MEDFORD LAKES SCHOOL DISTRICT

Science Curriculum Guide

2nd Grade

Written by: Jessica Cona

Approved by the Board of Education August 16, 2017

(Aligned with 2016 New Jersey Student Learning Standards for Science)

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Science Philosophy Statement

The goal of the Medford Lakes School District's science program/curriculum is to produce students who have gained sufficient knowledge of the practices, crosscutting concepts, and core ideas of science and engineering to engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to continue to learn about science throughout their lives. They should come to appreciate that science and the current scientific understanding of the world are the result of many hundreds of years of creative human endeavor.

Given this goal, an integrated science curriculum model should drive the formation of science curriculum because:

- *The nature of science is complex and multidisciplinary.*
- *Learning theory research in science shows expert knowledge base develops better through interdisciplinary connections and not through isolated content.*
- *Effective research-based practices for curriculum and instruction in science and engineering are supported through this approach.*

Nature of Science

The nature of science is complex and multidisciplinary. From research about how scientists work, we know that scientists do not work in isolation in their own house of physics, or biology or chemistry but they reach out and create networks of scientists within and across disciplines who can contribute understanding, share ideas, and critique evidence and explanations. As we see in the science of global climate change, scientists work across the fields of geology, physics, and biology to provide evidence, plan investigations, and develop models to represent new ways to think about Earth systems. Important practices like engaging in argument from evidence, modeling, and communicating information do not occur in isolation but rely on feedback from within and across scientific communities and disciplines. Basing the district's curriculum in an integrated model where the students are engaged with a variety of topics at each grade, focused on the connection of ideas across the domains, enhances the interdisciplinary nature of science.

Learning Theory

In the elementary years, students build their understandings of core concepts across all domains of science. Continuing this model in grades 6-8 better supports student learning in that there will not be a large gap of time in which a student does not engage in a specific discipline. This model takes advantage of current research which recognizes that there is variation across children at a given age and that thinking does not develop along a preset roadmap for each student. It allows middle school students to build on what they know and think they understand from their elementary years with the goal in middle school of helping students to revise their knowledge and understanding about those core ideas. Learning theory research shows expert knowledge base develops better through interdisciplinary real-world connections then through isolated content. This is especially important in middle school where motivation is critical to learning. An integrated and better articulated middle school model science curriculum that reflects what we know currently about how children learn science and how their mastery develops over time promotes deeper learning in science. As we know and understand about how students develop understanding while learning content, it informs teachers' practice; if teachers understand where their students are in their understanding of core ideas, and anticipate what students' misconceptions and struggles may be, they are better able to differentiate instruction and provide scaffolding that allows students to develop an integrated and deeper understanding of the science.

Research Based Science Instruction and Curriculum

Effective science instruction can take many forms but includes similar components. According to the Center on Instruction's 2010 report, *Effective Science Instruction: What does the Research Tell Us?*, research-based effective practices of curriculum and instruction important to science learning are: Motivation, Eliciting Students' Prior Knowledge, Intellectual Engagement; Use of Evidence to Critique Claims, and Sense-Making. The integrated model may be better able to support some of these instructional practices especially if it frames curriculum around engaging, relevant, and real-world interdisciplinary questions that will increase student motivation, intellectual engagement and sense-making. Effective science instruction helps middle school students build their understandings and practices, makes connections among and between core concepts and practices, and links to their prior knowledge. Students in grades 6-8 come to understand the natural world in a more scientifically accurate way and understand the nature of science.

Conclusion

Science curriculum should be thematic with a focus on connections among and between core concepts and practices. This approach reinforces the interdisciplinary nature of science and allows for a sequential progression of skills and concepts. This supports developmentally appropriate teaching and assessments. Each grade level has its own specific standards from each science domain that are seen as stepping stones in the progression of learning about a core idea and that meet a specific level of understanding.

Module #	Module Title	# of Core Lessons	Resources/Instructional Materials	Pacing
#1	*"Relationships in Habitats"*	**5**	Carolina Biological's Building Blocks of Science (2015) *"Ecosystem Diversity Kit"*	6-7 weeks
#2	*"Properties and Changes in Matter"*	**5**	Carolina Biological's Building Blocks of Science (2015) *"Matter Kit"*	6-7 weeks
#3	*"The Earth and Its Changes"*	**7**	TCI's Science Alive! (2015) Grade 2 *"Unit # 3 Earth's Surface"*	6-7 weeks

Grading Expectations Per Trimester	
Classwork	✓ minimum of 15 and maximum of 20
Homework	✓ minimum of 8 and maximum of 10
Quizzes	✓ minimum of 5 and maximum of 7
Tests/Assessment Task	✓ 1-2 per module

Module #1 "Relationships in Habitats"
Why do we see different living things in different habitats? In this unit of study, students develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students also compare the diversity of life in different habitats. The crosscutting concepts of *cause and effect* and *structure and function* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *developing and using models*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-LS4-1, 2-LS2-1, 2-LS2-2, and K-2-ETS1-1.
New Jersey Student Learning Standards/Student Learning Objectives
Make observations of plants and animals to compare the diversity of life in different habitats. *[Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [*Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.*]* **(2-LS4-1)**
Plan and conduct an investigation to determine if plants need sunlight and water to grow. [*Assessment Boundary: Assessment is limited to testing one variable at a time.*] **(2-LS2-1)**
Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.* (2-LS2-2)
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. (K-2-ETS1-1)
Benchmark Assessment: **Ecosystems Diversity Summative Assessment – page 86 in Teacher's Manual**

Unit Sequence	
Part A: *How does the diversity of plants and animals compare among different habitats?*	
Concepts	**Formative Assessment**
• People look for patterns and order when making observations about the world. • There are many different kinds of living things in any area, and they exist in different places on land and in water.	*Students who understand the concepts can:* • Look for patterns and order when making observations about the world. • Make observations (firsthand or from media) to collect data that can be used to make comparisons. • Make observations of plants and animals to compare the diversity of life in different habitats. *(Note: The emphasis is on the diversity of living things in each of a variety of different habitats; assessment does not include specific animal and plant names in specific habitats.)*

Unit Sequence	
Part B: *What do plants need to live and grow?*	
Concepts	**Formative Assessment**
• Events have causes that generate observable patterns. • Plants depend on water and light to grow.	*Students who understand the concepts can:* • Observe patterns in events generated by cause-and-effect relationships. • Plan and conduct an investigation collaboratively to produce data to serve as a basis for evidence to answer a question. • Plan and conduct an investigation to determine whether plants need sunlight and water to grow. *(Note: Assessment is limited to one variable at a time.)*

What It Looks Like in the Classroom

In this unit of study, students explore and compare the diversity of life in different habitats. They develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students learn about cause-and-effect relationships and how an organism's structures are related to the function that each structure performs. Developing and using models plays an important role in students' understanding of structure/function relationships.

