Science Standard-Specific Supports

Grade 3

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.

---

[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 - Grade 3 Introduction

The Third Grade Science standards build upon problem-solving and experimentation, moving into a more in-depth study of science. Through a progressive rigorous, integrated approach, the inquiry-based program of study provides students opportunities to demonstrate scientific literacy in the domains of Physical Science, Life Science, and Earth and Space Science, focusing on the connecting concepts of science: systems, changes, and models. The content develops early problem-solving skills through observing, experimenting, and concluding. Students will engage in hands-on activities at least 50% of the instructional time developing and demonstrating conceptual understandings along with research and laboratory skills described in the standards and indicators for science. Engineering, Technology, and the Application of Science are integrated throughout instruction as students define problems and design solutions related to the course standards and indicators for science. Third Grade Science intentionally supports developmental and academic growth. 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 3-5

<table>
<tr><th colspan="2">College- and Career-Readiness Indicators for Science</th></tr>
<tr><td colspan="2" align="center">Grades 3-5</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</td></tr>
</table>

Physical Science

Topic: Forces and Interactions

S.3.1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

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 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Students will plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. Scientific Investigations Use a Variety of Methods Science investigations use a variety of methods, tools, and techniques.	Forces and Motion Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces, are used at this level.) Types of Interactions Objects in contact exert forces on each other.
Science Connecting Concepts	
Cause and Effect Cause and effect relationships are routinely identified.	

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

1) Identifying the phenomenon under investigation
   a) Students identify and describe* the phenomenon under investigation, which includes the effects of different forces on an object's motion (e.g., starting, stopping, or changing direction).
   b) Students describe* the purpose of the investigation, which includes producing data to serve as the basis for evidence for how balanced and unbalanced forces determine an object's motion.
2) Identifying the evidence to address the purpose of the investigation
   a) Students collaboratively develop an investigation plan. In the investigation plan, students describe* the data to be collected, including:
      i) The change in motion of an object at rest after:
         (1) Different strengths and directions of balanced forces (forces that sum to zero) are applied to the object.
         (2) Different strengths and directions of unbalanced forces (forces that do not sum to zero) are applied to the object (e.g., strong force on the right, weak force or the left).
      ii) What causes the forces on the object.
   b) Students individually describe* how the evidence to be collected will be relevant to determining the effects of balanced and unbalanced forces on an object's motion.
3) Planning the investigation
   a) In the collaboratively developed investigation plan, students describe* how the motion of the object will be observed and recorded, including defining the following features:
      i) The object whose motion will be investigated.

        ii) The objects in contact that exert forces on each other.
        iii) Changing one variable at a time (e.g., control strength and vary the direction, or control direction and vary the strength).
        iv) The number of trials that will be conducted in the investigation to produce sufficient data.
    b) Students individually describe* how their investigation plan will allow them to address the purpose of the investigation.
4) Collecting the data
    a) Students collaboratively collect and record data according to the investigation plan they developed, including data from observations and/or measurements of:
        i) An object at rest and the identification of the forces acting on the object.
        ii) An object in motion and the identification of the forces acting on the object.

S.3.2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

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 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Students will make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. Science Knowledge is Based on Empirical Evidence Science findings are based on recognizing patterns.	Forces and Motion The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
Science Connecting Concepts	
Patterns Patterns of change can be used to make predictions.	

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

1) Identifying the phenomenon under investigation
    a) From the given investigation plan, students identify and describe* the phenomenon under investigation, which includes observable patterns in the motion of an object.
    b) Students identify and describe* the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon that includes the idea that patterns of motion can be used to predict future motion of an object.
2) Identifying the evidence to address the purpose of the investigation
    a) Based on a given investigation plan, students identify and describe* the data to be collected through observations and/or measurements, including data on the motion of the object as it repeats a pattern over time (e.g., a pendulum swinging, a ball moving on a curved track, a magnet repelling another magnet).

   b) Students describe* how the data will serve as evidence of a pattern in the motion of an object and how that pattern can be used to predict future motion.
3) Planning the investigation
   a) From the given investigation plan, students identify and describe* how the data will be collected, including how:
      i) The motion of the object will be observed and measured.
      ii) Evidence of a pattern in the motion of the object will be identified from the data on the motion of the object.
      iii) The pattern in the motion of the object can be used to predict future motion.
4) Collecting the data
   a) Students make observations and/or measurements of the motion of the object, according to the given investigation plan, to identify a pattern that can be used to predict future motion.

