Science Grade 3

Length of Course: Term
Elective/Required: Required
Schools: Elementary
Eligibility: Grade 3
Credit Value: N/A
Date Approved: August 24, 2015
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STATEMENT OF PURPOSE

In July 2011, the National Research Council (NRC) of the National Academy of Sciences developed *A Framework for K-12 Science Education*. This guidance provides a sound, evidence-based foundation for standards by drawing on current scientific research - including research on the methods in which students learn science effectively - and identifies the science all students in grade K-12 should know.

This Framework was composed based on a set of core principles that:

- Reaffirm children are born investigators;
- Recognize understanding builds over time;
- Assert science & engineering require both knowledge and practice;
- Acknowledge a connection to students’ interests and experiences is essential;
- Focus on core ideas and practices; and
- Promote equity.

The NRC’s Framework describes a vision of what it means to be proficient in science; it rests on a view of science as both a body of knowledge and an evidence-based, model and theory building enterprise that continually extends, refines, and revises understanding. It presents three dimensions that will be combined to form each standard:

**Dimension 1: Practices**

Practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world. They also include the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term “practices” instead of a term like “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Part of the NRC’s intent is to better explain and extend what is meant by “inquiry” in science and the range of cognitive, social, and physical practices that it requires.

Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through an investigation, while engineering design involves the formulation of a problem that can be solved through design. Emphasizing the engineering aspects of the Next Generation Science Standards will clarify for students the relevance of science, technology, engineering, and mathematics to everyday life.

**Dimension 2: CrossCutting Concepts**

The CrossCutting Concepts have application across all domains of science and, as such, are a way of linking different domains together. They include:
- Patterns, similarity, and diversity;
- Cause and effect;
- Scale, proportion, and quantity;
- Systems and system models;
- Energy and matter;
- Structure and function; and
- Stability and change.

The Framework emphasizes that these concepts need to be made explicit for students because they provide an organizational schema for inter-relating knowledge from various science fields into a coherent and scientifically-based view of the world.

**Dimension 3: Disciplinary Core Ideas**
Science Grade 3

Disciplinary Core Ideas have the power to focus K-12 science curriculum, instruction, and assessment on the most important aspects of science. To be considered core, the ideas meet at least two of the following criteria (and, ideally, all four):

- Have broad importance across multiple sciences or engineering disciplines, or be a key organizing concept of a single discipline;
- Provide a key tool for understanding or investigating more complex ideas and solving problems;
- Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge; and/or
- Be teachable and learnable over multiple grades at increasing levels of depth and sophistication.

Disciplinary Core Ideas are grouped in four domains: the physical sciences, the life sciences, the earth and space sciences; and engineering, technology, and applications of science.

The NRC’s Framework serves as the foundation of the Next Generation Science Standards (NGSS), a set of internationally-benchmarked science learning outcomes published in April 2013. NGSS proposes shifts in the teaching and learning of science to augment student engagement and strengthen connections between science, technology, engineering, and mathematics. Developed collaboratively with states and other stakeholders in science, science education, higher education, and industry, the NGSS present standards that are rich in content and practice and arranged in a coherent manner across disciplines and grades to prepare students for college and careers.

Our current K-5 Science instructional program reflects the learning and performance expectations found in the Next Generation Science Standards. The NGSS, adopted by the New Jersey State Board of Education in 2014, were officially renamed as the New Jersey Student Learning Standards for Science (NJSLS-S) in 2016.

The district’s curriculum is strategically designed to help students foster an understanding of the four domains of science from kindergarten through fifth grade.

In earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

The performance expectations in elementary school grade bands develop ideas and skills over time that will allow students to explain more complex phenomena in the four disciplines as they progress to middle and high school. While the performance expectations shown in kindergarten through fifth grade couple particular practices with specific Disciplinary Core Ideas, informed instructional decisions based on formative and summative assessment should be made by the teacher to ensure understanding of the many science and engineering practices that lead to the performance expectations.

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3RD GRADE SCIENCE CURRICULUM OVERVIEW

The performance expectations in third grade help students formulate answers to questions such as:

- What is typical weather in different parts of the world and during different times of the year?
- How can the impact of weather-related hazards be reduced? How do organisms vary in their traits?
- How are plants, animals, and environments of the past similar or different from current plants, animals, and environments?
- What happens to organisms when their environment changes?
- How do equal and unequal forces on an object affect the object? How can magnets be used?

Third grade performance expectations include PS2, LS1, LS2, LS3, LS4, ESS2, and ESS3 Disciplinary Core Ideas from the National Research Council Framework.

Life Science:

- Students are expected to develop an understanding of the similarities and differences of organisms’ life cycles.
  - An understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops, is acquired by students at this level. In addition, students are able to construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
- Students are expected to develop an understanding of types of organisms that lived long ago and also about the nature of their environments.
- Third graders are expected to develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.

Physical Science:

- Students are able to determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
  - They are then able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

Earth and Space Science:

- Students are able to organize and use data to describe typical weather conditions expected during a particular season.
  - By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards.

Crosscutting Concepts: The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these Disciplinary Core Ideas.

Science & Engineering Practices: In the third grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in:

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

Students are expected to use these practices to demonstrate understanding of the core ideas.

Please click HERE to view the NJSLS-Science / NGSS for 3rd Grade.
### 3RD GRADE SCIENCE SCOPE & SEQUENCE

#### 1st Marking Period

**Life Science - Organisms & Ecosystems**

**Unit 1: Organisms and Traits**  
(Suggested Pacing: 30 days)

- **3-LS1: From Molecules to Organisms: Structures and Processes**
  - Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (3-LS1-1)

- **3-LS3: Heredity: Inheritance and Variation of Traits**
  - 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. (3-LS3-1)
  - Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2)

**Unit 2: Ecosystems: Group Behavior**  
(Suggested Pacing: 15 days)

- **3-LS2: Ecosystems: Interactions, Energy, and Dynamics**
  - Construct an argument that some animals form groups that help members survive. (3-LS2-1)

#### 2nd Marking Period

**Life Science - Inheritance & Evolution**

**Unit 3: Engineering Design**  
(Suggested Pacing: 15 days)

- **3-5-ETS1: Engineering Design**
  - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)
  - 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. (3-5-ETS1-2)
  - 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. (3-5-ETS1-3)

**Unit 4 - Biological Evolution**  
(Suggested Pacing: 30 days)

- **3-LS4: Biological Evolution: Unity and Diversity**
  - Analyze and interpret data from fossils to provide evidence of the organisms and environments in which they lived long ago. (3-LS4-1)
  - 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. (3-LS4-2)
  - 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. (3-LS4-3)
  - 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. (3-LS4-4)
### 3rd Marking Period

**Physical Science - Forces & Interactions**

#### Unit 5 - Forces & Interactions  
(Suggested Pacing: 45 Days)

- **3-PS2: Motion and Stability: Forces and Interactions**
  - Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.  
  - Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.  
  - Ask questions to determine cause and effect relationships of electrical or magnetic interactions between two objects not in contact with each other.  
  - Define a simple design problem that can be solved by applying scientific ideas about magnets.

- **3-5-ETS1: Engineering Design**
  - 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.  
  - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of model or prototype that can be improved.

### 4th Marking Period

**Earth & Space Science - Weather & Climate**

#### Unit 6 - TransDisciplinary Unit  
(Suggested Pacing: 45 Days)

- **3-ESS2: Earth's Systems**
  - Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.  
  - Obtain and combine information to describe climates in different regions of the world.

- **3-ESS3: Earth and Human Activity**
  - Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

- **3-5-ETS1: Engineering Design**
  - 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.  
  - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of model or prototype that can be improved.
# Unit 1

## Unit 1: Organisms and Traits

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<th>Grade:</th>
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<td>Suggested Pacing:</td>
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<td>Discovery TechBook Unit:</td>
<td>Life Cycles of Organisms Traits and Inheritance</td>
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### NJSLS - Science Performance Expectations:

- **3-LS1: From Molecules to Organisms: Structures and Processes**
  - Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (3-LS1-1)

- **3-LS3: Heredity: Inheritance and Variation of Traits**
  - 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. (3-LS3-1)
  - Use evidence to support the explanation that traits can be influenced by the environment. (3-LS3-2)

### NJSLS - Science CrossCutting Concepts:

- **Patterns**
  - Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)
  - Patterns of change can be used to make predictions. (3-LS1-1)

- **Cause and Effect**
  - Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2)

### NJSLS - Science Disciplinary Core Ideas:

- **LS1.B: 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. (3-LS1-1)

- **LS3.A: Inheritance of Traits**
  - Many characteristics of organisms are inherited from their parents. (3-LS3-1)
  - Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

- **LS3.B: Variation of Traits**
  - Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
  - The environment also affects the traits that an organism develops. (3-LS3-2)

### Essential Questions**

**The questions below are suggested EQs to springboard the unit. NJSLS-Science was composed for students to drive learning. Afford children the opportunity to ask the questions and define potential problems.**

- How do organisms live, grow, respond to their environment, and reproduce?
- How is a plant life cycle similar/different to an animal's life cycle?
- Why do organisms look similar and different among generations?
- How are characteristics of one generation passed to the next?
- Is there variation of traits in a group of similar organisms?
### Enduring Understandings & Practices

**By the end of this unit, students will understand:**

- The pattern of life cycles include birth, growth, reproduction, and death.
- Plants and animals reproduce to create more plants and animals.
- Both animals and plants change throughout their life cycle.
- Parents pass inherited traits to their offspring.
- Variations exist among offspring.
- Heredity affects an organism's appearance and behavior.
- Distinguish between traits that are inherited and traits that are not inherited.
- Natural selection allows for certain traits to be passed on, while eliminating others.