To begin this unit's progression of learning, students observe a variety of plants and animals from a variety of habitats in order to compare the diversity of life. Using firsthand observations and media resources, students explore and collect data about different habitats that exist in the world and how plants and animals have structures that help them survive in their habitats. Students need many opportunities to observe many different kinds of living things, whether they live on land, in water, or both. As students learn about the diversity of life, they begin to look for patterns and order in the natural world. As scientists, students will begin to notice patterns in the structures that enable organisms to support their existence in specific habitats. For example, webbed feet enable survival in wetlands; gills enable survival in rivers, lakes, and oceans; and blubber enables survival in polar regions.

The learning progresses as students' focus changes from diversity to commonalities among plants—what plants need in order to grow. Students need opportunities to observe that plants depend on water and light to grow. As they begin to understand that changes in the amount of water and light can affect the growth of plants, they begin to understand that all cause-and-effect relationships generate observable patterns. For example, some plants require very little water to survive, most plants will not grow without sunlight, and most plants need an adequate amount of water to thrive. Students might also observe patterns such as the effects of too much or too little water on a plant and too much or too little light on a plant. In order for students to develop these understandings, they should plan and conduct investigations and collect data, which should be used as evidence to support the idea that all events have causes that generate observable patterns.

Finally, students investigate the roles that animals play in plant reproduction. Students learn that many types of plants depend on animals for pollination and/or for the dispersal of seeds. As students begin to explore the interdependent relationships among plants and animals, they learn that the shape and stability of the structures of organisms are related to their function. For example,

- ✓ As bees collect nectar, portions of their body are designed to collect and then carry pollen from plant to plant.
- ✓ Some seeds are designed to stick to animal fur so that animals can carry them from place to place.

- ✓ Animals eat fruits containing seeds, which are then dispersed through animals' body waste.

Second graders will need multiple opportunities to develop an understanding of the important relationship between structure and function, because they are expected to use engineering design to plan and develop simple models that mimic the function of an animal in dispersing seeds or pollinating plants. Students can use sketches, drawings or physical models to illustrate how the shape of the model helps it function as needed, and they should use evidence to support their design choices. Some common examples of models could include the following:

- ✓ Using Velcro "seeds" and furry material to model how seeds with hooks adhere to animal fur.
- ✓ Using pipe cleaners to gather and distribute "pollen" in a way similar to bees pollinate flowers.
- ✓ In this unit of study, students learn that designs can be conveyed through sketches, drawings, or physical models, and that these representations are useful in communicating ideas for a problem's solutions to other people. As described in the narrative above, students develop simple sketches, drawings, or models that mimic the function of an animal in dispersing seeds or pollinating plants in order to illustrate how the shape of an object helps it function as needed to solve a given problem.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts/Literacy English Language Arts can be leveraged in this unit in a number of ways. Students can participate in shared research using trade books and online resources to learn about the diversity of life in different habitats or to discover ways in which animals help pollinate plants or distribute seeds. Students can record their findings in science journals or use the research to write and illustrate their own books. Students can also learn to take notes in their journals order to help them recall information from experiences or gather information from provided sources. They can add drawings or other visual displays to their work, when appropriate, to clarify ideas, thoughts, and feelings. *Mathematic* Throughout this unit of study, students need opportunities to represent and interpret categorical data by drawing picture graphs and/or bar graphs (with a single-unit scale) to represent a data set with up to four categories. This will lead to opportunities to solve simple put-together, take-apart, and compare problems using information presented in these types of graphs. For example, students could create bar graphs that show the number of seedlings that sprout with and without watering or that document plant growth. They could also create a picture graph showing the number of plant species, vertebrate animal species, and invertebrate animal species observed during a field trip or in a nature photograph. As students analyze the data in these types of graphs, they can use the data to answer simple put-together, take apart, and compare problems. This unit also presents opportunities for students to model with mathematics. They can diagram situations mathematically or solve a one-step addition or subtraction word problems. Data collected in bar graphs and picture graphs can easily be used for this purpose.

Modifications	
Special Education: • 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. multi-sensory 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. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s)	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

• Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	
Students at Risk of School Failure: ● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	**Gifted Students:** • Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning
Kindergarten Unit 1: Pushes and Pulls • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. **Kindergarten Unit 4: Basic Needs of Living Things** • 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. • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Future Learning
Grade 3 Unit 6: Organisms and the Environment • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. **Grade 3 Unit 7: Using Evidence to Understand Change in the Environment** • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. **Grade 5 Unit 3: Energy and Matter in Ecosystems**

- Plants acquire their material for growth chiefly from air and water.
- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

Appendix A: NGSS and Foundations for the Module

Make observations of plants and animals to compare the diversity of life in different habitats. *[Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [*Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.*]* (2-LS4-1)

Plan and conduct an investigation to determine if plants need sunlight and water to grow. [*Assessment Boundary: Assessment is limited to testing one variable at a time.*] (2-LS2-1)

Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.* (2-LS2-2)

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. (K-2-ETS1-1)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Planning and Carrying Out Investigations**	**LS4.D: Biodiversity and Humans** • There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)	**Cause and Effect** • Events have causes that generate observable patterns. (2-LS2-1) **Structure and Function**

• Make observations (firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)	**LS2.A: Interdependent Relationships in Ecosystems** • Plants depend on water and light to grow. (2-LS2-1) • Plants depend on animals for pollination or to move their seeds around. (2-LS2-2) **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.*(secondary to 2-LS2-2)* **ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)	• The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2), (K-2-ETS1-2) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (2-LS4-1)

