold, and that temperature is a means of measuring heat energy (*Making Sense of Secondary Science,* p. 139).

Grade 2 Science, Quarter 1, Unit 1.2

Sun, Moon, and Stars

Overview

Number of instructional days: 5 (1 day = 40 minutes)

Content to be learned

- Observe that the sun and moon appear to move slowly across the sky.
- Observe that the moon looks slightly different from day to day.
- Observe that there are more stars in the sky than can easily be counted.
- Observe that stars are not scattered evenly and are not all the same brightness.

Science processes to be integrated

- Make and record observations.
- Use observations to describe the characteristics of objects.
- Use observations to describe how an object's position and/or shape appear to change over time.

Essential questions

- How does the sun appear to change over time?
- How does the moon appear to change over time?
- What characteristics of stars have you observed?

Written Curriculum

Grade-Span Expectations

ESS2 - The earth is part of a solar system, made up of distinct parts that have temporal and spatial interrelationships.

No further targets for EK ESS2 at the K-4 Grade Span

ESS2 (K-2)–7 Students demonstrate an understanding of temporal or positional relationships between or among the Earth, sun, and moon by …

7b observing that the sun and moon appear to move slowly across the sky.

7c observing that the moon looks slightly different from day to day.

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.

No further targets for EK ESS3 at the K-4 Grade Span

The GSEs listed below are assessed at the local level only

ESS3 (K-2)–9 Students demonstrate understanding of processes and change over time within the system of the universe (Scale, Distances, Star Formation, Theories, Instrumentation) by…

9a observing that there are more stars in the sky than can easily be counted, but they are not scattered evenly and not all the same in brightness.

Clarifying the Standards

Prior Learning

Kindergarten students observed that the sun can be seen only in the daytime, but the moon can be seen sometimes at night and sometimes during the day, and they identified the sun as a source of heat energy.

In first grade, students observed that the sun can only be seen in the daytime, but the moon can be seen sometimes at night and sometimes during the day. They observed that the sun and moon appear to move slowly across the sky, and that the moon looks slightly different from day to day. Students identified the sun as a source of heat energy, described that the sun warms land and water, and demonstrated when a shadow is created on sunny versus cloudy days.

Current Learning

At the reinforcement level of instruction, students in second grade observe that the moon looks slightly different from day to day, and that the sun and moon appear to move slowly across the sky. Students will need opportunities to observe the sun's position in the sky at various times of the day (e.g., morning, lunch time, afternoon) for at least 3–4 days, in order to observe and describe this pattern of change.

At the developmental level of instruction, second-graders observe that there are more stars in the sky than they are able to count, that stars are not scattered evenly, and that they vary in brightness. Students will

need opportunities to observe and draw the night sky, which will require that students make and record observations at home. Teachers should prepare a packet with directions and recording sheets for students to take home. These recording sheets should provide students the opportunity to draw pictures and record descriptions of visible stars, to include differences in brightness and in how the stars are scattered unevenly across the night sky.

As students are making observations of the stars in the nighttime sky, they should also observe and record data about the appearance and apparent motion of the moon. Students can use a recording sheet or a journal in which they record and illustrate the appearance of the moon over time. Back in class, students share their journal entries during class discussions, and teachers can use visual representations and pictures that show the different phases of the moon.

Future Learning

In grade 3, students will observe that the sun, moon, and stars appear to move slowly across the sky. They will observe that the appearance of the moon looks slightly different from day to day, but looks the same again in about four weeks. Students will also recognize that throughout history, people have identified patterns of stars that we call constellations.

Students in grade 4 will observe that the moon looks slightly different from day to day, but looks the same again in about four weeks. They will recognize that the day/night cycle is a result of the earth rotating on its axis every 24 hours, and that it takes approximately 365 days for the earth to orbit the sun. Students will recognize that the sun is the center of our solar system, that the earth is one of several planets that orbits the sun, and that the moon orbits the earth.

Additional Findings

As children become more familiar with their world, they can be guided to observe changes, including cyclical changes, such as night and day. Observing the day and night sky regularly will help children learn to identify sequences of change and to look for patterns in these changes. As they observe changes, such as the position of the sun and moon, they will find patterns in these movements. They can draw the moon's shape over the course of a few weeks, and then determine the pattern in the shapes. Students' understandings about objects in the sky should be confined to observations, descriptions, and finding patterns. Using models is less effective due to the inability of young children to understand that the earth is approximately spherical. They also have little understanding of gravity and usually have misconceptions about the properties of light that allow us to see objects such as the moon. Therefore, emphasis in grades K–4 should be on developing observation and description skills and the explanations based on observations. Younger children should be encouraged to draw what they see and think. Fundamental concepts for this unit include that objects in the sky have patterns of movement. The sun appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The moon also appears to move across the sky on a daily basis, much like the sun. The observable shape of the moon changes from day to day in a cycle that can be observed and described (*National Science Education Standards*, pp. 130, 134).