S.3.3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

Practices of Scientists and Engineers	Core Science Content
Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. Students will ask questions that can be investigated based on patterns such as cause and effect relationships.	Types of Interactions Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
Science Connecting Concepts	
Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.	

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

1) Addressing phenomena of the natural world
   a) Students ask questions that arise from observations of two objects not in contact with each other interacting through electric or magnetic forces, the answers to which would clarify the cause-and-effect relationships between:
      i) The sizes of the forces on the two interacting objects due to the distance between the two objects.
      ii) The relative orientation of two magnets and whether the force between the magnets is attractive or repulsive.
      iii) The presence of a magnet and the force the magnet exerts on other objects.
      iv) Electrically charged objects and an electric force.
2) Identifying the scientific nature of the question

a) Students' questions can be investigated within the scope of the classroom.

S.3.4. Define a simple design problem that can be solved by applying scientific ideas about magnets.* [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

Practices of Scientists and Engineers	Core Science Content
Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. Students will define a simple problem that can be solved through the development of a new or improved object or tool.	**Types of Interactions** Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
Science Connecting Concepts	
Interdependence of Science, Engineering, and Technology Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.	

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

1) Identifying the problem to be solved
   a) Students identify and describe* a simple design problem that can be solved by applying a scientific understanding of the forces between interacting magnets.
   b) Students identify and describe* the scientific ideas necessary for solving the problem, including:
      i) Force between objects do not require that those objects be in contact with each other.
      ii) The size of the force depends on the properties of objects, distance between the objects, and orientation of magnetic objects relative to one another.
2) Defining the criteria and constraints
   a) Students identify and describe* the criteria (desirable features) for a successful solution to the problem.
   b) Students identify and describe* the constraints (limits) such as:
      i) Time.
      ii) Cost.
      iii) Materials.

S.3.5. Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]

Practices of Scientists and Engineers	Core Science Content
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Students will support an argument with evidence, data, or a model.	**Types of Interactions** The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
Science Connecting Concepts	

Cause and Effect Cause and effect relationships are routinely identified and used to explain change.	

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

1) Supported claims
   a) Students identify a given claim to be supported about a phenomenon. The claim includes the idea that the gravitational force exerted by Earth on objects is directed down toward the center of Earth.
2) Identifying scientific evidence
   a) Students identify and describe* the given evidence, data, and/or models that support the claim, including:
      i) Multiple lines of evidence that indicate that the Earth's shape is spherical (e.g., observation of ships sailing beyond the horizon, the shape of the Earth's shadow on the moon during an eclipse, the changing height of the North Star above the horizon as people travel north and south).
      ii) That objects dropped appear to fall straight down.
      iii) That people live all around the spherical Earth, and they all observe that objects appear to fall straight down.
3) Evaluation and critique
   a) Students evaluate the evidence to determine whether it is sufficient and relevant to supporting the claim.
   b) Students describe* whether any additional evidence is needed to support the claim.
4) Reasoning and synthesis
   a) Students use reasoning to connect the relevant and appropriate evidence to support the claim with argumentation. Students describe* a chain of reasoning that includes:
      i) If Earth is spherical, and all observers see objects near them falling directly "down" to the Earth's surface, then all observers would agree that objects fall toward the Earth's center.
      ii) Since an object that is initially stationary when held moves downward when it is released, there must be a force (gravity) acting on the object that pulls the object toward the center of Earth.

Life Science

Topic: Interdependent Relationships in Ecosystems

S.3.6. Construct an argument that some animals form groups that help members survive.

Practices of Scientists and Engineers	Core Science Content
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Students will construct an argument with evidence, data, and/or a model.	Social Interactions and Group Behavior Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.
Science Connecting Concepts	
Cause and Effect Cause and effect relationships are routinely identified and used to explain change.	