English Language Arts	Mathematics
Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1) **W.2.7** Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(K-2-ETS1-1) **W.2.8** Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-LS2-2) **SL.2.5** With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1) **W.2.6** Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (K-2-ETS1-1) **RI.2.1**	Reason abstractly and quantitatively. (2-LS2-1),(K-2-ETS1-1) **MP.2** Model with mathematics. (2-LS2-1),(2-LS2-2),(K-2-ETS1-1) **MP.4** Use appropriate tools strategically. (2-LS2-1),(K-2-ETS1-1) **MP.5** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-LS2-2) **2.MD.D.10**

Module #1 "Relationships in Habitats" *(CBBS – "Ecosystem Diversity Kit")* **Core Lesson #1: "Organisms and Habitats"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Distinguish between living and nonliving things. • Evaluate the needs of living things and the significance of living in distinct habitats. • Distinguish characteristics of various habitats. • Identify habitats based on specific characteristics.	2.LS4.1 LS4.D L.2.4 RF.2.3 RI.2.1 RI.2.2 RI.2.3 RI.2.4 RI.2.5 RI.2.6 RI.2.7 RI.2.8 W.2.8 2.G.A.1 2.G.A.2 2.OA.C.4	*Introduction/ Anticipatory Set*	1 class session	Part A: • On chart paper, prepare a circle matrix (Figure 1.1 page 4) • Have chart paper and markers ready for tree map • Have two different colored markers ready
		Activity	1-2 class sessions	Part B: • Set of seven Habitat Cards • Use tundra card as example, place other cards around the room with chart paper and markers • Post Basic Needs of Living Things tree map • Make 6 copies of Teacher Sheet 1 and cut out labels • Have masking tape available
		Evaluate/Assess	1 class session	Part C: • Make 2 sided copy of Literacy and Science 1 (brochure style – see page 2 in teachers guide for steps) • Make copies of Learning Cycle Letter • Have highlighters available

Key Vocabulary:

Describing words: cold, dry, hot, wet

Science words: characteristic, climate, diverse (diversity), ecosystem, habitat, living, nonliving, organism, protection, shelter, survive

Module #1 "Relationships in Habitats" *(CBBS – "Ecosystem Diversity Kit")*
Core Lesson #2: "Plant Growth"

Objectives	NJSLS Standard(s)	Segment	Time	Materials
SWBAT: • Interpret the unique needs of plants through scientific discovery. • Relate that photosynthesis contributes to the green color of plants. • Simulate seeds dispersal using models.	2.LS2.1 LS2.A RI.2.3 RI.2.5 RI.2.7 RI.2.8 RI.2.9 RL.2.3 RL.2.6 W.2.8 2.OA.B.2 2.OA.C.3	*Introduction/ Anticipatory Set*	4-5 class sessions	Part A: • Make copies of Student Activity Sheet 2A • For each group, fill one plastic cup halfway with potting soil. Label groups with masking tape. • Have radish seeds ready. • Fill spray bottles with water for class to share
		Activity	1 class session	Part B: • Make a copy of Student Activity Sheet 2B • Gather crayons: brown, dark blue, light blue, green, red
		Evaluate/Assess	1-2 class sessions	Part C: • Copy Student Activity Sheet 2C • Set up five plants and the rye grass around the classroom. Label each plant 1-6

Key Vocabulary:

Describing words: dry, green, short, tall, thick, thin, wet

Science Words: energy, food, photosynthesis, plant, producer, soil

<table>
<tr><td colspan="5">Module #1 “Relationships in Habitats” (CBBS – “Ecosystem Diversity Kit”)
Core Lesson #3: “Plant and Animal Interactions”</td></tr>
<tr><th>Objectives</th><th>NJSLS Standard(s)</th><th>Segment</th><th>Time</th><th>Materials</th></tr>
<tr><td rowspan="3">SWBAT:
• Observe and identify various seed dispersal methods using models.
• Simulate bees polluting flowers.
• Explain the independence between plants and animals.</td><td rowspan="3">2.LS2.2
LS2.A
L.2.4
L.2.5
L.2.6
RI.2.1
RI.2.2
RI.2.3
RI.2.4
RI.2.8
RL.2.1
RL.2.5
W.2.2
W.2.8
2.MD.D.10
2.OA.B.2</td><td>Introduction/ Anticipatory Set</td><td>1 class session</td><td>Part A:
• Show Teacher Sheet 3 on Active Board
• Have sticky notes for groups</td></tr>
<tr><td>Activity</td><td>1 class session</td><td>Part B:
• 24 hours prior: prepare one bee stick for pairs (see teacher manual page 36)
• Use 4 plastic bottles and 4 flowers with exposed pollen, place each flower in bottle with ¾ water around the room
• Have hands lens available</td></tr>
<tr><td>Evaluate/Assess</td><td>1 class session</td><td>Part C:
• Make two sided copy (brochure format) of Literacy and Science 3</td></tr>
<tr><td colspan="5">Key Vocabulary:
Describing words: furry, hairy, sticky, windy

Science words: germination, pollution, reproduction, seed, seed dispersal</td></tr>
</table>

Module #1 "Relationships in Habitats" *(CBBS – "Ecosystem Diversity Kit")* **Core Lesson #4: "Diversity of Life"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Formulate an understanding of the interdependence between plants and animals in a habitat. • Apply concepts of the diversity of living things in each of a variety of different habitats. • Compare the diversity of life in different habitats, on land and in water.	2.LS4.1 LS4.D L.2.4 L.2.5 L.2.6 RI.2.1 RI.2.2 RI.2.3 RI.2.4 RI.2.8 RL.2.1 RL.2.5 W.2.2 W.2.8 2.MD.D.9 2.0A.B.2	*Introduction/ Anticipatory Set*	2 class sessions	Part A: • 6 plastic tanks • Use plants from Lesson 2 • Have 7 habitat cards, Basic Needs of Living Things tree map, and 7 habitat charts from lesson 1 • Display all live organisms • Weather permitting, take students outside to collect more items for habitats
		Activity	1-2 class sessions	Part B: • Organize habitat materials: tanks, spray bottles of water, woodland soil, aquarium gravel, water, etc. • Possibly collect ants, earthworms, or crayfish from outside • Distribute pill bugs • Prepare 3 plastic tanks for groups to make aquatic habitats • Once dragonfly nymphs arrive, open to allow fresh air. Add to tank with conditioned tap water • Do same with pill bugs

