Science Standard-Specific Supports

Kindergarten

Revised October 2022

Contents

Science Standard-Specific Supports

Overview

The West Virginia College- and Career-Readiness Standards for Science[1] identify what students should know and be able to do at the end of science instruction. Each standard represents the integration of three "dimensions" of science education: practices of scientists and engineers, core science content, and science connecting concepts. As such, both student learning and assessment around the standards should be "three dimensional." The Science Standard-Specific Supports in this document are intended to show what it looks like for students to fully satisfy the intent of the standard.

The Science Standard-Specific Supports are adapted from the Evidence Statements of the Next Generation Science Standards (NGSS)[2], created when West Virginia was a lead state during the NGSS writing process, and the Framework for K-12 Science Instruction[3], created prior to the development of the NGSS. For more information on the Evidence Statements, please refer to them in their original form.

Purpose

The Science Standard-Specific Supports were designed to articulate how students can use the practices of scientists and engineers to demonstrate their understanding of the core science content through the lens of the science connecting concepts, and thus, demonstrate proficiency on each standard. The Science Standard-Specific Supports do this by clarifying:

- how the three dimensions could be assessed together, rather than in independent units;
- the underlying knowledge required for each core science content;
- the detailed approaches to the practices of scientists and engineers; and
- how science connecting concepts might be used to deepen content- and practice-driven learning.

The Science Standard-Specific Supports are not intended to be used as curriculum or limit or dictate instruction.

Structure

The practices of scientists and engineers are used as the organizing structure for the Science Standard-Specific Supports. However, this does not mean that the practices are more important than the other dimensions. The practices of scientists and engineers form the activities through which students demonstrate understanding of the science content. The proper integration of the practices makes students' thinking visible.

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[1] *West Virginia College- and Career-Readiness Standards for Science* (Policy 2520.3C) https://apps.sos.wv.gov/adlaw/csr/readfile.aspx?DocId=54673&Format=PDF

[2] NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States.* Washington, DC: The National Academies Press.

[3] National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Washington, DC: The National Academies Press.

How to Use the Science Standard-Specific Supports

- For instruction:
  - The Science Standard-Specific Supports can be used to aid instructional design, but it is crucial to recognize there are numerous pathways educators may use throughout the sequence of lessons and units to allow students to ultimately be prepared to demonstrate mastery of the standards.
- For assessment:
  - The Science Standard-Specific Supports can be used to inform the development of formative and summative assessments by the classroom educator.

Although supports are listed individually for each standard, this does not indicate that they should be measured individually, or that standards should be taught or assessed individually. Best practices in classroom instruction should be focused on helping students build towards several standards at one time because many concepts and practices are interrelated.

Limitations of the Science Standard-Specific Supports

The science standard-specific supports cannot do the following:

- Provide or prescribe the contexts through which the standards may be taught or assessed.
- Be the rubrics on which levels of student success would be measured.
- Identify the sequence of instruction or assessment.
- Put limits on student learning or student coursework.
- Replace lesson plans or assessment items.
- Serve as complete scoring rubrics.

Science - Kindergarten Introduction

The Kindergarten Science standards are designed to engage students in finding answers to questions related to their interests and the world around them. Kindergarten students will engage in active inquiries, investigations, and hands-on activities at least 50% of the instructional time to develop conceptual understanding and research skills described in the standards and indicators for science. Kindergarten domains include Physical Science, Life Science, and Earth and Space Science. Students are expected to demonstrate age-appropriate proficiency in multiple indicators which include asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Engineering, Technology, and the Application of Science are integrated throughout instruction as students define problems and design solutions related to the course standard and indicators for science. Students are expected to use these practices to demonstrate an understanding of the scientific world. Standards followed by an asterisk (*) denote the integration of traditional science content with an engineering practice.

Within the evidence statements, the words “description” or “describe” followed by an asterisk indicate those descriptions given by students could include but are not limited to written, oral, pictorial, and kinesthetic descriptions unless otherwise specified.