During the primary years, learning about objects in the sky should be entirely observational and qualitative, since young students are far from ready to understand the magnitudes (size, distance, time) involved, or to make sense out of explanations. The priority should be to get students to notice and describe what the sky looks like at different times. It is too soon to name the phases of the moon, and much too soon to explain them. By the end of second grade, students should know that there are more stars in the sky that anyone can easily count, they are not scattered evenly, and not all the same brightness or color. The sun can only be seen in the daytime but the moon can be seen sometimes at night and

sometimes during the day. The sun, moon, and stars all appear to move slowly across the sky (*Benchmarks for Science Literacy*, p. 62).

Making Sense of Secondary Science states that although some students may be able to use correct scientific terms in their explanations of why it gets dark at night, they usually don't have a correct view of what is happening. They will hold on to misconceptions, such as the sun gets covered (by clouds or the moon) or that the earth goes around the sun to cause night. They often have an unclear view of the earth's rotation on its axis (pp. 168–171).

Notes About Resources and Materials

The following are suggested books and DVDs to be used with this unit.

Books

- Aldrin, B. (2005). *Reaching for the Moon*. New York: Harper Collins.
- Branley, F.M. (1987). *The Moon Seems to Change*. New York: Harper Collins.
- Branley, F.M. (2000). *What the Moon is Like*. New York: Harper Collins.
- Gibbons, Gail. (1992). *Stargazers*. New York: Holiday House.
- Graham, I. (1999). *The Best Book of the Moon*. Boston: Houghton Mifflin.
- Graham, I. (2003). *You Wouldn't Want to Be on Apollo 13!* New York: Scholastic.
- Knudsen, S. (2003). *Neil Armstrong*. Minneapolis, MN: Lerner Publishing Group.
- Love, A. (2004). *The Kids Book of the Night Sky*. Tonawanda, NY: Kids Can Press.
- McDermott, G. (1986). *Anansi the Spider: A Tale from the Ashanti*. New York: Macmillan.
- McNulty, F. (2005). *If You Decide to Go to the Moon*. New York: Scholastic.
- Moore, P. (1995). *The Sun and Moon*. Glens Falls, NY: Red Fox Books.
- Rau, D.M. (2003). *Moon*. Mankato, MN: Capstone.
- Rau, D.M. (2006). *Spots of Light: A Book About Stars*. Mankato, MN: Capstone.
- Sanfield, S. (1996). *Just Rewards, or Who is that Man in the Moon and What's He Doing Up There Anyway?* New York: Orchard Books.
- Sipiera, D.M. (1997). *Project Apollo*. New York: Scholastic.
- Sly, A. (2001). *Footprints on the Moon*. Watertown, MA: Charlesbridge Publishing.

DVDs

- McDermott, G. *Anansi*. Norwalk, CT: Rabbit Ears Entertainment.
- National Geographic Society. (1982). *Reflecting on the Moon*. Washington D.C.
- National Geographic Society. (1995). *Sun, Earth, Moon*. Washington D.C.

Grade 2 Science, Quarter 1, Unit 1.3

Light and Sound

Overview

Number of instructional days: 8 (1 day = 40 minutes)

Content to be learned

- Describe observable effects of light using a variety of light sources.
- Experiment and describe how vibrating objects make sound.
- Given a specific example or illustration, predict the observable effects of energy (light and sound).

Science processes to be integrated

- Conduct experiments.
- Make and record observations in order to describe changes that occur.
- Make predictions about the effects of energy on objects.

Essential questions

- What similarities and differences do you observe about light from different sources?
- How is sound created?

Written Curriculum

Grade-Span Expectations

PS 2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (K-4) SAE -4

Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together), predict the observable effects of energy (i.e., light bulb lights, a bell rings, hands warm up (e.g., a test item might ask, "what will happen when…?").

PS2 (K-2)-4 Students demonstrate an understanding of energy by…

4a describing observable effects of light using a variety of light sources**.**

4b experimenting and describe how vibrating objects make sound (e.g., guitar strings, seeing salt bounce on a drum skin).

Clarifying the Standards

Prior Learning

In kindergarten and first grade, students demonstrated when shadows are created, and identified the sun as a source of heat energy. First-graders also recognized that the sun warms land and water, and described that objects change in temperature when heat is added.