**By the end of this unit, students will be able to:**

- Develop models to describe phenomena. (3-LS1-1)
- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)
- Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-1)
- Use evidence (e.g., observation patterns) to construct an explanation. (3-LS4-2)
- Identify the importance of reproduction as essential to the continued existence of organiism (3-LS1-1)
- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)
- Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)

### Prior Learning

**Grade 1:**

- Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents.
- Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

### Future Learning

**Grade 6:**

- Animals engage in characteristic behaviors that increase the odds of reproduction.
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
- Genetic factors as well as local conditions affect the growth of the adult plant.
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the others for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affect the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others are harmful, and some are neutral to the organism.
Effective Implementation Strategies

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA).

Assessment

End-of-Unit Performance Assessment: Performance Task: Students will use their understandings of traits and inheritance to create a possible “offspring” of 2 animals from the same species.

Please click HERE to access our 2017 - 2018 K-5 Design Rubric.

Suggested Hands-On Activities / Classroom Inquiries:
From a Seed to a Plant, Animal Life Cycle Activity, Plant/Animal Life Cycle Mobile, Mustard Seed Lab, Comparing Traits, What Kind of Slythy Tove Lab

The following is a recommended progression to support the development of understandings necessary for the performance expectation(s).

Teachers should consider multiple data points when making instructional decisions.

(Please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)

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<th>Objective/Desired Outcome</th>
<th>Classwork Resources</th>
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| Student Questioning Opportunity | To spark curiosity and amplify engagement, students should formulate their own questions regarding the phenomena/topic of the unit. They should then be afforded an opportunity to investigate them (and others that emerge) throughout the unit in order to heighten authenticity and deepen their knowledge and understanding. Teachers may use these questions as a pre-assessment and as a means to guide future learning experiences. | -KWHLAQ: Organizer  
-KWHLAQ: Google Slides  
-Science Questioning Graphic Organizer  
-QFT: Formulating effective questions  
-Ideas For Phenomena To Question: NGSS Phenomena  
#ProjectPhenomena  
Additional Resource:  
-FOCUS VISUAL DE: Flowerparts focus visual |
| 1 | Observe how a plant changes and grows | -DE: Possible PreAssessment  
DE Engage: Getting to Know Plant Life Cycle  
DE: Hands-On: From a Seed to a Plant (Continue seed observations throughout unit) |
| 2 | Determine the difference between living and nonliving things | -DE: Hands-on Activity: Living and Non-Living Things  
Google Slides Unit Presentation |
| 3 | Define and identify characteristics of a life cycle | -DE Reading: The Life Cycle of a Pumpkin  
DE Interact: Life Cycles  
Google Slides Unit Presentation |
| 4 | Describe characteristics of seeds and conditions for growth | -DE Reading: What is a Seed?  
Seed observation |
| 5 | Describe the stages of the plant life cycle | -DE Engage: The Plant Life Cycle and Us  
DE Explore: What are the stages of the Plant Life Cycle?  
Google Slides Unit Presentation |
| 6 | Determine the effect of sunlight on plants | -DE: Phototropism  
DE: Hands-on Activity: Sunlight: A Basic Need  
Google Slides Unit Presentation |
| 7 | Explain why plants must produce seeds or spores | -DE Explore: Why do Plants Need Seeds or Spores?  
Mystery Science: Why do plants give us fruit?  
Google Slides Unit Presentation  
Mushroom Spore Lab |
| 8 | Describe how a plant changes throughout its life cycle | -DE Elaborate  
DE Explain (assessment) |
| 9 | Sequence stages in the animal life cycles | -DE Engage: Getting to Know: Animal Life Cycle  
Google Slides Unit Presentation  
NJCTL: Animal Life Cycle Activity |
| 10 | Describe how organisms change in appearance throughout their life cycle | -DE Explore: How do Some Organisms Change in Appearance During their Life Cycles?  
Google Slides Unit Presentation |
| 11 | Compare and contrast how different organisms reproduce | -DE Explore: How do Organisms Reproduce?  
DE EBook: How do Organisms Reproduce?  
Google Slides Unit Presentation |
| 12 | Use genetic traits to draw conclusions  
*Before you begin… tell students to bring in a picture of a parent or sibling as well as themselves. As another option, they may bring in a picture of a celebrity and his/her parent.* | Explore the Evidence: What Makes You You?  
Doc: Genetic Traits To Draw Conclusions |
| 13 | Define and compare genetic traits within a species | -DE Engage Getting to Know: Similarities of Parents and Offspring  
Google Slides Unit Presentation |
| 14 | Observe and describe environmental effects on traits | -DE Explore: The Quest for the Perfect Tomato  
-NJCTL: Mustard Seed Lab setup  
-Defined STEM: Organic Farming |
| 15 | Observe how traits are passed from parents to offspring | -DE: Explore - What are Traits?  
-DE: Hands on Activity - Comparing Traits  
-Google Slides Unit Presentation |
| 16 | Describe variations of traits among offspring | -DE Reading: A Litter of Kittens  
-DE: Inheriting Genetic Traits  
-Virtual Lab: Inherited Traits Virtual Lab  
-Mystery Science: Animals in the future  
-Google Slides Unit Presentation |
| 17 | Determine offspring of a set of parents via Slythy Tove Lab | -DE Reading: Parents and Offspring  
-Google Slides Unit Presentation  
-NJCTL: What Kind of Slythy Tove Lab  
-NJCTL: "Create Mustard Seed Experiment Conditions" |
| 18 | Observe environmental effects on a living organism’s traits | -Google Slides Unit Presentation  
-NJCTL: Mustard Seed Observation  
-Defined STEM: Naturalist Monarch Butterflies |
| 19 | Evaluate environmental effects on species | -DE Reading: The Color of Apples  
-DE: Natural Selection  
-Virtual Lab: Lizard Evolution Virtual Lab  
-Mystery Science: How could you make the biggest fruit in the world?  
-Google Slides Unit Presentation |
| 20 | Distinguish between traits that are inherited and traits that are not inherited. | -DE: A Nature and Nurture Walk in Mendel Park  
-PDF: Inherited vs Acquired Traits  
-Mystery Science: Why are some apples green & some apples red? |
| 21 | Draw final conclusions from mustard seed lab | -NJCTL: Mustard Seed Observations & Conclusion |

**Improve**

Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s).  
-Individuals or groups modify their designs to incorporate feedback.
### Additional Resources

- **Discovery Education: Life Cycle Mobile** In this investigation, students will build a model based on the life cycle of a plant or animal. Students will then compare and contrast their model with other classmates and look for patterns of change in the life cycles. Students will also make predictions based on the life cycles for each animal.
- **Study Jams**: Click on “Plants” or “Animals” to connect to videos on various topics about plants and animals.
- **Teach Engineering (Swim to and from the Sea)**: Exploring fish migration
- **Teach Engineering**: Lessons Activities and Units
- **Design Squad**
- **Design Squad Educators Page**
- **Let’s Hear It For Ladybugs!** This article describes a ladybug life cycle unit that incorporates language arts and science concepts. Students build on their prior knowledge of butterflies as they explore the metamorphosis of ladybugs. To create their final project, clay life cycle models, students synthesize what they learned from live observation and nonfiction texts.
- **Guppies Galore**: Groups of students set up a small freshwater aquarium (made from gallon jars) that feature a male guppy, a female guppy, and a green plant. After the female guppy goes through her pregnancy and gives birth, the students will then observe, over time, the development of the fry into male and female guppies with characteristics similar to the parents.

### Teacher Professional Learning Resources

**NSTA Web Seminar: Teaching NGSS in Elementary School—Third Grade**
The web seminar began with explaining how to unpack the performance expectations in third grade. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science Talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed. The web seminar concluded with an overview of NSTA resources on the NGSS available to teachers by Ted, and a Q & A with Carla, Mary, Kathy and Kimber.

**Teaching NGSS in K-5: Constructing Explanations from Evidence**
Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

**NGSS Core Ideas: Heredity: Inheritance and Variation of Traits**
The presenter was Ravit Golan Duncan of Rutgers University. The program featured strategies for teaching about life science concepts that answer questions such as “How are the characteristics of one generation related to the previous generation?” and “Why do individuals of the same species vary in how they look, function, and behave?” Dr. Duncan began the presentation by discussing the importance of heredity as a disciplinary core idea. She then described how student learning should progress across grade levels and showed examples of common preconceptions. Dr. Duncan also shared strategies and resources for teaching about heredity. Participants had the opportunity to submit their questions and comments in the chat. Visit the [resource collection](#).

**Assessment for the Next Generation Science Standards**
The presenters were Joan Herman, Co-Director Emeritus of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA; and Nancy Butler Songer, Professor of Science Education and Learning Technologies, University of Michigan. Dr. Herman began the presentation by summarizing a report by the National Research Council on assessment for the Next Generation Science Standards (NGSS). She talked about the development of the report and shared key findings. Next, Dr. Songer discussed challenges for classroom implementation and provided examples of tasks that can be used...
with students to assess their proficiency on the NGSS performance expectations. Participants had the opportunity to submit questions and share their feedback in the chat.

**NGSS Crosscutting Concepts: Patterns**

The presenter was Kristin Gunckel from the University of Arizona. Dr. Gunckel began the presentation by discussing how patterns fit in with experiences and explanations to make up scientific inquiry. Then she talked about the role of patterns in NJSLS and showed how the crosscutting concept of patterns progresses across grade bands. After participants shared their ideas about using patterns in their own classrooms, Dr. Gunckel shared instructional examples from the elementary, middle school, and high school levels.