		Evaluate/Assess	1-2 class sessions	Part C: • Make copies of Student Activity Sheet 4,Family Science Activity Sheet: Habitat Exploration, and Family Science General Letter • Have habitats available
Key Vocabulary: All vocabulary from previous lessons				

<table>
<tr><td colspan="5">Module #1 “Relationships in Habitats” (CBBS – “Ecosystem Diversity Kit”)
Core Lesson #5: “Human Impact”</td></tr>
<tr><th>Objectives</th><th>NJSLS Standard(s)</th><th>Segment</th><th>Time</th><th>Materials</th></tr>
<tr><td rowspan="3">SWBAT:
Evaluate the effect of human actions on habitats.
Identify which human action has the greatest effect on specific habitats.
Determine ways that changes in behavior can have a positive effect on habitats.</td><td rowspan="3">2.LS4.1
LS4.D
ETS1.B
L.2.4
L.2.5
L.2.6
RI.2.1
RI.2.2
RI.2.3
RI.2.4
RI.2.8
RL.2.1
RL.2.5
W.2.2
W.2.8
2.MD.D.10</td><td>Introduction/ Anticipatory Set</td><td>1 class session</td><td>Part A:
Make 2 sided copy (brochure format) of Literacy and Science 5: Humans and Habitats
Have highlighters available</td></tr>
<tr><td>Activity</td><td>1 class session</td><td>Part B:
Make Copy of Literacy Sheet 5: Human Impact
Have habitats from Lesson 4 available
Make copy of Summative Assessment – Appendix f</td></tr>
<tr><td>Evaluate/Assess</td><td>2 class sessions</td><td>Part C:
Large white paper for groups, markers, and colored pencils</td></tr>
<tr><td colspan="5">Key Vocabulary:
Describing science: Clean, dirty

Science words: air pollution, land development, land pollution, runoff, water pollution</td></tr>
</table>

Module #2a "Properties and Changes in Matter"
How do the properties of materials determine their use? In this unit of study, students demonstrate an understanding of observable properties of materials through analysis and classification of different materials. The crosscutting concepts of patterns, cause and effect, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.
New Jersey Student Learning Standards/Student Learning Objectives
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. *[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]* **(2-PS1-1)**
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. *[Clarification Statement: Examples of properties could include strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]* **(2-PS1-2)**
Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. (K-2-ETS1-3)
Benchmark Assessment: **Matter Summative Assessment – page 96 in Teacher's Manual**

Unit Sequence	
Part A: ✓ *How can we sort objects into groups that have similar patterns?* ✓ *Can some materials be a solid or a liquid?*	
Concepts	**Formative Assessment**
• Patterns in the natural and human-designed world can be observed. • Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. • Matter can be described and classified by its observable properties.	*Students who understand the concepts can:* • Observe patterns in the natural and human-designed world. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. • Plan and conduct an investigation to describe and classify different kinds of material by their observable properties. ✓ Observations could include color, texture, hardness, and flexibility. ✓ Patterns could include the similar properties that different materials share.

Unit Sequence	
Part B: *What should the three little pigs have used to build their houses?*	
Concepts	**Formative Assessment**
• Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. • Simple tests can be designed to gather evidence to support or refute student ideas about causes. • Different properties are suited to different purposes. • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	*Students who understand the concepts can:* • Design simple tests to gather evidence to support or refute student ideas about causes. • Analyze data from tests of an object or tool to determine if it works as intended. • Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (Assessment of quantitative measurements is limited to length.) Examples of properties could include: ✓ Strength ✓ Flexibility ✓ Hardness ✓ Texture ✓ Absorbency • Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of each.

What It Looks Like in the Classroom
In this unit of study, students look for patterns and cause-and-effect relationships as they describe and classify materials using physical properties. In addition, students collaboratively plan and carry out investigations and analyze and interpret data in order to determine which materials are best suited for an intended purpose. In the natural world, different types of matter exist, and all matter can be described and classified according to physical properties. To begin this unit's progression of learning, students plan and conduct investigations to describe different kinds of material using observable properties. They will collect data during these investigations; analyze the data to find patterns, such as similar properties that different materials share; and use the data to classify materials. Materials can be classified by color, texture, hardness, flexibility, or state of matter. For example, students can explore hardness of rocks by shaking them in containers to see how easily they break apart. They can explore viscosity by pouring a set amount of various liquids, such as glue, oil, and water from one container to another to observe the relative speed that each flows. Students can also heat or cool a variety of materials, such as butter, chocolate, or pieces of crayon, in order to determine whether or not these materials can be either solid or liquid depending on temperature. Because every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world, it is important that students understand that different properties are suited to different purposes. After investigating and classifying a variety of materials based on their physical properties, students will engage in the engineering design process. Students can work collaboratively, with adult guidance, to test different materials to determine which have properties that are best suited for an intended purpose. For example, this project could be launched using the children's story, *The Three Little Pigs*. After reading the story, students would: ✓ Investigate the physical properties of straw, sticks, and bricks in order to determine what properties make bricks the material best suited for building a house. ✓ Work together to brainstorm a list of possible structures that could be built with different materials. For example, students could build bridges or simple roller coasters for marbles. ✓ Select one structure from the list and determine the intended purpose of that structure. ✓ Select two or three different materials that could be used to build the structure. ✓ Investigate the physical properties of the materials, including shape, strength, flexibility, hardness, texture, or absorbency.

- ✓ Collect and analyze data to determine whether or not the given materials have properties that are suited for the intended purpose of the selected structure.
- ✓ In groups, use one of the materials to build the structure. (Teachers should have different groups use different materials.)
- ✓ Test and compare how each structure performs. Because there is always more than one possible solution to a problem, it is useful to compare the strengths and weaknesses of each structure and each material used.