College- and Career-Readiness Indicators for Science Grades K-2

<table>
<tr><th colspan="2">College- and Career-Readiness Indicators for Science</th></tr>
<tr><td colspan="2" align="center">Grades K - 2</td></tr>
<tr><th colspan="2">Nature of Science</th></tr>
<tr><td colspan="2">

Scientific knowledge is simultaneously reliable and subject to change based on empirical evidence and interpretation.
Scientific knowledge is obtained through a combination of observations of the natural world and inferences based on those observations.
Science is a creative human endeavor which is influenced by social and cultural biases.
A primary goal of science is the formation of theories and laws. Theories are inferred explanations of some aspect of the natural world based on successfully tested information from evidence and evaluated phenomena. Laws describe relationships among what has been observed in the natural world.
Scientific investigations use a variety of methods to address questions about the natural and material world.

</td></tr>
<tr><th>Practices of Scientists and Engineers</th><th>Science Connecting Concepts</th></tr>
<tr><td>

Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematical and computational thinking
Constructing explanations and designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information

</td><td>

Observing patterns
Investigating and explaining cause and effect
Recognizing scale, proportion, and quantity
Defining systems and system models
Tracking energy and matter flows into, out of, and within systems to understand system behavior
Determining the relationships between structure and function
Studying stability and change

</td></tr>
<tr><th>Science Literacy</th><th>Science Lab Safety</th></tr>
<tr><td>

Utilizing and connecting ideas among informational (factual) scientific texts
Integrating and applying information presented in various media formats when writing and speaking
Citing evidence to support scientific claims
Comparing and contrasting sets of data
Building and appropriately using science domain vocabulary and phrases
Interpreting and applying visually expressed information (e.g., flowchart, diagram, model, graph, or table)

</td><td>

Requiring lab safety training and archiving signed student safety contracts including medical conditions
Wearing proper protective equipment as needed (e.g., goggles, apron, and gloves)
Requiring grade-appropriate lab equipment operation and safety training
Storing and disposing of chemical/biological materials properly
Following ethical classroom use of living organisms

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</table>

Physical Science

Topic: Forces and Interactions: Pushes and Pulls

S.K.1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]

<table>
<tr><td>Practices of Scientists and Engineers</td><td>Core Science Content</td></tr>
<tr><td>Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. With guidance, students will plan and conduct an investigation in collaboration with peers.
Scientific Investigations Use a Variety of Methods
Scientists use different ways to study the world.</td><td rowspan="3">Forces and Motion
Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
Types of Interactions
When objects touch or collide, they push on one another and can change motion.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Cause and Effect
Simple tests can be designed to gather evidence to support or refute student ideas about causes.</td></tr>
</table>

Observable features of the student performance by the end of the course:

1) Identifying the phenomenon to be investigated
   a) With guidance, students collaboratively identify the phenomenon under investigation, which includes the following idea: the effect caused by different strengths and directions of pushes and pulls on the motion of an object.
   b) With guidance, students collaboratively identify the purpose of the investigation, which includes gathering evidence to support or refute student ideas about causes of the phenomenon by comparing the effects of different strengths of pushes and pulls on the motion of an object.
2) Identifying the evidence to address this purpose of the investigation
   a) With guidance, students collaboratively develop an investigation plan to investigate the relationship between the strength and direction of pushes and pulls and the motion of an object (i.e., qualitative measures or expressions of strength and direction; e.g., harder, softer, descriptions* of “which way”).
   b) Students describe* how the observations they make connect to the purpose of the investigation, including how the observations of the effects on object motion allow causal relationships between pushes and pulls and object motion to be determined
   c) Students predict the effect of the push of pull on the motion of the object, based on prior experiences.
3) Planning the investigation
   a) In the collaboratively developed investigation plan, students describe*:
      i) The object whose motion will be investigated.
      ii) What will be in contact with the object to cause the push or pull.
      iii) The relative strengths of the push or pull that will be applied to the object to start or stop its motion or change its speed.
      iv) The relative directions of the push or pull that will be applied to the object.

v) How the motion of the object will be observed and recorded.
vi) How the push or pull will be applied to vary strength or direction.