**NGSS Crosscutting Concepts: Structure and Function**

The presenters were Cindy Hmelo-Silver and Rebecca Jordan from Rutgers University. Dr. Hmelo-Silver and Dr. Jordan began the presentation by discussing the role of the crosscutting concept of structure and function within NGSS. They then asked participants to think about the example of a sponge and discuss in the chat how a sponge’s structure relates to its function. The presenters introduced the Structure-Behavior-Function (SBF) theory and talked about the importance of examining the relationships between mechanisms and structures. They also discussed the use of models to explore these concepts. Participants drew their own models for one example and shared their thoughts about using this strategy in the classroom.

UNIT 2

Unit 2: Ecosystems: Group Behavior

Grade: 3rd Grade
Suggested Pacing: 15 days
Domain: Life Science
Discovery TechBook Unit: Various

NJSLS - Science Performance Expectation:

- 3-LS2: Ecosystems: Interactions, Energy, and Dynamics
  - Construct an argument that some animals form groups that help members survive. (3-LS2-1)

NJSLS - Science CrossCutting Concept:

- Cause and Effect
  - Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1)

NJSLS - Science Disciplinary Core Idea:

- LS2.D: 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. (3-LS2-1)

Essential Questions**

**The questions below are suggested EQs to springboard the unit. NJSLS-Science was composed for students to drive learning. Afford children the opportunity to ask the questions and define potential problems.

- What are the advantages/disadvantages of group living?
- How do animal groups differ from one another?
- How and why do organisms interact with their environment and what are the effects of these interactions?

Enduring Understandings & Practices

By the end of this unit, students will understand:

- Animals are either solitary or live in groups.
- Animals cannot spend their entire lives alone; they need each other in order to breed.
- Living in a group has advantages. Living in a group has disadvantages.
- Animal groups form for different reasons.
- Animal groups vary widely in size, even among the same species.
- Different ways that living things interact with one another in the same ecosystem

By the end of this unit, students will be able to:

- Construct an argument with evidence, data, and/or a model. (3-LS2-1)
- Construct an argument with evidence. (3-LS4-3)
Science Grade 3

Prior Learning

Kindergarten:
- 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.

Grade 1:
- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

Grade 2:
- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.
- There are many different kinds of living things in any area, and they exist in different places on land and in water.

Future Learning

Grade 6:
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

Grade 7:
- The geologic time scale interpreted from rock strata provides a way to organize Earth’s history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.

Grade 8:
- Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.
Effective Implementation Strategies

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA).

Assessment

End-of-Unit Performance Assessment:
Performance Task: Students will create a story about an animal suddenly alone or in a new group. Students will write and illustrate their story. *You may wish to motivate students by allowing them to share their stories with younger grades

Please click HERE to access our Unit 2 rubric.

Suggested Hands-On Activities / Classroom Inquiries:
Solidarity versus Group Lab, Who Has the Advantage? Lab, Animals Living Together, Surviving in a Changing Ecosystem

The following is a recommended progression to support the development of understandings necessary for the performance expectation(s). Teachers should consider multiple data points when making instructional decisions.

(Please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)

<table>
<thead>
<tr>
<th>Experience</th>
<th>Objective/Desired Outcome</th>
<th>Classwork Resources</th>
</tr>
</thead>
</table>
| Student Questioning         | To spark curiosity and amplify engagement, students should formulate their own questions regarding the phenomena/topic of the unit. They should then be afforded an opportunity to investigate them (and others that emerge) throughout the unit in order to heighten authenticity and deepen their knowledge and understanding. Teachers may use these questions as a pre-assessment and as a means to guide future learning experiences. | -KWHLAQ: Organier  
-KWHLAQ: Google Slides  
-Science Questioning Graphic Organizer  
-QFT: Formulating effective questions  
-Ideas For Phenomena To Question:  
NGSS Phenomena  
#ProjectPhenomena |
### Science Grade 3

|   | Determine ways different animals live | -Google Slides Unit Presentation  
-DE: [Interactions in Ecosystems Engage](#) |
|---|--------------------------------------|------------------------------------------------------------------|
| 2 | Explain how animals interact within a food chain or web | -Google Slides Unit Presentation  
-DE: [Interactions in Ecosystems Explore](#)  
-DE: [Interactive game: Make a Food Chain, Needs of Living Things, Parts of a Food Chain](#) |
| 3 | Distinguish roles within a group | -Animal Groups Word List  
-DE: [A Busy Home: Examining a BeeHive](#)  
-Busy as a Bee Guess the Caste |
| 4 | Explain how situations change when individuals work in a group as opposed to working alone | -NJCTL: [Solitary vs. Group Lab](#)  
(Solitary vs. Group Lab Teacher's Notes)  
-Biodiversity: Everything Counts! |
| 5 | Define group living and identify its advantages | -Google Slides Unit Presentation  
-DE: [Communities and Interdependence](#)  
-DE: [Habitat Characteristics](#) |
| 6 | Determine who has the advantage (group or individual) in a given situation | -NJCTL: [Who Has the Advantage? Lab](#)  
(Who Has the Advantage? Teacher’s Notes)  
-DE: [Predator and Prey](#) |
| 7 | Identify the disadvantages of group living | -Google Slides Unit Presentation  
-Group Behavior Games |
| 8 | Advantages vs disadvantages of group living | -Google Slides Unit Presentation  
-DE: [Hands-On: Animals Living Together](#)  
-Group Behavior Games |
| 9 | Determine differences between groups and survival methods | -Google Slides Unit Presentation  
-DE: [Hands-On: Surviving in a Changing Ecosystem](#) |
| Improve | Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s). | -Individuals or groups modify their designs to incorporate feedback. |

### Additional Classroom Resources

- **Study Jams**: Click on “Plants” or “Animals” to connect to videos on various topics about plants and animals.
- **Teach Engineering**: Lessons Activities and Units
- **Teach Engineering (Environmental Interactions)**: Creating interaction webs
- **Design Squad**
- **Design Squad Educators Page**
- **Muskox Maneuvers**: In this activity, students create a physical model showing how muskoxen work together as a group to protect their young from predators (wolves).
### Science Grade 3

- **Musk Ox Save Calf from Wolves Video** In this short video, Arctic wolves attack a musk ox calf on Canada's Ellesmere Island, but the herd rushes to its defense by forming a defensive circle around the calves.

- **Insects That Work Together** This nonfiction book summarizes how some insects work together to increase their chances of survival. Details are provided on four types of insects: honeybees, hive wasps (hornets, yellow jackets, and paper wasps), termites, and ants. A short section on insect migration and building a hive model are also included.

- **Battle at Kruger: Water Buffalo Save Calf from Lions Video** This short video captures student imagination and elicits ideas about how groups of organisms work together for survival. The video contains real footage of a pack of lions attack on a water buffalo calf. The footage filmed by amateur tourists features a surprising plot twist (featuring a crocodile), and exciting finale with the water buffalo herd rescues the calf and chases off the lions.

### Teacher Professional Learning Resources

| NGSS Crosscutting Concepts: Stability and Change |
| --- | |
| The presenter was Brett Moulding, director of the Partnership for Effective Science Teaching and Learning. Mr. Moulding began the web seminar by defining stability and change and discussing the inclusion of this concept in previous standards documents such as the National Science Education Standards (NSES). Participants brainstormed examples of science phenomena that can be explained by using the concept of stability and change. Some of their ideas included Earth's orbit around the Sun, carrying capacity of ecosystems, and replication of DNA. Mr. Moulding then discussed the role of stability and change within NGSS. Participants again shared their ideas in the chat, providing their thoughts about classroom implementation of this crosscutting concept. |

| NGSS Core Ideas: Ecosystems: Interactions, Energy, and Dynamics |
| --- | |
| The presenters were Andy Anderson and Jennifer Doherty of Michigan State University. This was the ninth web seminar in a series focused on the disciplinary core ideas that are part of the Next Generation Science Standards (NGSS). The program featured strategies for teaching about life science concepts that answer questions such as "How do organisms interact with the living and nonliving environments to obtain matter and energy?" and "How do matter and energy move through an ecosystem?" Dr. Anderson and Dr. Doherty began the presentation by discussing the two main strands of the ecosystems disciplinary core idea: community ecology and ecosystem science. They talked about common student preconceptions and strategies for addressing them. Next, Dr. Anderson and Dr. Doherty shared learning progressions for this core idea, showing how student understanding builds from elementary through high school. Last, the presenters described approaches for teaching about ecosystems and shared resources to use with students. Visit the resource collection. |

| NGSS Core Ideas: Biological Evolution: Unity and Diversity |
| --- | |
| The presenter was Cindy Passmore. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?" Following an overview of the web seminar's main topics to be covered, Cindy Passmore discussed what makes LS4 a "core" idea and how its subsections A, B, C and D should be approached as being related to one another, rather than sequenced elements to be taught one after the other. Cindy then spoke about the concept of using models to explain and make sense of the natural world through two detailed examples about the Peppered moth and the Galapagos finches. View the resource collection. |

**Bozeman Science**
# UNIT 3

## Unit 3: Engineering Design

<table>
<thead>
<tr>
<th>Grade:</th>
<th>3rd</th>
<th>Pacing:</th>
<th>15 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain:</td>
<td>Engineering Design</td>
<td>Discovery TechBook Unit:</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### NJSLS - Science Performance Expectations:

- **3-5-ETS1: Engineering Design**
  - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)
  - 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. (3-5-ETS1-2)
  - 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. (3-5-ETS1-3)

### NJSLS - Science CrossCutting Concepts:

- **Influence of Engineering, Technology, and Science on Society and the Natural World**
  - People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)
  - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

### NJSLS - Science Disciplinary Core Ideas:

- **ETS1.A: 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. (3-5-ETS1-1)

- **ETS1.B: 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. (3-5-ETS1-2)
  - 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. (3-5-ETS1-2)
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

- **ETS1.C: 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. (3-5-ETS1-3)

### NJSLS - Technology:

- **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming**
  - Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models. (8.2.5.C.4)
  - Explain the functions of a system and subsystems. (8.2.5.C.5)
  - Work with peers to redesign an existing product for a different purpose. (8.2.5.C.7)
## Essential Questions**

**The questions below are suggested EQs to springboard the unit. NJSLS-Science was composed for students to drive learning. Afford children the opportunity to ask the questions and define potential problems.**

- How would you apply technological design and problem-solving methods in the development of inventions and innovations?
- Why is economic interdependence a function of geography?