Integration of engineering

- ✓ In this unit, students investigate the physical properties of a variety of materials, and then build a structure with materials that are best suited for the structure's intended purpose. This process is outlined in greater detail in the previous section

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts The NJSLS for English Language Arts can be incorporated in this unit in a number of ways. Students can participate in shared research, using trade books and online resources, to learn about the properties of matter. As students explore different types of materials, they can record their observations in science journals, and then use their notes to generate questions that can be used for formative or summative assessment. Students can add drawings or other visual displays to their work, when appropriate, to help clarify their thinking. To teach students how to describe how reasons support specific points an author makes in a text, teachers can model the comprehension skill of main idea and details using informational text about matter. Technology can be integrated into this unit of study using free software programs (e.g., Animoto) that students can use to produce and publish their writing in science. *Mathematics* Throughout this unit of study, students have opportunities to model with mathematics and reason abstractly and quantitatively. During investigations, students can collect and organize data using picture graphs and/or bar graphs (with a single-unit scale). This can lead to opportunities to analyze data and solve simple put together, take-apart, and compare problems using information presented in these types of graphs. Some examples of ways to sort and classify materials in order to create graphs include: ✓ Classifying materials as solids, liquids, or gases.

Modifications	
Special Education: • 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. multi-sensory 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. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning
Kindergarten Unit 1: Pushes and Pulls (engineering practices) ○ A situation that people want to change or create can be approached as a problem to be solved through engineering. ○ Asking questions, making observations, and gathering information are helpful in thinking about problems. ○ Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Future Learning
Grade 5 Unit 1: Properties of Matter • Measurements of a variety of properties can be used to identify materials. *(Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)* • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. **Grade 5 Unit 2: Changes to Matter** • When two or more different substances are mixed, a new substance with different properties may be formed. • No matter what reaction or change in properties occurs, the total weight of the substances does not change. *(Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)*

Appendix A: NGSS and Foundations for the Module
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. *[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]* **(2-PS1-1)**
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. *[Clarification Statement: Examples of properties could include strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]* **(2-PS1-2)**
Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. (K-2-ETS1-3)
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)	**PS1.A: Structure and Properties of Matter** • Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1) • Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) • A great variety of objects can be built up from a small set of pieces. (2-PS1-3) **ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is	**Patterns** • Patterns in the natural and human designed world can be observed. (2-PS1-1) **Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) - ***Connections to Engineering, Technology, and Applications of Science***

	useful to compare and test designs. (K-2-ETS1-3)	**Influence of Engineering, Technology, and Science, on Society and the Natural World** • Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

English Language Arts	Mathematics
Describe how reasons support specific points the author makes in a text. (2-PS1-2) **RI.2.8** With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-3) **W.2.6** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1-2) **W.2.7** Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(K-2-ETS1-3) **W.2.8**	Reason abstractly and quantitatively. (2-PS1-2), (K-2-ETS1-3) **MP.2** Model with mathematics. (2-PS1-1),(2-PS1-2, (K-2-ETS1-3)) **MP.4** Use appropriate tools strategically. (2-PS1-2), (K-2-ETS1-3) **MP.5** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-PS1-1),(2-PS1-2), (K-2-ETS1-3) **2.MD.D.10**

Module #2b "Changes to Matter"
How can objects change? ***Are all changes reversible?*** In this unit of study, students continue to develop an understanding of observable properties of materials through analysis and classification of different materials. The crosscutting concepts of *cause and effect* and *energy and matter* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *constructing explanations, designing solutions*, and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-PS1-3 and 2-PS1-4.
New Jersey Student Learning Standards/Student Learning Objectives
Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. *[Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]* **(2-PS1-3)**
Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. *[Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]* **(2-PS1-4)**

Unit Sequence	
Part A: *In what ways can an object made of a small set of pieces be disassembled and made into a new object?*	
Concepts	**Formative Assessment**
• Objects may break into smaller pieces and be put together into larger pieces or change shapes. • Different properties are suited to different purposes. • A great variety of objects can be built up from a small set of pieces.	*Students who understand the concepts are able to:* • Break objects into smaller pieces and put them together into larger pieces or change shapes. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. • Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

Unit Sequence	
Part B: *Can all changes caused by heating or cooling be reversed?*	
Concepts	**Formative Assessment**
• People search for cause-and-effect relationships to explain natural events. • Events have causes that generate observable patterns. • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.	*Students who understand the concepts are able to:* • Observe patterns in events generated due to cause-and-effect relationships. • Construct an argument with evidence to support a claim. • Construct an argument with evidence that some changes caused by heating or cooling can be reversed, and some cannot. ✓ Examples of reversible changes could include materials such as water and butter at different temperatures. ✓ Examples of irreversible changes could include ➢ Cooking an egg ➢ Freezing a plant leaf ➢ Heating paper

What It Looks Like in the Classroom
In this unit of study, students investigate cause-and-effect relationships between matter and energy as they analyze and classify materials that undergo change. Throughout the unit, students will construct explanations and engage in argument from evidence as they investigate the ways in which matter can change and determine whether or not a change is reversible. In Unit 2, Properties of Matter, students engaged in the engineering design process in order to understand that different properties are suited to different purposes. Students use this understanding as they construct evidence-based accounts of how an object made of small pieces can be disassembled and made into new objects. In order to do this, they need multiple opportunities to take apart and reassemble objects that are made of small pieces. For example, using blocks, building bricks, and other small objects such as Legos, small groups of students can build an object, and then a second group of students can take the object apart and build another object using those same small blocks or bricks. As students construct and deconstruct objects, then reconstruct the pieces into new objects, they should document the process in their science journals, explaining how they went about reconstructing the pieces into a new object. After students have worked through and documented this process, ask them, "Are the changes you made to each of the original objects reversible? Can we disassemble the new objects and use the pieces to reconstruct the original object? After class discussion, ask students, "Are all changes reversible?" This should lead to opportunities for students to observe changes caused by heating or cooling. With close supervision and guidance by teachers, students can investigate such changes as heating or cooling butter, chocolate chips, or pieces of crayon, freezing water, and melting ice. They can observe an egg before and after cooking or a small piece of paper or cardboard before and after burning. As they attempt to reverse changes, they will also notice that all events have causes that generate patterns of change that can be observed and predicted. Through these types of experiences, students will recognize that some changes caused by heating or cooling can be reversed and some cannot, and they can use evidence from their investigations to support their thinking.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts Students need opportunities to read texts that give information about matter and the changes that can happen to matter. With adult support, students can identify the main idea and details in informational text in order to answer questions about matter. With teacher support and modeling, students can ask and answer who, what, where, when, why, and how questions to demonstrate their understanding of key details in informational text. As students investigate reversible and irreversible changes to matter, they should record observations in science journals, using drawings or other visual displays, when appropriate, to help clarify their thinking. To further support their learning, students can conduct shared research using trade books and online resources in order to learn more about physical changes to matter. After reading informational texts and conducting investigations, students should be able to write opinion pieces in which they state an opinion, supply evidence to support their opinion, use linking words to connect opinion to evidence (reasons), and provide a concluding statement. For example, students can be presented with an example of matter that has been changed in some way, then asked to write an opinion piece in which they state whether or not they think the change is reversible or irreversible, and supply evidence to support their thinking. Evidence can include information recalled from experiences or information gathered from informational texts or other resources. Some possible changes that can be used are: ✓ Tearing paper ✓ Bending a spoon ✓ Baking a cake ✓ Hammering a nail into a piece of wood ✓ Getting grass stains on a pair of jeans ✓ Cutting your hair. *Mathematics* N/A