4) Collecting the data
   a) According to the investigation plan they developed, and with guidance, students collaboratively make observations that would allow them to compare the effect on the motion of the object caused by changes in the strength or direction of the pushes and pulls and record their data.

S.K.2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.]

Practices of Scientists and Engineers	Core Science Content
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Students will analyze data from tests of an object or tool to determine if it works as intended.	Forces and Motion Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
Science Connecting Concepts	
Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.	

Observable features of the student performance by the end of the course:

1) Organizing data
   a) With guidance, students organize given information using graphical or visual displays (e.g., pictures, pictographs, drawings, written observations, tables, charts). The given information students organize includes:
      i) The relative speed or direction of the object before a push or pull is applied (i.e., qualitative measures and expressions of speed and direction; e.g., faster, slower, descriptions* of "which way").
      ii) The relative speed or direction of the object after a push or pull is applied.
      iii) How the relative strength of a push or pull affects the speed or direction of an object (i.e., qualitative measures or expressions of strength; e.g., harder, softer).
2) Identifying relationships
   a) Using their organization of the given information, students describe* relative changes in the speed or direction of the object caused by pushes or pulls from the design solution.
3) Interpreting data
   a) Students describe* the goal of the design solution.
   b) Students describe* their ideas about how the push or pull from the design solution causes the change in the object's motion.
   c) Based on the relationships they observed in the data, students describe* whether the push or pull from the design solution causes the intended change in speed or direction of motion of the object.

Life Science

Topic: Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment

S.K.3. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food, but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Practices of Scientists and Engineers	Core Science Content
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Students will use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. Scientific Knowledge is Based on Empirical Evidence Scientists look for patterns and order when making observations about the world.	Organization for Matter and Energy Flow in Organisms All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.
Science Connecting Concepts	
Patterns Patterns in the natural and human designed world can be observed and used as evidence.	

Observable features of the student performance by the end of the course:

1) Organizing data
   a) With guidance, students organize the given data from observations (firsthand or from media) using graphical displays (e.g., pictures, charts), including:
      i) Different types of animals (including humans).
      ii) Data about the foods different animals eat.
      iii) Data about animals drinking water.
      iv) Data about plants' need for water (e.g., observations of the effects on plants in a classroom or school when they are not watered, observations of natural areas that are very dry).
      v) Data about plants' need for light (e.g., observations of the effect on plants in a classroom when they are kept in the dark for a long time; observations about the presence or absence of plants in very dark places, such as under rocks or porches).
2) Identifying relationships
   a) Students identify patterns in the organized data, including that:
      i) All animals eat food.
         (1) Some animals eat plants.
         (2) Some animals eat other animals.
         (3) Some animals eat both plants and animals.
         (4) No animals do not eat food.
      ii) All animals drink water.
      iii) Plants cannot live or grow if there is no water.
      iv) Plants cannot live or grow if there is no light.
3) Interpreting data
   a) Students describe* that the patterns they identified in the data provide evidence that:
      i) Plants need light and water to live and grow.
      ii) Animals need food and water to live and grow.
      iii) Animals get their food from plants, other animals, or both.

S.K.4. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]

Practices of Scientists and Engineers	Core Science Content
Engaging in Argument from Evidence Engaging in argument from evidence in K– 2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). Students will construct an argument with evidence to support a claim.	Biogeology Plants and animals can change their environment.
Science Connecting Concepts	
Systems and System Models Systems in the natural and designed world have parts that work together.	

Observable features of the student performance by the end of the course:

1) Supported claims
   a) Students make a claim to be supported about a phenomenon. In their claim, students include the idea that plants and animals (including humans) can change the environment to meet their needs.
2) Identifying scientific evidence
   a) Students identify and describe* the given evidence to support the claim, including:
      i) Examples of plants changing their environments (e.g., plant roots lifting sidewalks).
      ii) Examples of animals (including humans) changing their environments (e.g., ants building an ant hill, humans clearing land to build houses, birds building a nest, squirrels digging holes to hide food).
      iii) Examples of plant and animal needs (e.g., shelter, food, room to grow).
3) Evaluating and critiquing evidence
   a) Students describe* how the examples do or do not support the claim.
4) Reasoning and synthesis
   a) Students support the claim and present an argument by logically connecting various needs of plants and animals to evidence about how plants/animals change their environments to meet their needs. Students include:
      i) Examples of how plants affect other parts of their systems by changing their environments to meet their needs (e.g., roots push soil aside as they grow to better absorb water).
      ii) Examples of how animals affect other parts of their systems by changing their environments to meet their needs (e.g., ants, birds, rabbits, and humans use natural materials to build shelter; some animals store food for winter).