## Enduring Understandings & Practices

**By the end of this unit, students will understand:**
- Mathematics and engineering play a significant role in product design.
- A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.
- Distribution and migration of human populations impact culture, economic interdependence, and settlement patterns.

**By the end of this unit, students will be able to:**
- 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. (3-5-ETS1-1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)
- 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. (3-5-ETS1-3)

## Prior Learning

**K-2 Engineering Design:**
- 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.
- 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.
- Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

## Future Learning

**Middle School Engineering Design**
- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

## Effective Implementation Strategies

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
● Use project-based science learning to connect science with observable phenomena.
● Structure the learning around explaining or solving a social or community-based issue.
● Provide ELL students with multiple literacy strategies.
● Collaborate with after-school programs or clubs to extend learning opportunities.
● Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA).

### Assessment

**Performance Task**: Backpack Product Design: You are a creative designer working for a company that produces backpacks. You are responsible for designing a new pack that stands out in the crowd. Your goal is to create a unique backpack to present to your company’s marketing team for manufacturing.

Please click HERE to access our 2017 - 2018 K-5 Design Rubric.

The following is a recommended progression to support the development of understandings necessary for the performance expectation(s).

(please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)

<table>
<thead>
<tr>
<th>Experience</th>
<th>Objective/Desired Outcome</th>
<th>Classwork Resources</th>
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</table>
| **Student Questioning Opportunity** | To spark curiosity and amplify engagement, students should formulate their own questions regarding the phenomena/topic of the unit. They should then be afforded an opportunity to investigate them (and others that emerge) throughout the unit in order to heighten authenticity and deepen their knowledge and understanding. Teachers may use these questions as a pre-assessment and as a means to guide future learning experiences. | -KWHLAQ: Organizer  
-KWHLAQ: Google Slides  
-Science Questioning Graphic Organizer  
-QFT: Formulating effective questions  
-Ideas For Phenomena To Question: NGSS Phenomena #ProjectPhenomena |
| 1 | Observe and describe the components of the Engineering Design Process. | -Engineering Design Process Outline  
-Design Squad: Kid Engineer  
-DE: Discovery Science Alliance: Building Bridges |
| 2 | Ask questions about a problem or situation. | -Unit Portfolio page 2  
-Defined STEM: Backpack Design (To access video, please click “LogIn With Google” on the left-hand side of the screen.)  
-DefinedSTEM: Research Resources Scroll to the bottom of the page and click “Research Resources” to access (also found at the bottom of student view page under “Supporting Articles”) |
|   | Imagine a solution by brainstorming ideas and choosing the best options. | Unit Portfolio page 3  
Each team member should draw and label a possible solutions to this problem independently. Then in a group, students will discuss the various solutions they came up with and which ideas to use in their product. Ideas should vary based on their research. |
|---|---|---|
| 4 | Plan for the solution by drawing a diagram and gathering needed materials. | Unit Portfolio page 4  
-Design Squad: How to Sketch  
Students will choose one or a combination of the ideas in their group and draw a final sketch of the product they will make. Students should label all of the parts with materials that they will use. |
| 5 | Create, follow, and test out the plan. | Unit Portfolio page 5 (create), page 6 (create, cont), page 7 (test)  
-Students will use their plan as the blueprint to creating the product. As students work, they should be taking notes of the parts that are going to work well, and which parts might still have problems. (Unit Portfolio page 4)  
-As students are creating their product, they should be preparing for their pitch to the "marketing team." During the test stage, students will present their pitch and design to another group for feedback.  
-Students will test their product by sharing it with another group to give feedback on each other’s products. Give students time to share their product with others. |
| 6 | Improve your solution by determining what can work better and repeating steps 1-5 to make changes. | Unit Portfolio page 8  
-Students should reflect on feedback given by peers and evaluate how to improve their design  
-Provide students with time to improve design by reflecting on the Engineering Design Process, if applicable.  
-As a group students should discuss and reflect on: how well their backpack solved their problem, what could have made it better |
| 7 | Present your product to an audience. | Design Squad: Design Presentations  
DefinedSTEM: Product Presentation  
-Students will present backpack solution to a “marketing team” to share their findings and final product. After the presentation, the “marketing team” should ask students focusing on the Engineering Design Process components, particularly the improve stage. |
|   | Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s). | -Individuals or groups modify their designs to incorporate feedback. |
## Additional Classroom Resources

- **Study Jams**: Click on “Scientific Inquiry” to connect to videos on various topics about plants and animals.
- **Teach Engineering**: Lessons Activities and Units
- **Teach Engineering (Race to the Top: Modeling Skyscrapers)**
- **Teach Engineering (Straw Towers to the Moon)**
- **Teach Engineering (Design Packing to Safely Mail Raw Spaghetti)**
- **Teach Engineering (Recycled Towers)**
- **Design Squad**
- **Design Squad: Fidgit Game**
- **Design Squad Educators Page**

## Teacher Professional Learning Resources

### NSTA Web Seminar: Teaching NGSS in Elementary School—Third Grade

The web seminar began with explaining how to unpack the performance expectations in third grade. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science Talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed. The web seminar concluded with an overview of NSTA resources on the NGSS available to teachers by Ted, and a Q & A with Carla, Mary, Kathy and Kimber.

### Assessment for the Next Generation Science Standards

The presenters were Joan Herman, Co-Director Emeritus of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA; and Nancy Butler Songer, Professor of Science Education and Learning Technologies, University of Michigan. Dr. Herman began the presentation by summarizing a report by the National Research Council on assessment for the Next Generation Science Standards (NGSS). She talked about the development of the report and shared key findings. Next, Dr. Songer discussed challenges for classroom implementation and provided examples of tasks that can be used with students to assess their proficiency on the NGSS performance expectations. Participants had the opportunity to submit questions and share their feedback in the chat.

### Teaching NGSS in K-5: Constructing Explanations from Evidence

Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena. View the [resource collection](#).

### Engineering Design as a Core Idea

The presenter was Cary Sneider, Associate Research Professor at Portland State University in Portland, Oregon. The seminar focused on the Core Idea of Engineering, led by Cary Sneider, Associate Research Professor at Portland State University. Cary explained the overall NGSS engineering components for K-2, MS and HS, and went through a number of practical examples of how teachers could develop modules and investigations for their students to learn them. Cary also spoke about the ways in which teachers could include cross-cutting engineering concepts to a number of classroom subjects. The seminar concluded with an overview of NSTA resources about NGSS available to teachers by Ted, and a Q & A session with Cary. Visit the [resource collection](#).

### Bozeman Science

UNIT 4

Unit 4: Biological Evolution

<table>
<thead>
<tr>
<th>Grade:</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggested Pacing:</td>
<td>30 days</td>
</tr>
<tr>
<td>Domain:</td>
<td>Life Science</td>
</tr>
<tr>
<td>Discovery TechBook Unit:</td>
<td>Survival and Extinction</td>
</tr>
</tbody>
</table>

**NJSLS - Science Performance Expectations:**

- **3-LS4:** Biological Evolution: Unity and Diversity
  - Analyze and interpret data from fossils to provide evidence of the organisms and environments in which they lived long ago. (3-LS4-1)
  - 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. (3-LS4-2)
  - 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. (3-LS4-3)
  - 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. (3-LS4-4)

**NJSLS - Science CrossCutting Concepts:**

- **Cause and Effect:**
  - Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1), (3-LS4-3)
- **Scale, Proportion, and Quality:**
  - Observable phenomena exist from very short to very long time periods. (3-LS4-1)
- **Systems and System Models:**
  - A system can be described in terms of its components and their interactions. (3-LS4-4)
- **Interdependence of Science, Engineering, and Technology:**
  - Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-3)
- **Scientific Knowledge Assumes an Order and Consistency in Natural System:**
  - Science assumes consistent patterns in natural systems. (3-LS4-1)

**NJSLS - Science Disciplinary Core Ideas:**

- **LS2.C:** 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. (secondary to 3-LS4-4)

- **LS4.A:** Evidence of Common Ancestry and Diversity
  - Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3-LS4-1)
  - Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

- **LS4.B:** Natural Selection
  - Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

- **LS4.C:** Adaptation
  - For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

- **LS4.D:** Biodiversity and Humans
  - Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)
## Essential Questions**

**The questions below are suggested EQs to springboard the unit. NJSL-S-Science was composed for students to drive learning. Afford children the opportunity to ask the questions and define potential problems.**

- How and why a habitat of an organism can affect its survival over time?
- What are examples of adaptations to increase survival?
- What happens to a species if it cannot survive changes in the environment?
- What information about the environment can we learn from fossils?
- What are some positive and negative impacts humans have on the environment?