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 some animals form groups and that being a member of that group helps each member survive.
2) Identifying scientific evidence
   a) Students describe* the given evidence, data, and/or models necessary to support the claim, including:
      i) Identifying types of animals that form or live in groups of varying sizes.
      ii) Multiple examples of animals in groups of various sizes:
         (1) Obtaining more food for each individual animal compared to the same type of animal looking for food individually.
         (2) Displaying more success in defending themselves than those same animals acting alone.
         (3) Making faster or better adjustments to harmful changes in their ecosystem than would those same animals acting alone.
3) Evaluating and critiquing evidence
   a) Students evaluate the evidence to determine its relevance, and whether it supports the claim that being a member of a group has a survival advantage.
   b) Students describe* whether the given evidence is sufficient to support the claim and whether additional evidence is needed.
4) Reasoning and synthesis
   a) Students use reasoning to construct an argument connecting the evidence, data and/or models to the claim. Students describe* the following reasoning in their argument:
      i) The causal evidence that being part of a group can have the effect of animals being more successful in obtaining food, defending themselves, and coping with change supports the claim that being a member of a group helps animals survive.
      ii) The causal evidence that an animal losing its group status can have the effect of the animal obtaining less food, not being able to defend itself, and not being able to cope with change supports the claim that being a member of a group helps animals survive

S.3.7. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Students will construct an argument with evidence.</td><td rowspan="3">Adaptation
For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Cause and Effect
Cause and effect relationships are routinely identified and used to explain change.</td></tr>
</table>

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 in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.
2) Identifying scientific evidence
   a) Students describe* the given evidence necessary for supporting the claim, including:
      i) Characteristics of a given particular environment (e.g., soft earth, trees and shrubs, seasonal flowering plants).
      ii) Characteristics of a particular organism (e.g., plants with long, sharp leaves; rabbit coloration).
      iii) Needs of a particular organism (e.g., shelter from predators, food, water).
3) Evaluating and critiquing evidence
   a) Students evaluate the evidence to determine:
      i) The characteristics of organisms that might affect survival.
      ii) The similarities and differences in needs among at least three types of organisms.
      iii) How and what features of the habitat meet the needs of each of the organisms (i.e., the degree to which a habitat meets the needs of an organism).
      iv) How and what features of the habitat do not meet the needs of each of the organisms (i.e., the degree to which a habitat does not meet the needs of an organism).
   b) Students evaluate the evidence to determine whether it is relevant to and supports the claim.
   c) Students describe* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed.
4) Reasoning and synthesis
   a) Students use reasoning to construct an argument, connecting the relevant and appropriate evidence to the claim, including describing* that any particular environment meets different organisms' needs to different degrees due to the characteristics of that environment and the needs of the organisms. Students describe* a chain of reasoning in their argument, including the following cause-and-effect relationships:
      i) If an environment fully meets the needs of an organism, that organism can survive well within that environment.
      ii) If an environment partially meets the needs of an organism, that organism can survive less well (e.g., lower survival rate, increased sickliness, shorter lifespan) than organisms whose needs are met within that environment.
      iii) If an environment does not meet the needs of the organism, that organism cannot survive within that environment.
      iv) Together, the evidence suggests a causal relationship within the system between the characteristics of a habitat and the survival of organisms within it.

S.3.8. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Students will make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.</td><td rowspan="3">Ecosystem Dynamics, Functioning, and Resilience
When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

Biodiversity and Humans
Populations live in a variety of habitats, and change in those habitats affects the organisms living there.</td></tr>
<tr><th>Science Connecting Concepts</th></tr>
<tr><td>Systems and System Models
A system can be described in terms of its components and their interactions.
Interdependence of Engineering, Technology, and Science on Society and the Natural World
Knowledge of relevant scientific concepts and research findings is important in engineering.</td></tr>
</table>

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

1) Supported claims
   a) Students make a claim about the merit of a given solution to a problem that is caused when the environment changes, which results in changes in the types of plants and animals that live there.
2) Identifying scientific evidence
   a) Students describe* the given evidence about how the solution meets the given criteria and constraints. This evidence includes:
      i) A system of plants, animals, and a given environment within which they live before the given environmental change occurs.
      ii) A given change in the environment.
      iii) How the change in the given environment causes a problem for the existing plants and animals living within that area.
      iv) The effect of the solution on the plants and animals within the environment.
      v) The resulting changes to plants and animals living within that changed environment, after the solution has been implemented.
3) Evaluating and critiquing evidence
   a) Students evaluate the solution to the problem to determine the merit of the solution. Students describe* how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:
      i) How well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:
         (1) How the solution makes changes to one part (e.g., a feature of the environment) of the system, affecting the other parts of the system (e.g., plants and animals).
         (2) How the solution affects plants and animals.
   b) Students evaluate the evidence to determine whether it is relevant to and supports the claim.
   c) Students describe* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed.