S.K.5. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live. [Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight, so they often grow in meadows. Plants, animals, and their surroundings make up a system.]

Practices of Scientists and Engineers	Core Science Content
Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, storyboard) that represent concrete events or design solutions. Students will use a model to represent relationships in the natural world.	Natural Resources Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
Science Connecting Concepts	
Systems and System Models Systems in the natural and designed world have parts that work together.	

Observable features of the student performance by the end of the course:

1) Components of the model
   a) From the given model (e.g., representation, diagram, drawing, physical replica, diorama, dramatization, storyboard) of a phenomenon involving the needs of living things and their environments, students identify and describe* the components that are relevant to their representations, including:
      i) Different plants and animals (including humans).
      ii) The places where the different plants and animals live.
      iii) The things that plants and animals need (e.g., water, air, and land resources such as wood, soil, and rocks).
2) Relationships
   a) Students use the given model to represent and describe* relationships between the components, including:
      i) The relationships between the different plants and animals and the materials they need to survive (e.g., fish need water to swim, deer need buds and leaves to eat, plants need water and sunlight to grow).
      ii) The relationships between places where different plants and animals live and the resources those places provide.
      iii) The relationships between specific plants and animals and where they live (e.g., fish live in water environments, deer live in forests where there are buds and leaves, rabbits live in fields and woods where there is grass to eat and space for burrows for homes, plants live in sunny and moist areas, humans get resources from nature [e.g., building materials from trees to help them live where they want to live]).
3) Connections
   a) Students use the given model to represent and describe*, including:
      i) Students use the given model to describe* the pattern of how the needs of different plants and animals are met by the various places in which they live (e.g., plants need sunlight, so they are found in places that have sunlight; fish swim in water so they live in lakes, rivers, ponds, and oceans; deer eat buds and leaves so they live in the forest).
      ii) Students use the given model to describe* that plants and animals, the places in which they live, and the resources found in those places are each part of a system, and that these parts of systems work together and allow living things to meet their needs.

S.K.6. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.* [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. Students will communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.</td><td rowspan="3">Human Impacts on Earth Systems
Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Cause and Effect
Events have causes that generate observable patterns.</td></tr>
</table>

Observable features of the student performance by the end of the course:

1) Communicating information
   a) Students use prior experiences and observations to describe* information about:
      i) How people affect the land, water, air, and/or other living things in the local environment in positive and negative ways.
      ii) Solutions that reduce the negative effects of humans on the local environment.
   b) Students communicate information about solutions that reduce the negative effects of humans on the local environment, including:
      i) Examples of things that people do to live comfortably and how those things can cause changes to the land, water, air, and/or living things in the local environment.
      ii) Examples of choices that people can make to reduce negative impacts and the effect those choices have on the local environment.
   c) Students communicate the information about solutions with others in oral and/or written form (which include using models and/or drawings).

Earth and Space Science

Topic: Weather and Climate

S.K.7. Use and share observations of local weather conditions to describe patterns over time. [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.]

Practices of Scientists and Engineers	Core Science Content
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Students will use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. **Science Knowledge is Based on Empirical Evidence** Scientists look for patterns and order when making observations about the world	**Weather and Climate** Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
Science Connecting Concepts	
Patterns Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.	