Modifications	
Special Education: • 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. multi-sensory 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. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning
In **Properties of Matter**, students described and classified different kinds of materials based on their observable properties. They also tested different materials to determine which have properties that are best suited for an intended purpose.

Future Learning
Grade 4 Unit 1: Weathering and Erosion • 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. **Grade 5 Unit 1: Properties of Matter** • Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. **Grade 5 Unit 2: Changes to Matter** • When two or more different substances are mixed, a new substance with different properties may be formed. • No matter what reaction or change in properties occurs, the total weight of the substances does not change. *(Note: Mass and weight are not distinguished at this grade level.)* • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. **Grade 5 Unit 3: Matter and Energy in Ecosystems** • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead

organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. When two or more different substances are mixed, a new substance with different properties may be formed.

- No matter what reaction or change in properties occurs, the total weight of the substances does not change. *(Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)*

Appendix A: NGSS and Foundations for the Module		
Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.] **(2-PS1-3)**		
Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.] **(2-PS1-4)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) **Constructing Explanations and Designing Solutions** • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) **Engaging in Argument from Evidence** • Construct an argument with evidence to support a claim. (2-PS1-4)	**PS1.A: Structure and Properties of Matter** • Different properties are suited to different purposes. (2-PS1-3) • A great variety of objects can be built up from a small set of pieces. (2-PS1-3) **PS1.B: Chemical Reactions** • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	**Cause and Effect** • Events have causes that generate observable patterns. (2-PS1-4) **Energy and Matter** • Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) - ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Science searches for cause and effect relationships to explain natural events. (2-PS1-4)

English Language Arts	Mathematics
Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4) **RI.2.1** Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4) **RI.2.3** Describe how reasons support specific points the author makes in a text. (2-PS1-4) **RI.2.8** Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4) **W.2.1** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-3) **W.2.7** Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-3) **W.2.8**	**N/A**

Module #2 "Properties and Changes in Matter" *(CBBS – "Matter Kit")* **Core Lesson #1: "Same Pieces, Different Look"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Recognize that everything is made of many smaller things. • Understand that the pieces of one thing can sometimes be arranged differently to make something else. • Know that parts must be ordered to work together.	2.PS1.3 PS1.A L.2.1 L.2.5 L.2.6 RI.2.1 R.2.6 W.2.8 2.MD.D.10	*Introduction/ Anticipatory Set*	1 class session	Part A: • Prepare a pyramid-like structure using Unifix cubes • Prepare set of 50 Unifix cubes from the kit for groups • Make copies of Student Activity Sheet 1A: Parts of a Whole • Have crayons and pencils available
		Activity	1 class session	Part B: • Have one set of 50 Unifix cubes for each group • Make copies Student Activity Sheet 1B: The Building Blocks of Whole Structures • Have crayons and pencils available

Key Vocabulary:
Describing science: arrangement, big, different, order, part, small, whole

Science words: Specification, structure

Module #2 "Properties and Changes in Matter" *(CBBS – "Matter Kit")* **Core Lesson #2: "What is Matter?"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Identify the properties of different states of matter. • Classify three states of matter by their properties. • Compare and contrast the properties of solids and liquids. • Recognize that matter can go through physical changes without changing the material it is made of.	2.PS1.3 PS1.A L.2.1 L.2.4 L.2.5 L.2.6 RI.2.1 RI.2.3 RI.2.6 RI.2.7 RI.2.8 W.2.8 2.MD.D.10	*Introduction/ Anticipatory Set*	1 class session	Part A: • Make copies of Student Activity Sheet 2: States of Matter • For groups, prepare set of three 1 oz. cups to show the states of matter where water can be found (use Teacher Manual page 17) • Have scissors and glue available • Measure one half cup of water and pour into hot pot, set aside
		Activity	1 class session	Part B: • Need hand lens, forceps, and graduated cylinders for groups • Fill 1 oz cup of sand and secure with lid for each group
		Activity	1 class session	Part C: • Each group of four students will need four hand lenses, graduated cylinders, 1 oz. cup of water with lid, and 1 oz. cup of sand from Part B

		Evaluate/Assess	1 class session	Part D: • For each group of four, inflate a balloon, • Each group needs hand lenses and air filled balloon • Use pipette from kit, place 1-2 drops of water in each six 1 oz. cups and secure with lid. Please near heater or sun for 3 hours before lesson so water can evaporate.
Key Vocabulary: Describing science: cold, hard, hot, invisible, misty, oblong, wet Science words: evaporation, flexible, gas, graduated cylinder, liquid, matter, microscope, particle, physical change, solid, state of matter, substance, water vapor				

Module #2 "Properties and Changes in Matter" *(CBBS – "Matter Kit")* **Core Lesson #3: "Solids, Liquids, and Mixtures"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Investigate solids and liquids to determine that each state of matter can have varying characteristics. • Manipulate substances to determine that different types of matter can be combined to create a mixture.	2.PS1.1 PS1.A L.2.1 L.2.2 L.2.4 L.2.6 RF.2.3 RI.2.3 RI.2.4 RI.2.6 RI.2.9 W.2.8 2.G.A.1	*Introduction/ Anticipatory Set*	1 class session	Part A: • Each group needs a paper clip, sponge (wet to activate), sticky notes, marker, and rubber band • Make chart titled "Words to Describe Properties", make t-chart
		Activity	1 class session	Part B: • Prepare set of three liquid samples for each group using dish soap, vegetable oil, and water • Each group needs sticky notes and marker • Display "Words to Describe Properties" chart
		Evaluate/Assess	1 class session	Part C: • Make copies of Student Activity Sheet 3: Mix It Up • Prepare set of solids for each group, fill two 1 oz. cups halfway with sand and a third halfway with rice, secure with lid • For each group, fill one 1 oz. cup halfway with water and

				secure with lid
Key Vocabulary: Describing science: bendable, slow, sticky, stretchy Science words: Characteristic, fluid, fluidity, malleable, mixture, property				