Topic: Inheritance and Variation of Traits: Life Cycles and Traits

S.3.9. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. [Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

Practices of Scientists and Engineers	Core Science Content
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Students will develop models to describe phenomena. Scientific Knowledge is Based on Empirical Evidence Science findings are based on recognizing patterns.	Growth and Development of Organisms Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.
Science Connecting Concepts	
Patterns Patterns of change can be used to make predictions.	

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

1) Components of the model
    a) Students develop models (e.g., conceptual, physical, drawing) to describe* the phenomenon. In their models, students identify the relevant components of their models including:
        i) Organisms (both plant and animal).
        ii) Birth.
        iii) Growth.
        iv) Reproduction.
        v) Death.
2) Relationships
    a) In the models, students describe* relationships between components, including:
        i) Organisms are born, grow, and die in a pattern known as a life cycle.
        ii) Different organisms' life cycles can look very different.
        iii) A causal direction of the cycle (e.g., without birth, there is no growth; without reproduction, there are no births).
3) Connections
    a) Students use the models to describe* that although organisms can display life cycles that look different, they all follow the same pattern.
    b) Students use the models to make predictions related to the phenomenon, based on patterns identified among life cycles (e.g., prediction could include that if there are no births, deaths will continue and eventually there will be no more of that type of organism).

S.3.10. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Analyzing and Interpreting Data
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. Students will analyze and interpret data to make sense of phenomena using logical reasoning.</td><td rowspan="3">Inheritance of Traits
Many characteristics of organisms are inherited from their parents.

Variation of Traits
Different organisms vary in how they look and function because they have different inherited information.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Patterns
Similarities and differences in patterns can be used to sort and classify natural phenomena.</td></tr>
</table>

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

1) Organizing data
   a) Students organize the data (e.g., from students' previous work, grade-appropriate existing datasets) using graphical displays (e.g., table, chart, graph). The organized data include:
      i) Traits of plant and animal parents.
      ii) Traits of plant and animal offspring.
      iii) Variations in similar traits in a grouping of similar organisms.
2) Identifying relationships
   a) Students identify and describe* patterns in the data, including:
      i) Similarities in the traits of a parent and the traits of an offspring (e.g., tall plants typically have tall offspring).
      ii) Similarities in traits among siblings (e.g., siblings often resemble each other).
      iii) Differences in traits in a group of similar organisms (e.g., dogs come in many shapes and sizes, a field of corn plants have plants of different heights).
      iv) Differences in traits of parents and offspring (e.g., offspring do not look exactly like their parents).
      v) Differences in traits among siblings (e.g., kittens from the same mother may not look exactly like their mother).
3) Interpreting data
   a) Students describe* that the pattern of similarities in traits between parents and offspring, and between siblings, provides evidence that traits are inherited.
   b) Students describe* that the pattern of differences in traits between parents and offspring, and between siblings, provides evidence that inherited traits can vary.
   c) Students describe* that the variation in inherited traits results in a pattern of variation in traits in groups of organisms that are of a similar type.

S.3.11. Use evidence to support the explanation that traits can be influenced by the environment. [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

Practices of Scientists and Engineers	Core Science Content
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Students will use evidence (e.g., observations, patterns) to support an explanation.	Inheritance of Traits Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
Science Connecting Concepts	
Cause and Effect Cause and effect relationships are routinely identified and used to explain change.	Variation of Traits The environment also affects the traits that an organism develops.

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

1) Articulating the explanation of phenomena
   a) Students identify the given explanation to be supported, including a statement that relates the phenomenon to a scientific idea, including that many inherited traits can be influenced by the environment.
2) Evidence
   a) Students describe* the given evidence that supports the explanation, including:
      i) Environmental factors that vary for organisms of the same type (e.g., amount or food, amount of water, amount of exercise an animal gets, chemicals in the water) that may influence organisms' traits.
      ii) Inherited traits that vary between organisms of the same type (e.g., height or weight of a plant or animal, color or quantity of the flowers).
      iii) Observable inherited traits of organisms in varied environmental conditions.
3) Reasoning
   a) Students use reasoning to connect the evidence and support an explanation about environmental influences on inherited traits in organisms. In their chain of reasoning, students describe* a cause and-effect relationship between a specific causal environmental factor and its effect of a given variation in a trait (e.g., not enough water produces plants that are shorter and have fewer flowers than plants that had more water available).