Observable features of the student performance by the end of the course:

1) Organizing data
   a) With guidance, students organize data from given observations (firsthand or from media) about local weather conditions using graphical displays (e.g., pictures, charts). The weather condition data include:
      i) The number of sunny, cloudy, rainy, windy, cool, or warm days.
      ii) The relative temperature at various times of the day (e.g., cooler in the morning, warmer during the day, cooler at night).
2) Identifying relationships
   a) Students identify and describe* patterns in the organized data, including:
      i) The relative number of days of different types of weather conditions in a month.
      ii) The change in the relative temperature over the course of a day.
3) Interpreting data
   a) Students describe* and share that:
      i) Certain months have more days of some kinds of weather than do other months (e.g., some months have more hot days, some have more rainy days).
      ii) The differences in relative temperature over the course of a day (e.g., between early morning and the afternoon, between one day and another) are directly related to the time of day.

S.K.8. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.* [Clarification Statement: Emphasis is on local forms of severe weather.]

Practices of Scientists and Engineers	Core Science Content
Asking Questions and Defining Problems Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested. Students will ask questions based on observations to find more information about the designed world. **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. Students will read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world.	**Natural Hazards** Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.
Science Connecting Concepts	
Cause and Effect Events have causes that generate observable patterns. **Interdependence of Science, Engineering, and Technology** People encounter questions about the natural world every day. **Influence of Engineering, Technology, and Science on Society and the Natural World** People depend on various technologies in their lives; human life would be very different without technology.	

Observable features of the student performance by the end of the course:

1) Addressing phenomena of the natural world
   a) Students formulate questions about local severe weather, the answers to which would clarify how weather forecasting can help people avoid the most serious impacts of severe weather events.
2) Identifying the scientific nature of the question
   a) Students' questions are based on their observations.
3) Obtaining information
   a) Students collect information (e.g., from questions, grade appropriate texts, media) about local severe weather warnings (e.g., tornado alerts, hurricane warnings, major thunderstorm warnings, winter storm warnings, severe drought alerts, heat wave alerts), including that:
      i) There are patterns related to local severe weather that can be observed (e.g., certain types of severe weather happen more in certain places).
      ii) Weather patterns (e.g., some events are more likely in certain regions) help scientists predict severe weather before it happens.
      iii) Severe weather warnings are used to communicate predictions about severe weather.
      iv) Weather forecasting can help people plan for, and respond to, specific types of local weather (e.g., responses: stay indoors during severe weather, go to cooling centers during heat waves; preparations: evacuate coastal areas before a hurricane, cover windows before storms).

S.K.9. Make observations to determine the effect of sunlight on Earth's surface. [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water.] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]

Practices of Scientists and Engineers	Core Science Content
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. Students will make observations (firsthand or from media) to collect data that can be used to make comparisons. **Scientific Investigations Use a Variety of Methods** Scientists use different ways to study the world.	**Conservation of Energy and Energy Transfer** Sunlight warms Earth's surface.
Science Connecting Concepts	
Cause and Effect Events have causes that generate observable patterns.	

Observable features of the student performance by the end of the course:

1) Identifying the phenomenon to be investigated
   a) From the given investigation plan, students describe* (with guidance) the phenomenon under investigation, which includes the following idea: sunlight warms the Earth's surface.
   b) Students describe* (with guidance) the purpose of the investigation, which includes determining the effect of sunlight on Earth materials by identifying patterns of relative warmth of materials in sunlight and shade (e.g., sand, soil, rocks, water).
2) Identifying the evidence to address the purpose of the investigation
   a) Based on the given investigation plan, students describe* (with guidance) the evidence that will result from the investigation, including observations of the relative warmth of materials in the presence and absence of sunlight (i.e., qualitative measures of temperature; e.g., hotter, warmer, colder).
   b) Students describe* how the observations they make connect to the purpose of the investigation.
3) Planning the investigation
   a) Based on the given investigation plan, students describe* (with guidance):
      i) The materials on the Earth's surface to be investigated (e.g., dirt, sand, rocks, water, grass).
      ii) How the relative warmth of the materials will be observed and recorded.
4) Collecting the data
   a) According to the given investigation plan and with guidance, students collect and record data that will allow them to:
      i) Compare the warmth of Earth materials placed in sunlight and the same Earth materials placed in shade.
      ii) Identify patterns of relative warmth of materials in sunlight and in shade (i.e., qualitative measures of temperature; e.g., hotter, warmer, colder).
      iii) Describe* that sunlight warms the Earth's surface.