## Enduring Understandings & Practices

<table>
<thead>
<tr>
<th>By the end of this unit, students will understand:</th>
<th>By the end of this unit, students will be able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Habitats include biotic and abiotic factors.</td>
<td>● Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS4-1)</td>
</tr>
<tr>
<td>● Fossils indicate changes of environments on Earth.</td>
<td>● Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)</td>
</tr>
<tr>
<td>● Adaptations help organisms survive.</td>
<td>● Construct an argument with evidence. (3-LS4-3)</td>
</tr>
<tr>
<td>● Environmental changes affect an organism’s survival.</td>
<td>● 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. (3-LS4-4)</td>
</tr>
</tbody>
</table>

## Prior Learning:

### Kindergarten:
- 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.
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (secondary)

### Grade 2:
- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.

## Future Learning:

### Grade 4:
- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.
- 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. (secondary)

### Grade 6:
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
Science Grade 3

- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
- Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health.

### Effective Implementation Strategies

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles ([http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)).

### Assessment

**End-of-Unit Performance Assessment:**

**Performance Task:** Students will create a suitable environment for an endangered species to survive. Students will create a model of the environment and explain how design supports survival. *Suggestion: Have students present their projects and then provide feedback to their peers.*

Please click [HERE](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA) to access our 2017 - 2018 K-5 Design Rubric.

**Suggested Hands-On Activities / Classroom Inquiries:** Compost Time Capsule, Adaptation Lab, Camouflage Lab, Make an Imprint Activity, Constructing a Fossil Map

The following is a recommended progression to support the development of understandings necessary for the performance expectation(s). Teachers should consider multiple data points when making instructional decisions.

*(Please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)*
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<th>Objective/Desired Outcome</th>
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| Student Questioning Opportunity | To spark curiosity and amplify engagement, students should formulate their own questions regarding the phenomena/topic of the unit. They should then be afforded an opportunity to investigate them (and others that emerge) throughout the unit in order to heighten authenticity and deepen their knowledge and understanding. Teachers may use these questions as a pre-assessment and as a means to guide future learning experiences. | - **KWHLAQ**: Organizer  
- **KWHLAQ**: Google Slides  
- **Science Questioning Graphic Organizer**  
- **QFT**: Formulating effective questions  
- **Ideas For Phenomena To Question**: NGSS Phenomena  
  #ProjectPhenomena  

| 1 | Observe and describe how items change over time | - **DE** Compost  
- **NJCTL**: Compost Time Capsule *(Teacher's Notes)*  
- Google Slides Unit Presentation: *Set up Compost Time Capsule* |
| 2 | Explain that a habitat is part of an ecosystem; identify biotic and abiotic factors of the ecosystem | - **DE** Reading: Where Animals Live  
- **DE** Habitats: Homes for Living Things  
- Google Slides Unit Presentation |
| 3 | Describe changes in an ecosystem that can affect how well an organism can survive. | - **DE** Reading: Why Organisms Need a Habitat  
- **DE** Animal Communities  
- **DE** Changes in Habitats  
- Google Slides Unit Presentation |
| 4 | Predict characteristics that organisms have that enable them to survive in their specific environments. | - **DE** Needs of Living Things  
- **DE** How a Habitat Meets Needs  
- **DE** Explore: Habitat Characteristics  
  Student Recording Sheet  
- **Defined STEM**: Nature Center Education: Animal Adaptations  
- Google Slides Unit Presentation |
| 5 | Describe adaptations that organisms have to be able to survive changes in their environment. | - **DE** Explore: Natural Selection, Adaptations, and Environmental Changes  
- **DE**: Animal Adaptations  
- **Lab**: Adaptation Lab  
- **Defined STEM**: Nature Center Education: Animal Adaptations  
- Google Slides Unit Presentation |
| 6 | Determine the importance of camouflage as a useful adaptation for many organisms. | - **DE** Camouflage and Mimicry  
- **DE** Elaborate: Moth of a Different Color  
- **NJCTL**: Camouflage Lab *(Teacher's Notes)*  
- Google Slides Unit Presentation |
| 7 | Identify fossils as a way to determine evidence that proves the existence of dinosaurs. | - **DE** Reading: Gradual Change versus Rapid Change  
- **DE**: How Fossils Help Us Learn about Earth's History  
- Google Slides Unit Presentation |
<table>
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<tr>
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<th>Activity / Assignment</th>
<th>Additional Resources</th>
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| 8    | Appreciate the difference between a body and trace fossil. | -DE: The Types of Fossils and How They are Formed, Body Fossils, Trace Fossils  
-DE: Make an Imprint Activity  
-Google Slides Unit Presentation |
| 9    | Evaluate how fossils are formed and excavated. Describe the kinds of information they can tell us. | -DE Explore: Extinction  
-Mystery Science: How do we know what dinosaurs looked like?  
-Google Slides Unit Presentation |
| 10   | Compare and contrast fossils and their modern day relatives. | -NJCTL: Constructing a Fossil Map Activity (Answer Key)  
-Google Slides Unit Presentation |
| 11   | Compare and contrast fossils and their modern day relatives. | -DE: Fossils and the Study of Evolution  
-Great Transitions Interactive, EFossils, ESkeletons  
-Google Slides Unit Presentation |
| 12   | Draw conclusions about the extinction of dinosaurs (because of adaptation to environment) | -DE Explore: Extinction  
-DE: From Dinosaurs to Today: Issues of Extinction  
-Google Slides Unit Presentation |
| 13   | Describe how the actions of humans sometimes cause disturbances to ecosystems. | -DE Explore: Exploring Ecosystems  
-DE: Humans’ Role in Nature's Balance  
-Google Slides Unit Presentation |
| 14   | Analyze your time capsules to describe how different items change over time. | -NJCTL: Compost Time Capsule  
-Google Slides Unit Presentation |
| 15   | End of unit performance assessment | -Performance Task  
*Have students present their projects and then provide feedback to their peers.* |
|      | Extension Possible extension project: Identify some positive changes humans can make to take care of our planet. | -DE: Why Should We Care?  
-NJCTL: Small Change, Big Range Activity  
-Google Slides Unit Presentation |
|      | Improve Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s). | -Individuals or groups modify their designs to incorporate feedback. |

**Additional Classroom Resources**

- **Study Jams**: Click on “Ecosystems” to connect to videos on various topics about ecosystems.
- **Teach Engineering**: Lessons Activities and Units  
- **Teach Engineering (Environments and Ecosystems)**  
- **Teach Engineering (Swinging With Style)**  
- **Design Squad**  
- **Design Squad Educators Page**  
- **Mass Environmental Change**: In this lesson, students explore what happens to organisms when they cannot meet their needs due to changes in the environment. They categorize scenario cards representing different changes to an environment, then discuss in a whole group. Using what they have learned, they write about how changes to the environment can affect organisms. The resource link takes you to a full unit titled Effects of Changes in an Environment on the Survival of Organisms, of which Mass Environmental Change is a lesson.  
- **A Walk in the Desert (Biomes of North America)** This nonfiction text describes the climate, soil, plants and animals of the North American deserts. It provides detailed information on how plants and animals adapt and survive there.
Science Grade 3

- **A Walk in the Deciduous Forest (Biomes of North America):** This nonfiction text describes the climate, soil, plants and animals of the North American deciduous forests. It provides detailed information on how plants and animals adapt and survive there.
- **A Walk in the Rain Forest (Biomes of North America):** This nonfiction text describes the climate, soil, plants and animals of the North American rainforests. It provides detailed information on how plants and animals adapt and survive there.
- **A Walk in the Prairie (Biomes of North America):** This nonfiction text describes the climate, soil, plants and animals of the North American prairies. It provides detailed information on how plants and animals adapt and survive there.
- **A Walk in the Tundra (Biomes of North America):** This nonfiction text describes the climate, soil, plants and animals of the North American tundra. It provides detailed information on how plants and animals adapt and survive there.
- **A Walk in the Boreal Forest (Biomes of North America):** This nonfiction text describes the climate, soil, plants and animals of the North American boreal forests. It provides detailed information on how plants and animals adapt and survive there.
- **A Journey into the Ocean (Biomes of North America):** This nonfiction text describes the organisms and features of the ocean environment. It provides detailed information on how plants and animals adapt and survive there.
- **Journey Into an Estuary (Biomes of North America):** This nonfiction text describes the features and plants and animals of North American estuaries. It provides detailed information on how plants and animals adapt and survive there.

**Teacher Professional Learning Resources**

The presenters were Charles W. (Andy) Anderson and Joyce Parker from Michigan State University. Dr. Anderson and Dr. Parker began the web seminar by discussing the role of energy and matter as a crosscutting concept. They talked about energy and matter at different scales, from the atomic to the macroscopic. The presenters shared information about how students learn about this crosscutting concept and how to address preconceptions. They then described instructional strategies such as modeling that can help students better understand the flow of energy and matter.

**NGSS Crosscutting Concepts: Scale, Proportion, and Quantity**
The presenters were Amy Taylor and Kelly Riedinger from the University of North Carolina Wilmington. Dr. Taylor began the presentation by discussing the definition of scale. Next, Dr. Riedinger talked about the role of scale, proportion, and quantity in NGSS. Participants shared their own experiences teaching about scale in the classroom before the presenters described additional instructional strategies that can provide students with a real-world understanding of this crosscutting concept. Dr. Taylor and Dr. Riedinger showed examples of activities from elementary, middle, and high school. They shared video clips and other resources that can help educators build their capacity for teaching about scale.