Module #2 "Properties and Changes in Matter" *(CBBS – "Matter Kit")* **Core Lesson #4: "Describing Matter"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Recognize the physical properties of certain materials. • Distinguish between materials that float in water and those that sink. • Construct an argument detailing why some materials are better for completing certain projects than other materials.	2.PS1.2 PS1.A L.2.1 L.2.2 L.2.4 L.2.6 RI.2.3 RI.2.4 RI.2.6 RI.2.9 W.2.8 2.G.A.1	*Introduction/ Anticipatory Set*	1 class session	Part A: • For each group, have one metal cube, wood cube, and foam ball • Fill 9 oz. plastic cup about two thirds full of water • Prepare small piece of paper for each group by cutting six small pieces from one single sheet • Make copies of Student Activity Sheet 4A: The Properties of Matter • Have a roll of paper towels handy for clean up
		Activity	1 class session	Part B: • Make copies of Student Activity Sheet 4B: The Properties of Materials

Key Vocabulary:
Describing science: breakable, changeable, soft, workable

Science words: Colloid, porous

Module #2 "Properties and Changes in Matter" *(CBBS – "Matter Kit")* **Core Lesson #5: " Heating Matter"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Investigate physical changes by freezing and warming coconut oil. • Investigate chemical changes by adding heat to a bag of unpopped popcorn.	2.PS1.4 PS1.B L.2.1 L.2.2 L.2.4 L.2.6 RI.2.3 RI.2.4 RI.2.6 RI.2.9 W.2.8 2.G.A.1	*Introduction/ Anticipatory Set*	1 class session	Part A: • Make copies of Student Activity Sheet 5A: The States of Matter • Fill a 1 oz. plastic cup about one-third full, secure with lid • Obtain large bag of ice and pour it into large cooler. Have this on hand so you can fill a 9 oz. cup with ice for each group. Have an additional 9 oz. cup available with a scoop. • Have paper towels handy
		Activity	1 class session	Part B: • Obtain microwave for the classroom • Purchase 6 bags of microwave popcorn • Paper plate for each group • Have paper towels handy

Key Vocabulary:
Vocabulary from previous lessons.

Module #3a "The Earth's Land and Water"
Where do we find water? In this unit of study, students use information and models to identify and represent the shapes and kinds of land and bodies of water in an area and where water is found on Earth. The crosscutting concept of *patterns* is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *developing and using models* and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-ESS2-3 and 2-ESS2-2.
New Jersey Student Learning Standards/Student Learning Objectives
Obtain information to identify where water is found on Earth and that it can be solid or liquid. (2-ESS2-3)
Develop a model to represent the shapes and kinds of land and bodies of water in an area. *[*Assessment Boundary: Assessment does not include quantitative scaling in models.*]* **(2-ESS2-2)**
Benchmark Assessment: TCI Assessment: What Is on Earth's Surface? – Found in Assessment Tab on teachtci.com

Unit Sequence	
Part A: *How can we identify where water is found on Earth and if it is solid or liquid?*	
Concepts	**Formative Assessment**
• Patterns in the natural world can be observed. • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	*Students who understand the concepts are able to:* • Observe patterns in the natural world. • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) and other media that will be useful in answering a scientific question. • Obtain information to identify where water is found on Earth and to communicate that it can be a solid or liquid.

Unit Sequence	
Part B: *In what ways can you represent the shapes and kinds of land and bodies of water in an area?*	
Concepts	**Formative Assessment**
• Patterns in the natural world can be observed. • Maps show where things are located. One can map the shapes and kinds of land and water in any area.	*Students who understand the concepts are able to:* • Observe patterns in the natural world. • Develop a model to represent patterns in the natural world. • Develop a model to represent the shapes and kinds of land and bodies of water in an area. (*Assessment does not include quantitative scaling in models.)*

What It Looks Like in the Classroom
Students look for patterns as they identify where water is found on Earth and explore the shapes and kinds of land and bodies of water found in an area. Students also develop models to identify and represent the shapes and kinds of land and bodies of water in an area. To begin this unit's progression of learning, students identify where water is found on Earth and whether it is solid or liquid. Using texts, maps, globes, and other resources (including appropriate online resources), students will observe that water is found in liquid form in oceans, rivers, lakes, and ponds. They also discover that water exists as a solid in the Earth's snowcaps and glaciers. After students identify where water is found on the Earth, they take a closer look at bodies of water and landforms that can be found in the natural world. Using firsthand observations and media resources, students should look for patterns among the types of landforms and bodies of water. For example, students should notice that mountains are much taller and more rugged than hills, lakes are an enclosed body of water surrounded by land, and streams flow across land and generally end at a larger body of water, such as a lake or the ocean. Students should also have opportunities to use maps to determine where landforms and bodies of water are located. As students become more familiar with the types and shapes of landforms and bodies of water, they develop models to represent the landforms and bodies of water found in an area. For example, students can draw/create a map of the area of the state in which they live, showing various landforms (e.g., hills, coastlines, and islands) and bodies of water (e.g., rivers, lakes, ponds, and the ocean). Teachers should keep in mind that assessment does not include quantitative scaling of models (an accurate proportional relationship with the real world).

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts Students gather information about the types of landforms and bodies of water from experiences or from text and digital resources. They can use this information to answer questions such as, "Where can water be found as solid ice or snow year round?" Students should also have the opportunity to use their research to publish a writing piece, with guidance and support from adults or collaboratively with peers, based on their findings about various landforms and bodies of water. Diagrams, drawings, photographs, audio or video recordings, poems, dioramas, models, or other visual displays can accompany students' writing to help recount experiences or clarify thoughts and ideas. *Mathematics* As students collect data about the size of landforms and bodies of water, these numbers can be used to answer questions, make comparisons, or solve problems. For example, ✓ If students know that a mountain is 996 feet in height, a lake is 550 feet deep, a river is 687 miles long, and a forest began growing about 200 years ago, have students show each number in three ways using base-ten blocks, number words, and expanded form. ✓ A stream was 17 inches deep before a rainstorm and 33 inches deep after a rainstorm. How much deeper did it get during the rainstorm? As students engage in these types of mathematical connections, they are also modeling with mathematics and reasoning abstractly and quantitatively. When modeling with mathematics, students diagram situations mathematically (using equations, for example) and/or solve addition or subtraction word problems. When students reason abstractly and quantitatively, they manipulate symbols (numbers and other math symbols) abstractly and attend to the meaning of those symbols while doing so.