S.K.10. Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth’s surface.* [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]

Practices of Scientists and Engineers	Core Science Content
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. Students will use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem.	Conservation of Energy and Energy Transfer Sunlight warms Earth’s surface.
Science Connecting Concepts	
Cause and Effect Events have causes that generate observable patterns.	

Observable features of the student performance by the end of the course:

1) Using scientific knowledge to generate design solutions
    a) Students use given scientific information about sunlight’s warming effect on the Earth’s surface to collaboratively design and build a structure that reduces warming caused by the sun.
    b) With support, students individually describe*:
        i) The problem.
        ii) The design solution.
        iii) In what way the design solution uses the given scientific information.
2) Describing* specific features of the design solution, including quantification when appropriate
    a) Students describe* that the structure is expected to reduce warming for a designated area by providing shade.
    b) Students use only the given materials and tools when building the structure.
3) Evaluating potential solutions
    a) Students describe* whether the structure meets the expectations in terms of cause (structure blocks sunlight) and effect (less warming of the surface).

Engineering, Technology, and Applications of Science

Topic: Engineering Design

S.K.11. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Asking Questions and Defining Problems
Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. Students will ask questions based on observations to find more information about the natural and/or designed world(s). Students will define a simple problem that can be solved through the development of a new or improved object or tool.</td><td rowspan="3">Defining and Delimiting Engineering Problems
A situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td></td></tr>
</table>

Observable features of the student performance by the end of the course:

1) Addressing phenomena of the natural or designed world
   a) Students ask questions and make observations to gather information about a situation that people want to change. Students' questions, observations, and information gathering are focused on:
      i) A given situation that people wish to change.
      ii) Why people want the situation to change.
      iii) The desired outcome of changing the situation.
2) Identifying the scientific nature of the question
   a) Students' questions are based on observations and information gathered about scientific phenomena that are important to the situation.
3) Identifying the problem to be solved
   a) Students use the information they have gathered, including the answers to their questions, observations they have made, and scientific information, to describe* the situation people want to change in terms of a simple problem that can be solved with the development of a new or improved object or tool.
4) Defining the features of the solution
   a) With guidance, students describe* the desired features of the tool or object that would solve the problem, based on scientific information, materials available, and potential related benefits to people and other living things.

S.K.12. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. Students will develop a simple model based on evidence to represent a proposed object or tool.</td><td rowspan="3">Developing Possible Solutions
Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Structure and Function
The shape and stability of structures of natural and designed objects are related to their function(s).</td></tr>
</table>

Observable features of the student performance by the end of the course:

1) Components of the model
   a) Students develop a representation of an object and the problem it is intended to solve. In their representation, students include the following components:
      i) The object.
      ii) The relevant shape(s) of the object.
      iii) The function of the object.
   b) Students use sketches, drawings, or physical models to convey their representations.
2) Relationships
   a) Students identify relationships between the components in their representation, including:
      i) The shape(s) of the object and the object's function.
      ii) The object and the problem it is designed to solve.
3) Connections
   a) Students use their representation (simple sketch, drawing, or physical model) to communicate the connections between the shape(s) of an object, and how the object could solve the problem.

S.K.13. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Practices of Scientists and Engineers	Core Science Content

Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Students will analyze data from tests of an object or tool to determine if it works as intended.	Optimizing the Design Solution Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
Science Connecting Concepts	

Observable features of the student performance by the end of the course:

1) Organizing data
   a) With guidance, students use graphical displays (e.g., tables, pictographs, line plots) to organize given data from tests of two objects, including data about the features and relative performance of each solution.
2) Identifying relationships
   a) Students use their organization of the data to find patterns in the data, including:
      i) How each of the objects performed, relative to:
         (1) The other object.
         (2) The intended performance.
      ii) How various features (e.g., shape, thickness) of the objects relate to their performance (e.g., speed, strength).
3) Interpreting data
   a) Students use the patterns they found in object performance to describe*:
      i) The way (e.g., physical process, qualities of the solution) each object will solve the problem.
      ii) The strengths and weaknesses of each design.
      iii) Which object is better suited to the desired function, if both solve the problem.

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