**NGSS Core Ideas: Ecosystems: Interactions, Energy, and Dynamics**
The presenters were Andy Anderson and Jennifer Doherty of Michigan State University. This was the ninth web seminar in a series focused on the disciplinary core ideas that are part of the Next Generation Science Standards (NGSS). The program featured strategies for teaching about life science concepts that answer questions such as "How do organisms interact with the living and nonliving environments to obtain matter and energy?" and "How do matter and energy move through an ecosystem?" Dr. Anderson and Dr. Doherty began the presentation by discussing the two main strands of the ecosystems disciplinary core idea: community ecology and ecosystem science. They talked about common student preconceptions and strategies for addressing them. Next, Dr. Anderson and Dr. Doherty shared learning progressions for this core idea, showing how student understanding builds from elementary through high school. Last, the presenters described approaches for teaching about ecosystems and shared resources to use with students. Visit the resource collection.

**Bozeman Science**
UNIT 5

Unit 5: Forces & Interactions

Grade: 3rd  Suggested Pacing: 45 days
Domain: Physical Science  Discovery TechBook Unit: Forces and Motion, Electricity and Magnetism

NJSLS - Science Performance Expectations:

- **3-PS2: Motion and Stability: Forces and Interactions**
  - Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (3-PS2-1)
  - Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion. (3-PS2-2)
  - Ask questions to determine cause and effect relationships of electrical or magnetic interactions between two objects not in contact with each other. (3-PS2-3)
  - Define a simple design problem that can be solved by applying scientific ideas about magnets. (3-PS2-4)

- **3-5-ETS1: Engineering Design**
  - 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. (3-5-ETS1-2)
  - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of model or prototype that can be improved. (3-5-ETS1-3)

NJSLS - Science CrossCutting Concepts:

- **Patterns**
  - Patterns of change can be used to make predictions. (3-PS2-2)

- **Cause and Effect**
  - Cause and effect relationships are routinely identified. (3-PS2-1)
  - Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

- **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. (3-PS2-4)

NJSLS - Science Disciplinary Core Ideas:

- **PS2.A: 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. (3-PS2-1)
  - 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.) (3-PS2-2)

- **PS2.B: Types of Interactions**
  - Objects in contact exert forces on each other. (3-PS2-1)
  - 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. (3-PS2-3), (3-PS2-4)
**Essential Questions**

**The questions below are suggested EQs to springboard the unit. NJSLScience was composed for students to drive learning. Afford children the opportunity to ask the questions and define potential problems.**

- How and why do objects move?
- How can one explain and predict interactions between objects and within systems of objects?
- How can one predict an object’s continued motion, changes in motion, or stability?

**Enduring Understandings & Practices**

By the end of this unit, students will understand:

- Forces are pushes and pulls.
- Motion occurs in predictable patterns.
- The cause and effect relationships of electric interactions.
- The cause and effect relationships of magnetic interactions.
- Magnets can be used to solve problems.
- How different forces and combinations of forces will affect the motion of an object.
- Why a certain force has a particular effect on an object.

By the end of this unit, students will be able to:

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)
- 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. (3-PS2-1)
- 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. (3-PS2-2)
- Science findings are based on recognizing patterns. (3-PS2-2)
- Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

**Prior Learning:**

**Kindergarten:**

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of the object's motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull causes things speed up or slow down more quickly.

**Grade 1:**

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (secondary)

**Future Learning:**

**Grade 4:**

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when water meets a beach.
- Waves of the same type can differ in amplitude (height) and length (the spacing between wave peaks).
Science Grade 3

- 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. (secondary)

Grade 5:
- The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.

Grade 6:
- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton’s third law).
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, the object’s motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.
- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
- This model of the solar system can explain eclipses of the sun and the moon. Earth’s spin axis is fixed in direction over the short term but is tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
- Water continually cycles among land, ocean, and the atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- The complex patterns of the changes in the movement of water in the atmosphere are determined by winds, landforms, and ocean temperatures and currents; which are major determinants of local weather patterns.
- Global movements of water and its changes in form are propelled by sunlight and gravity.
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.
- Water’s movements—both on land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations.
- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.
- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.
- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).

Effective Implementation Strategies

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
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- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

### Assessment

**End-of-Unit Performance Assessment:**

*(Performance Assessment)* Your family cat just had kittens, and now is too busy taking care of them to catch any mice that might sneak into your house! Your job is to build a mousetrap that will help catch mice without hurting them, so they can be set free outside. The mousetrap must include 2 of the 3 main forces you learned about: **Push, Pull, and Magnets**. It will also be important to keep in mind the forces of gravity and friction as you will want your mousetrap to work quickly!

*Please click [HERE](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA) to access our Integrated Math/Science Rubric.

### Please note: Students will receive a separate math and science grade for this PBA based on the rubrics. For scoring information, please click [HERE](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

**Suggested Hands-On Activities / Classroom Inquiries:**

Distance, Time, and Speed Lab, It’s Game time, Balanced and Unbalanced Forces, Making Things Move, Predicting Motion Lab, Pendulum Motion Lab, Gravity Learning Lab, Magnetic Interactions Lab, Magnetic Interactions, Electricity Lab

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### The following is a recommended progression to support the development of understandings necessary for the performance expectation(s). Teachers should consider multiple data points when making instructional decisions.

*(Please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)*

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-DE: Speed Video
-Science Questioning Graphic Organizer
-QFT: Formulating effective questions
-Ideas For Phenomena To Question: NGSS Phenomena #ProjectPhenomena` |
| 1 | Appreciate speed as a measure of time and distance measurement; complete speed lab *Students need to wear sneakers today!* | `-DE: Speed video
-NJCTL: Distance, Time and Speed Lab, (Teacher’s Notes)` |
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| 2 | Appreciate ways that force affects motion | -DE Reading: May the Force Be With You  
-DE Engage: What is a force? |
| 3 | Forces and Motion Review - Push/pull; motion | -DE Explore: What is a force? 
-Mystery Science: What makes a bridge so strong?  
-Defined STEM: Golden Gate Bridge Project  
-Google Slide Unit Presentation |
| 4 | Evaluate the effects of balanced and unbalanced forces | -DE: Force exploration  
-DE Reading: It’s Game Time  
-Mystery Science: How can you win a game of tug of war?  
*Play marble game from reading passage* |
| 5 | Explain how there is the force of gravity that pulls down and the force of the air pushing up on the ping pong ball that keep it balanced. | -DE: Balance  
-DE: Balanced Force  
-NJCTL: Balanced and Unbalanced Forces Lab (Teacher’s Notes) |
| 6 | Describe friction as a force that always acts against an object’s motion when two objects rub against one another. | -DE: A World Without Friction and a World of a Baseball  
-Mystery Science: How can you go down a slide faster?  
-Google Slide Unit Presentation |
| 7 | Collect data on forces that affect pulling weight. | -DE: Virtual Lab Pulling Your Weight  
-Google Slide Unit Presentation |
| 8 | Define net forces as the total force applied to an object and identify forces acting against each other. | -Google Slide Unit Presentation  
-DE: Friction-Free Tug of War  
-DE Explore: Hands-on Activity - Play Ball |
| 9 | Determine where force is applied in a given scenario. | -Google Slide Unit Presentation  
-DE Explore: Making Things Move, Student Lab Sheet |
| 10 | Predict the motion of objects due to different forces. | -NJCTL: Predicting Motion Lab (Teacher’s Notes)  
-Defined STEM Performance Task: Data Analyst : Testing Baseball Bats  
-Defined STEM Constructed Response: Metal ans Wooden Baseball Bats  
-Google Slide Unit Presentation |
| 11 | Predict motion from an observation of a moving pendulum and use the pattern to predict future motion. | -Google Slide Unit Presentation  
-DE: Student Activity: How Do Pendulums Work?  
-DE Explore: Pendulum Motion Lab |
| 12 | Describe and identify electrical, gravitational, and magnetic forces as non-contact forces. | -DE Reading: Look Out Below!  
-Google Slide Unit Presentation  
-DE: Gravity Learning Lab |
| 13 | Demonstrate how objects in a magnetic field can be attracted or repelled by the magnet. | -Google Slide Unit Presentation  
-NJCTL: Magnetic Interactions Lab (Teacher’s Notes) |
| 14 | Identify Earth as a magnet with north and south poles and explain how a compass works using magnetism. | -Google Slide Unit Presentation |
### Science Grade 3

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<th>Activity</th>
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| 15     | Discover what magnetic forces and show how magnets interact with each other through attraction and repulsion. | **-NJCTL: Magnetic Racing Lab**  
**-Google Slide Unit Presentation** |
| 16     | Demonstrate how opposite charges (positive and negative) attract each other and identical charges repel each other through static electricity (electrical force). | **-Mystery Science: What can magnets do?**  
**-Google Slide Unit Presentation** |
| 17     | Demonstrate electrostatic forces of attraction and repulsion through charged materials. | **-Google Slide Unit Presentation**  
**-NJCTL: Electricity Lab (Teacher’s Notes)** |
| 18     | Demonstrate understanding of magnetism. | **-NJCTL: Magnet Train Lab**  
**-Google Slide Unit Presentation** |
| 19     | End of Unit Performance Assessment | **-Performance Assessment** |

**Improve**

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<td>Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s).</td>
<td><strong>-Individuals or groups modify their designs to incorporate feedback.</strong></td>
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### Additional Resources

- **How to Win a Tug of War**: This lesson explores the scenario: "There is a tug of war competition with two teams, team A has five players, team B has three players. Team A won. In a second tug of war, team C has three players and team D has five players, but team C won." Students will explore and conduct a solution to the scenario.
- **Study Jams**: Click on “Force and Motion” to connect to videos on various topics about force and motion.
- **Teach Engineering**: Lessons Activities and Units
- **Teach Engineering (Charge It!)**
- **Teach Engineering (How High Can a Super Ball Bounce?)**
- **Design Squad**
- **Design Squad Educators Page**
- **Investigating the Magnetic Force Field**: Calculating the Magnetic Pull of a Magnet by Varying Distances: Students will investigate the magnetic pull of a bar magnet at varying distances with the use of paper clips. Students will hypothesize, conduct the experiment, collect the data, and draw conclusions. As a class, students will then compare each team’s data and their interpretation of the results.
- **Robo Arm**: This fun activity is one of five in a series of space based engineering challenges developed by NASA and Design Squad where students are engaged in implementing the Engineering Design process to build a robotic arm that can lift a cup off a table using cardboard strips, brass fasteners, paper clips, straw, string, tape and a cup. The activity includes an instructor’s guide, questioning techniques, discussion questions, extension activity, a rubric, and 3 short video clips that enhance the purpose of the activity and its relevance to NASA.