S.3.12. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Students will use evidence (e.g., observations, patterns) to construct an explanation.</td><td rowspan="3">Natural Selection
Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Cause and Effect
Cause and effect relationships are routinely identified and used to explain change.</td></tr>
</table>

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

1) Articulating the explanation of phenomena
   a) Students articulate a statement that relates the given phenomenon to a scientific idea, including that variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
   b) Students use evidence and reasoning to construct an explanation for the phenomenon.
2) Evidence
   a) Students describe* the given evidence necessary for the explanation, including:
      i) A given characteristic of a species (e.g., thorns on a plant, camouflage of an animal, the coloration of moths).
      ii) The patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals).
      iii) Potential benefits of a given variation of the characteristic (e.g., the light coloration of some moths makes them difficult to see on the bark of a tree).
3) Reasoning
   a) Students use reasoning to logically connect the evidence to support the explanation for the phenomenon. Students describe* a chain of reasoning that includes:
      i) That certain variations in characteristics make it harder or easier for an animal to survive, find mates, and reproduce (e.g., longer thorns prevent predators more effectively and increase the likelihood of survival; light coloration of some moths provides camouflage in certain environments, making it more likely that they will live long enough to be able to mate and reproduce).
      ii) That the characteristics that make it easier for some organisms to survive, find mates, and reproduce give those organisms an advantage over other organisms of the same species that don't have those traits.
      iii) That there can be a cause-and-effect relationship between a specific variation in a characteristic (e.g., longer thorns, coloration of moths) and its effect on the ability of the individual organism to survive and reproduce (e.g., plants with longer thorns are less likely to be eaten, darker moths are less likely to be seen and eaten on dark trees).

Earth and Space Science

Topic: Weather and Climate

S.3.13. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Analyzing and Interpreting Data
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. Students will represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.</td><td rowspan="3">Weather and Climate
Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Patterns
Patterns of change can be used to make predictions.</td></tr>
</table>

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

1) Organizing data
    a) Students use graphical displays (e.g., table, chart, graph) to organize the given data by season using tables, pictographs, and/or bar charts, including:
        i) Weather condition data from the same area across multiple seasons (e.g., average temperature, precipitation, wind direction).
        ii) Weather condition data from different areas (e.g., hometown and nonlocal areas, such as a town in another state).
2) Identifying relationships
    a) Students identify and describe* patterns of weather conditions across:
        i) Different seasons (e.g., cold and dry in the winter, hot and wet in the summer; more or less wind in a particular season).
        ii) Different areas (e.g., certain areas (defined by location, such as a town in the Pacific Northwest), have high precipitation, while a different area (based on location or type, such as a town in the Southwest) have very little precipitation).
3) Interpreting data
    a) a Students use patterns of weather conditions in different seasons and different areas to predict:
        i) The typical weather conditions expected during a particular season (e.g., "In our town in the summer it is typically hot, as indicated on a bar graph over time, while in the winter it is typically cold; therefore, the prediction is that next summer it will be hot and next winter it will be cold.").
        ii) The typical weather conditions expected during a particular season in different areas.

S.3.14. Obtain and combine information to describe climates in different regions of the world.

Practices of Scientists and Engineers	Core Science Content
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. Students will obtain and combine information from books and other reliable media to explain phenomena.	**Weather and Climate** Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.
Science Connecting Concepts	
Patterns Patterns of change can be used to make predictions.	

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

1) Obtaining information
   a) Students use books and other reliable media to gather information about:
      i) Climates in different regions of the world (e.g., equatorial, polar, coastal, mid-continental).
      ii) Variations in climates within different regions of the world (e.g., variations could include an area's average temperatures and precipitation during various months over several years or an area's average rainfall and temperatures during the rainy season over several years).
2) Evaluating information
   a) Students combine obtained information to provide evidence about the climate pattern in a region that can be used to make predictions about typical weather conditions in that region.
3) Communicating information
   a) Students use the information they obtained and combined to describe*:
      i) Climates in different regions of the world.
      ii) Examples of how patterns in climate could be used to predict typical weather conditions.
      iii) That climate can vary over years in different regions of the world.

S.3.15. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.* [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

Practices of Scientists and Engineers	Core Science Content
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Students will make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	**Natural Hazards** A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
Science Connecting Concepts	
Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change. **Influence of Engineering, Technology, and Science on Society and the Natural World** Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). **Science is a Human Endeavor** Science affects everyday life.	