Current Learning

In this unit of study, student learning at grade 2 will focus on light and sound energy. At the developmental level of instruction, students describe the observable effects of light, using a variety of light sources. Students need opportunities to experiment with natural and man-made light sources in order to observe how light interacts with objects. Teachers can provide groups of students with light sources, such as flashlights, penlights, lamps, and sunlight, and objects, such as foil, wax paper, laminating film, cardboard, and mirrors, in order to investigate how light interacts with those objects. Students should observe that light can pass through objects that are transparent; light is allowed to partially pass through objects that are translucent, and is blocked by objects that are opaque. In addition, translucent objects cause a partial shadow to be created, while opaque objects create a complete shadow.

Also at the developmental level of instruction, students describe how vibrating objects make sound by experimenting with stringed instruments, elastic objects, tuning forks, glass bottles, rulers, and any other objects that can be made to vibrate. Teachers can set up different stations for exploring sound. These stations can include:

- Using two or three differently sized tuning forks, students can explore the similarities and differences between the sounds they make. They can observe what happens when their vibrating tuning fork comes into contact with a desk, water, or air. They should also observe how the sound changes when the tuning fork is tapped softly or more forcefully.

- Using different size rubber bands, students can wrap the bands tightly or loosely around a variety of boxes or cans, and then pluck the rubber bands. They should observe and describe the differences they notice in the sounds produced by the different sized rubber bands.

- Using rulers made out of various materials (plastic, wooden, rubber, and metal), students will discover how changing the placement of these rulers on the table affects the sound produced when the ruler is plucked or tapped.

A class discussion of the results can help students understand that vibrating objects make sound and that pitch and volume can be changed.

Future Learning

In grade 3, student learning will focus on sound and heat energy. They will experiment to identify and classify different pitches and volumes of sounds produced by different objects. They will use data to explain what causes sound to have different pitch or volume, and they will use experimental data to classify a variety of materials as conductors or insulators. Students will make logical predictions about the changes in state of matter when adding or taking away heat. They will describe how heat moves from warm objects to cold objects until both objects are the same temperature, and will show that heat moves from one object to another, causing a change in temperature.

Student learning in grade 4 will focus on light, electrical, and heat energy. Students will investigate observable effects of light using a variety of light sources, and they will predict, describe, and investigate how light rays are reflected, refracted, or absorbed. They will draw, diagram, build, and explain a complete electrical circuit, and will use experimental data to classify a variety of materials as conductors or insulators. Students will describe or show that heat can be produced in many ways, and will make logical predictions about the changes in state of matter when adding or taking away heat.

Additional Findings

Young children have a difficult time understanding a complex concept such as energy. They have intuitive notions of energy—for example, energy is needed to get things done; humans get energy from food, and teachers should build on the intuitive notions of students. By experimenting with light, heat, and sound, students can begin to understand that energy can be observed, measured, and controlled without requiring them to memorize technical definitions. (*National Science Education Standards*, p. 126).

Energy is a mysterious concept even though its various forms can be precisely defined and measured. People in general are likely to think of energy as a substance, with flow and conservation analogous to that of matter. Although learning about energy does not make it much less mysterious, it is worth trying to understand because a wide variety of scientific explanations are difficult to follow without some knowledge of the concept of energy. Energy is a major exception to the principle that students should understand ideas before being given labels for them. Children benefit from talking about energy before they are able to define it. At the simplest level, children can think of energy as something needed to make things go, run, or happen (*Benchmarks for Science Literacy*, p. 81).

Students will most likely make music from the first day in school, and this provides an opportunity to introduce vibrations as a phenomenon that can be observed. With drums, bells, stringed instruments, and their own voices, students can feel vibrations as they hear sounds. These experiences help students know that things that make sound vibrate (*Benchmarks,* p. 89).

Making Sense of Secondary Science states that the scientific concept of energy is above the developmental level of grade 2 students. Second-graders tend to describe energy in terms of force (or drive), using ideas they have gained from their everyday experiences. Children often believe fuel 'contains' or is 'a source of' energy (pp. 143–147).

Notes About Resources and Materials

Websites

- www.primaryresources.co.uk/science/science4c.htm
- www.teachingideas.co.uk/science/contents_lightandsound.htm

Literature

- *All About Light*, by Melvin Berger
- *Discover Light and Sound*, by Francis Reddy
- *What Do You See & How Do You See It? Exploring Light, Color and Vision*, by Patricia Lauber
- *All About Sound*, by David C. Knight
- *The Magic of Sound*, by Larry Kettelkamp

Videos

- The Magic School Bus gets a Bright Idea
- The Magic School Bus in the Haunted House