### Teaching Professional Learning Resource

**Connections Between Practices in NGSS, Common Core Math, and Common Core ELA**

The presenter was Sarah Michaels from Clark University. In this seminar Dr. Michaels talked about connecting the scientific and engineering practices described in A Framework for K–12 Science Education with the Common Core State Standards in Mathematics and English Language Arts.
Engineering Design as a Core Idea
The presenter was Cary Sneider, Associate Research Professor at Portland State University in Portland, Oregon. The seminar focused on the Core Idea of Engineering, led by Cary Sneider, Associate Research Professor at Portland State University. Cary explained the overall NGSS engineering components for K-2, MS and HS, and went through a number of practical examples of how teachers could develop modules and investigations for their students to learn them. Cary also spoke about the ways in which teachers could include cross-cutting engineering concepts to a number of classroom subjects. The seminar concluded with an overview of NSTA resources about NGSS available to teachers by Ted, and a Q & A session with Cary. Visit the resource collection.

NGSS Core Ideas: Motion and Stability: Forces and Interactions
The presenters were Alicia Alonzo from Michigan State University and Alex Robinson, a teacher at Thornapple Kellogg High School in Middleville, Michigan. The program featured strategies for teaching about physical science concepts that answer questions such as "How can one explain and predict interactions between objects and within systems of objects?" Dr. Alonzo began the presentation by providing an overview of how disciplinary core ideas fit into the overall structure of NGSS. Then she and Mr. Robinson discussed common student preconceptions related to Motion and Stability: Forces and Interactions. They also showed how this disciplinary core idea progresses across grade bands. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers. View the resource collection.

Using the NGSS Practices in the Elementary Grades
The presenters were Heidi Schweingruber from the National Research Council, Deborah Smith from Penn State University, and Jessica Jeffries from State College Area School District. In this seminar the presenters talked about applying the scientific and engineering practices described in A Framework for K–12 Science Education in elementary-level classrooms.

Teaching NGSS in K-5: Constructing Explanations from Evidence
Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena. View the resource collection.

NSTA Web Seminar: NGSS Core Ideas: Motion and Stability: Forces and Interactions
Dr. Alonzo began the presentation by providing an overview of how disciplinary core ideas fit into the overall structure of NGSS. Then she and Mr. Robinson discussed common student preconceptions related to Motion and Stability: Forces and Interactions. They also showed how this disciplinary core idea progresses across grade bands. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers. View the resource collection.

Science Object: Newton’s First Law
This Science Object is the second of four Science Objects in the Force and Motion SciPack. It provides a conceptual and real-world understanding of Newton’s First Law of Motion. All objects will maintain a constant speed and direction of motion unless an unbalanced outside force acts upon it. When an unbalanced force acts on an object, its speed or direction (or both) will change. The tendency of objects to maintain a constant speed and direction of motion (velocity) in the absence of an unbalanced force is known as inertia. Even in the most familiar, everyday situations, frictional forces can complicate the analysis of motion, although the basic principles still apply.

Bozeman Science
# UNIT 6

**TransDisciplinary Unit: Weather, Climate, & Natural Hazards**

<table>
<thead>
<tr>
<th>Grade:</th>
<th>3rd</th>
<th>Suggested Pacing:</th>
<th>45 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain:</td>
<td>Earth &amp; Space Science</td>
<td>Discovery TechBook Unit:</td>
<td>Weather &amp; Climate</td>
</tr>
</tbody>
</table>

## NJSLS - Science Performance Expectations:

- **3-ESS2: Earth’s Systems**
  - Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1)
  - Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)
- **3-ESS3: Earth and Human Activity**
  - Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. (3-ESS3-1)
- **3-5-ETS1: Engineering Design**
  - 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. (3-5-ETS1-2)
  - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of model or prototype that can be improved. (3-5-ETS1-3)

## NJSLS - Science CrossCutting Concepts:

- **Patterns:**
  - Patterns of change can be used to make predictions. (3-ESS2-1), (3-ESS2-2)
- **Cause and Effect:**
  - Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
- **Influence of Engineering, Technology, and Science 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. (3-ESS3-1)

## NJSLS - Science Disciplinary Core Ideas:

- **ESS2.D: Weather and Climate**
  - Scientists record patterns of weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)
  - Climate describes a range of an area’s typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)
- **ESS3.B: Natural Hazards**
  - A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1)

## NJSLS - Technology:

- **8.1 Educational Technology**
  - Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. (8.1.5.A.1)
  - Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks. (8.1.5.E.1)
  - Apply digital tools to collect, organize, and analyze data that support a scientific finding. (8.1.5.F.1)

## Overarching Local/Global Problem:

How do we use building materials to minimize the impact of natural disasters?
### Essential Questions**

**The questions below are suggested EQs to guide the unit. NJSLS-Science was composed for students to drive learning. Afford children the opportunity to ask the question and define potential problems as the unit progresses.**

- How do we use materials to minimize the impact of weather-related hazards?
- How does weather affect daily life?

### Enduring Understandings & Practices

**By the end of this unit, students will understand:**

- humans can take steps to reduce the impacts of natural and weather-related hazards
- the difference between climate and weather
- the use of graphs to determine weather patterns

**By the end of this unit, students will be able to:**

- Represent data in tables and various graphical displays to reveal patterns that indicate relationships (3-ESS2-1)
- 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. (3-ESS3-1)
- Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)

### Prior Learning:

**Kindergarten:**

- 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.
- 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.
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (secondary)

### Future Learning:

**Grade 4:**

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.
- 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. (secondary)

**Grade 5:**

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

### Effective Implementation Strategies
Science Grade 3

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

Assessment

End-of-Unit Performance Assessment: **Culminating Project**: Students will work in collaborative groups to design a structure and test it for impacts of different weather hazards. Students will create a presentation to show how their structure will minimize the impact of weather-related hazards.

Please click [HERE](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA) to access our 2017 - 2018 K-5 Design Rubric.

Hands-On Activities / Classroom Inquiries: “House of Cards,” Weather observation labs, Natural hazard demonstrations (hurricane, tornado, volcano), virtual simulations, Earthquake Lab, Water-resistant roof design

The following progression supports the development of understandings necessary for the performance expectations. Teachers should consider multiple data points when making instructional decisions.

*(Please note: Though listed individually, some experiences may last longer than one class period. Time has been built into the pacing calendar to allot for this.)*

<table>
<thead>
<tr>
<th>Experience:</th>
<th>Daily Objective</th>
<th>Classwork/Resources</th>
</tr>
</thead>
</table>
| Student Questioning Opportunity | To spark curiosity and amplify engagement, students should formulate their own questions regarding the phenomena/topic of the unit. They should then be afforded an opportunity to investigate them (and others that emerge) throughout the unit in order to heighten authenticity and deepen their knowledge and understanding. Teachers may use these questions as a pre-assessment and as a means to guide future learning experiences. | -KWHLAQ: Organizer  
-KWHLAQ: Google Slides  
-Science Questioning Graphic Organizer  
-QFT: Formulating effective questions  
-Ideas For Phenomena To Question: NGSS Phenomena  
#ProjectPhenomena |
|   | TLWD work with partners to design and redesign a house made of cards to demonstrate understanding of the engineering design process | -House of cards experiment (refer to guidelines)  
-Reflection  
-Provide another challenge with the cards and reflect again |
|---|---|---|
| 2 | Pre-assessment;  
*Option: Depending on the students’ prior knowledge of weather, you may wish to include a hands on water cycle experience to introduce the main idea and build schema. | Pre-assessment in Design Portfolio  
Sample water cycle experiences: [http://thewaterproject.org/resources/the_water_cycle](http://thewaterproject.org/resources/the_water_cycle) |
| 3 | TLWD an appreciation of how temperature, moisture, wind speed and direction, and precipitation make up weather in a place | -Go outside (if possible) and challenge kids to describe the weather: what do you describe?  
-What do we notice about the sun, air, water? how could we use tools to help us measure parts of weather?  
-Watch weather report and see what elements are included and what vocab words are used  
-Begin class vocab chart to include words discussed so far  
**DE: About Weather: Engage** |
| 4 | TLWD an appreciation for weather tools by using thermometers to measure temperature of water | -Review parts of weather: what tools can be used to measure weather?  
-Show thermometers and how to use them; record room temp in F and C  
-Predict temperatures of hot and iced water → measure and record  
-Why is it important to be able to measure temperature?  
At what temperature F/C is it “cold” or “hot” to us?  
*Add on to class vocab chart  
-If time: go outside or to other cool/warm spots to measure* |
| 5 | TLWD an appreciation for other tools used to measure data by creating wind anemometers  
*Option: students may also create rain gauges and wind vanes | -Review how therm measures temperature  
-Provide materials for groups to make tools  
-Go outside to measure anemometers by timing rotations per minute  
-How are weather tools useful to meteorologists?  
*Add all weather tools to vocab chart  
**Create weather tools**  
**DE: Weather Data - Engage/Explore**  
**DE: exploring tools** |
| 6 | TLWD an appreciation for water in the air by conducting experiment and analyzing weather data | -Water in the Air Humidity Precipitation Lab  
**Mystery Science: Where do clouds come from?**  
-Introduce idea of humidity to class; the amount of water vapor in the air  
-Student groups each get a sponge, bowl of water, plate, and pipette  
-Predict what will happen if you add water to the sponge  
-Keep adding water until it is saturated |
<table>
<thead>
<tr>
<th>Page</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>TLWD an ability to synthesize their understanding of weather terminology and tools by creating a quiz / game in partnerships</td>
</tr>
<tr>
<td>8</td>
<td>TLWD an understanding of “water-resistant” by testing various materials during design challenge</td>
</tr>
<tr>
<td>9</td>
<td>TLWD an understanding of weather versus climate by watching BrainPop video about climate types and drawing conclusions</td>
</tr>
<tr>
<td>10</td>
<td>TLWD an understanding of different climate types by exploring in TechBook and playing charades</td>
</tr>
<tr>
<td>11</td>
<td>TLWD an understanding of the terminology related to weather by doing RAFT presentations</td>
</tr>
<tr>
<td>12</td>
<td>TLW explore natural disasters by sorting and determining terminology</td>
</tr>
<tr>
<td>13</td>
<td>TLW analyze and model different types of natural hazards-- wind, tornado.</td>
</tr>
<tr>
<td>14</td>
<td>TLW analyze and model different types of natural hazards-- hurricane, water.</td>
</tr>
</tbody>
</table>