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

1) Supported claims
   a) Students make a claim about the merit of a given design solution that reduces the impact of a weather-related hazard.
2) Identifying scientific evidence
   a) Students describe* the given evidence about the design solution, including evidence about:
      i) The given weather-related hazard (e.g., heavy rain or snow, strong winds, lightning, flooding along river banks).
      ii) Problems caused by the weather-related hazard (e.g., heavy rains cause flooding, lightning causes fires).
      iii) How the proposed solution addresses the problem (e.g., dams and levees are designed to control flooding, lightning rods reduce the chance of fires) [note: mechanisms are limited to simple observable relationships that rely on logical reasoning].
3) Evaluating and critiquing evidence
   a) Students evaluate the evidence using given criteria and constraints to determine:
      i) How the proposed solution addresses the problem, including the impact of the weather-related hazard after the design solution has been implemented.
      ii) The merits of a given solution in reducing the impact of a weather-related hazard (i.e., whether the design solution meets the given criteria and constraints].
      iii) The benefits and risks a given solution poses when responding to the societal demand to reduce the impact of a hazard.

Engineering, Technology, and Applications of Science

Topic: Engineering Design

S.3.16. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Practices of Scientists and Engineers	Core Science Content
Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. Students will define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
Science Connecting Concepts	
Influence of Science, Engineering, and Technology on Society and the Natural World People's needs and wants change over time, as do their demands for new and improved technologies.	

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

1) Identifying the problem to be solved
    a) Students use given scientific information and information about a situation or phenomenon to define a simple design problem that includes responding to a need or want.
    b) The problem students define is one that can be solved with the development of a new or improved object, tool, process, or system.
    c) Students describe* that people's needs and wants change over time.
2) Defining the boundaries of the system
    a) Students define the limits within which the problem will be addressed, which includes addressing something people want and need at the current time.
3) Defining the criteria and constraints
    a) Based on the situation people want to change, students specify criteria (required features) of a successful solution.
    b) Students describe* the constraints or limitations on their design, which may include:
        i) Cost.
        ii) Materials.
        iii) Time.

S.3.17. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

<table>
<tr><th>Practices of Scientists and Engineers</th><th>Core Science Content</th></tr>
<tr><td>Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Students will generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.</td><td rowspan="3">Developing Possible Solutions
Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.</td></tr>
<tr><td>Science Connecting Concepts</td></tr>
<tr><td>Influence of Science, Engineering, and Technology on Society and the Natural World
Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.</td></tr>
</table>

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

1) Using scientific knowledge to generate design solutions
   a) Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information.
   b) Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem.
   c) Students specify how each design solution solves the problem.
   d) Students share ideas and findings with others about design solutions to generate a variety of possible solutions.
   e) Students describe* the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design [note: emphasis is on what is necessary for designing solutions, not on a step-wise process].
2) Describing* criteria and constraints, including quantification when appropriate
   a) Students describe*:
      i) The given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate.
      ii) How the criteria and constraints will be used to generate and test the design solutions.
3) Evaluating potential solutions
   a) Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem.
   b) Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem.

S.3.18. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

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 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Students will plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Developing Possible Solutions** Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **Optimizing the Design Solution** Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
Science Connecting Concepts	

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

1) Identifying the purpose of the investigation
   a) Students describe* the purpose of the investigation, which includes finding possible failure points or difficulties to identify aspects of a model or prototype that can be improved.
2) Identifying the evidence to be address the purpose of the investigation
   a) Students describe* the evidence to be collected, including:
      i) How well the model/prototype performs against the given criteria and constraints.
      ii) Specific aspects of the prototype or model that do not meet one or more of the criteria or constraints (i.e., failure points or difficulties).
      iii) Aspects of the model/prototype that can be improved to better meet the criteria and constraints.
   b) Students describe* how the evidence is relevant to the purpose of the investigation.
3) Planning the investigation
   a) Students create a plan for the investigation that describes* different tests for each aspect of the criteria and constraints. For each aspect, students describe*:
      i) The specific criterion or constraint to be used.
      ii) What is to be changed in each trial (the independent variable).
      iii) The outcome (dependent variable) that will be measured to determine success.
      iv) What tools and methods are to be used for collecting data.
      v) What is to be kept the same from trial to trial to ensure a fair test.
4) Collecting the data
   a) Students carry out the investigation, collecting and recording data according to the developed plan.

David L. Roach
West Virginia Superintendent of Schools