- How does this show humidity? (air can hold a certain amount of moisture before it begins to rain)
- How does humid air feel? how does dry air feel?
- Exit ticket (such as Padlet) - describe humidity as though you are explaining to a kindergartner
  *Add term humidity to the vocab chart

- Choose a quiz-making application (see resources)
- Partners can create quiz questions for each vocab word
- Submit quiz with an answer key
- Kids may try each others’ quizzes
- DE About Weather: Explain, Elaborate
- Mystery Science: How can we predict when its going to storm?

- Provide students with a plastic cup and a choice of many 9 sq inch materials (felt, cardboard, wax paper, aluminum foil, popsicle sticks, plastic wrap, cloth) and have them build a “roof” that will withstand water the best
- Test out structures by pouring water over them and checking

- Revisit weather vocab
- Establish definition for weather vs climate
- Watch BrainPop video about climate types, pausing to take notes
  - DE: Type of Climates, Engage

- DE: Types of Climates: Explore, Explain
- DE: Hands-on Climate Charades

- Mystery Science: Why are some places always hot?

- DE: Tornado explorations

- Give groups of 2-3 natural disaster cards and create a chart as a class using all terms (use post-its to easily move them around and create categories) them to sort the words into groups
- Children should explain their justifications for their sort and record it

- Tornado: Discovery Ed: Hands On Tornado
- Ask questions
- DE: Tornado explorations

- Hands on Hurricane
- Ask questions
- Hurricane: DE Hurricane Interact
| 15 | TLW analyze and model different types of natural hazards—earthquakes and volcanoes. | - **Soda Volcano experiment**  
- [http://interactivesites.weebly.com/volcanoes.html](http://interactivesites.weebly.com/volcanoes.html)  
- Discussion: What did you observe during the labs?  
What patterns do you notice when analyzing the maps over several days? |
| 16 | TLW distinguish between weather and non-weather related hazards by using knowledge about weather to redo their sort from Day 11 | - Review what terms relate to “weather”  
- Revisit terms from Day 11 and challenge kids to sort as weather and non-weather |
| 17 | TLW demonstrate the types of weather and hazards that impacts them. | - Provide maps showing a specific hazard (such as hurricanes, tornadoes, flooding, blizzards, all over the world)  
- Draw conclusions about a specific hazard  
- Present findings  
- Draw conclusions as a class  
**Defined STEM:** Weather Reporter: Reducing the Impact of Severe Weather |
| 18 | TLWD an appreciation for which types of hazards are most relevant to Edison, NJ by reflecting which types of storms impact us the most and researching their effects | - What did we notice about where certain weather hazards might be? Which ones could most likely impact us?  
- Research Superstorm Sandy and Hurricane Irene; what happened?  
DE: **Flooding**  
- Kids research and report about the effects of the storms |
| 19 | TLW design a structure and test it for impacts of an earthquake. | - **Earthquake lab**  
- Focus on testing aspect of Engineering Design Process in preparation for upcoming design challenge. |
| 20 | TLW design a structure and test it for impacts of different weather hazards—brainstorm and plan. | - Assign a location  
- Students research location for weather hazards  
- Explore materials  
- Begin brainstorming and planning their structure  
- Follow "Design Project Guidelines" |
| 21 | TLW design a structure and test it for impacts of different weather hazards—create. | - Begin creating structure  
- Follow "Design Project Guidelines"  
- Students may refer to DE throughout design challenge |
| 22 | TLW design a structure and test it for impacts of different weather hazards—test and improve. | - Test, review and improve structure  
- Repeat as needed  
- Follow "Design Project Guidelines" |
| 23 | TLW demonstrate understanding of how to minimize the impact of weather-related hazards by creating a presentation on their structure. | - Work on presentations with groups  
- See “Presentation Guidelines” for more information |
| 24 | TLW demonstrate understanding of how to minimize the impact of weather-related hazards by presenting their structure. | - Students present their presentations to the class  
- Other students will answer questions about presentations and structures |
### Science Grade 3

<table>
<thead>
<tr>
<th>25</th>
<th>TLW reflect on the design process of their structure and how effectively it minimized the impact of weather-related hazards.</th>
<th>Reflect on design process and final product</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPROVE</td>
<td>Students are given time to revise their projects/solutions and finalize their plans based on the feedback of their peers and teacher(s).</td>
<td>Individuals or groups modify their designs to incorporate feedback.</td>
</tr>
</tbody>
</table>

#### Additional Classroom Resources

- **Weather HyperDoc**: Students will analyze how weather works and moves. They will also apply concepts to uncover how severe weather affects the country/community where they live.
- **Study Jams**: Click on "Weather and Climate" to connect to videos on various topics about weather and climate.
- **Teach Engineering**: Lessons Activities and Units
- **Design Squad**
- **Design Squad Educators Page**
- **Weather Science content for Kids and Teens**: The National Weather Service has several education resources available at this website.
- **NOAA Education Resources**: The National Oceanic and Atmospheric Administration (NOAA) provides education resources at this website.

#### Background Information:

- [http://www.weather.com/storms/hurricane](http://www.weather.com/storms/hurricane)

#### Graphing Websites for Day 8:

- [www.online-stopwatch.com](http://www.online-stopwatch.com)

#### Experiments:

- [http://www.weatherwizkids.com/experiments-wind.htm](http://www.weatherwizkids.com/experiments-wind.htm)

#### Videos:

- [https://www.brainpop.com/science/weather/climatetypes/](https://www.brainpop.com/science/weather/climatetypes/)
- [http://www.discoveryeducation.com/connectwithweather/index.cfm](http://www.discoveryeducation.com/connectwithweather/index.cfm)
- [http://www.discoveryeducation.com/Texas-Virtual/index1.cfm](http://www.discoveryeducation.com/Texas-Virtual/index1.cfm)

#### Climate

Hurricane Interactives / Maps
- [http://www.miamisci.org/hurricane/hurricanepopup.html](http://www.miamisci.org/hurricane/hurricanepopup.html)
- [https://www.brainpop.com/science/weather/hurricanes/](https://www.brainpop.com/science/weather/hurricanes/)
- [http://www.nhc.noaa.gov/outreach/games/canelab.htm](http://www.nhc.noaa.gov/outreach/games/canelab.htm)

Tornado Interactives / Maps
- [http://www.pbs.org/wgbh/nova/earth/rate-tornado-damage.html](http://www.pbs.org/wgbh/nova/earth/rate-tornado-damage.html)
- [http://www.scs.sk.ca/science/science/weather/instruments.htm#Barometer](http://www.scs.sk.ca/science/science/weather/instruments.htm#Barometer)

Teacher Professional Learning Resources

**Teaching NGSS in Elementary School—Third Grade**
Carla Zembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director of Michigan Mathematics and Science Centers Network, Kathy Renfrew, K-5 Science Coordinator for VT Agency of Education and Kimber Hershberger, co-author of "What's Your Evidence?" introduced an overview of the NGSS for Third Grade. The web seminar began with explaining how to unpack the performance expectations. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed. Visit the resource collection.

**NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence**
Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

**NGSS Core Ideas: Earth’s Systems**
The presenter was Jill Wertheim from National Geographic Society. The program featured strategies for teaching about Earth science concepts that answer questions such as "What regulates weather and climate?" and "What causes earthquakes and volcanoes?" Dr. Wertheim began the presentation by introducing a framework for thinking about content related to Earth systems. She then showed learning progressions for each concept within the Earth's Systems disciplinary core idea and shared resources and strategies for addressing student preconceptions. Dr. Wertheim also talked about changes in the way NGSS addresses these ideas compared to previous common approaches. Participants had the opportunity to submit questions and share their feedback in the chat.

**Bozeman Science**