Modifications	
Special Education: • 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. multi-sensory 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. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice	**English Language Learners (ELLs):** ● Model Thinking Aloud ● Encourage Partner Talk ● Repeat and Clarify ● Provide a Sequence ● Encourage self-selection of topics ● Target vocabulary ● Scaffold comprehension when reading is used to promote reader response ● Scaffold content-literacy reading ● Allow products to demonstrate student's learning ● Provide on-going feedback

• Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	
Students at Risk of School Failure: ● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	**Gifted Students:** • Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

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Prior Learning
Kindergarten Unit Pushes and Pulls 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 Unit 2: Earth Processes • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. **Grade 5 Unit 4: Water on the Earth** • Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

Appendix A: NGSS and Foundations for the Module		
Obtain information to identify where water is found on Earth and that it can be solid or liquid. (2-ESS2-3)		
Develop a model to represent the shapes and kinds of land and bodies of water in an area. *[*Assessment Boundary: Assessment does not include quantitative scaling in models.*]* **(2-ESS2-2)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2-ESS2-3) **Developing and Using Models** • Develop a model to represent patterns in the natural world. (2-ESS2-2)	**ESS2.C: The Roles of Water in Earth's Surface Processes** • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-2)	**Patterns** • Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

English Language Arts	Mathematics
With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS2-3) **W.2.6** Recall information from experiences or gather information from provided sources to answer a question. (2-ESS2-3) **W.2.8** Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-ESS2-2) **SL.2.5**	Reason abstractly and quantitatively. (2-ESS2-2) **MP.2** Model with mathematics. (2-ESS2-2) **MP.4** Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (2-ESS2-2) **2.NBT.A.3** Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. (2-ESS2-1) **2.MD.B.5**

Module #3b "The Earth and Its Changes"
In what ways do humans slow or prevent wind or water from changing the shape of the land? In this unit of study, students apply their understanding of the idea that wind and water can change the shape of land to compare design solutions to slow or prevent such change. The crosscutting concepts of *stability and change*; *structure and function*; and *the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *asking questions and defining problems*, *developing and using models*, and *constructing explanations and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-ESS1-1, 2-ESS2-1, K-2-ETS1-1, and K-2-ETS1-2.
New Jersey Student Learning Standards/Student Learning Objectives
Use information from several sources to provide evidence that Earth events can occur quickly or slowly. *[Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.]* [Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]* **(2-ESS1-1)**
Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.**[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]* **(2-ESS2-1)**
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. (K-2-ETS1-1)
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. (K-2-ETS1-2)

Benchmark Assessment:

Matter Summative Assessment – page 96 in Teacher's Manual

Unit Sequence	
Part A: *What evidence can we find to prove that Earth events can occur quickly or slowly?*	
Concepts	**Formative Assessment**
• Some events happen very quickly; others occur very slowly over a time period much longer than one can observe. • Things may change slowly or rapidly.	*Students who understand the concepts are able to:* • Make observations from several sources to construct an evidence-based account for natural phenomena. • Use information from several sources to provide evidence that Earth events can occur quickly or slowly. *(Assessment does not include quantitative measurements of timescales.)* Some examples of these events include: ✓ Volcanic explosions ✓ Earthquakes ✓ Erosion of rocks.

Unit Sequence	
Part B: *In what ways do humans slow or prevent wind or water from changing the shape of the land?*	
Concepts	**Formative Assessment**
• Things may change slowly or rapidly. • Developing and using technology has impacts on the natural world. • Scientists study the natural and material world. • The shape and stability of structures of natural and designed objects are related to their function(s). • Wind and water can change the shape of the land. • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	*Students who understand the concepts are able to:* • Compare multiple solutions to a problem. • Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Examples of solutions could include: ✓ Different designs of dikes and windbreaks to hold back wind and water ✓ Different designs for using shrubs, grass, and trees to hold back the land. • Ask questions based on observations to find more information about the natural and/or designed world. • 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. • Define a simple problem that can be solved through the development of a new or improved object or tool. • Develop a simple model based on evidence to represent a proposed 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.

What It Looks Like in the Classroom
In this unit of study, students learn that a situation that people want to change or create can be approached as a problem to be solved through engineering. Before beginning to design a solution, it is important to clearly understand the problem, and asking questions, making observations and gathering information are helpful in thinking about and clarifying problems. Students learn that designs can be conveyed through sketches, drawings, or physical models, and that these representations are useful in communicating ideas for a problem's solutions to other people. As outlined in the narrative above, students will develop simple sketches or drawings showing how humans have helped minimized the effects of a chosen Earth event. Students use evidence from several sources to develop an understanding that Earth events can occur quickly or slowly. Because some events happen too quickly too observe, and others too slowly, we often rely on models and simulations to help us understand how changes to the surface of the Earth are caused by a number of different Earth events. For example, ✓ Volcanic eruptions are Earth events that happen very quickly. As volcanic eruptions occur, ash and lava are quickly emitted from the volcano. The flow of lava from the volcano causes immediate changes to the landscape as it flows and cools. ✓ Flooding can happen quickly during events such as hurricanes and tsunamis. Flooding can cause rapid changes to the surface of the Earth. ✓ Rainfall is an event that recurs often over long periods of time and will gradually lead to the weathering and erosion of rocks and soil. In order to gather information to use as evidence, students need to make observations. They can easily look for evidence of changes caused by rain, flooding, or drought. However, actually observing Earth events as they happen is often not possible; therefore, students will need opportunities to observe different types of Earth events using models, simulations, video, and other media and online sources. At this grade level, quantitative measurements of timescales are not important. Students do need to see the kinds of changes that Earth events cause, and whether the changes are rapid or slow.

Engaging in engineering design helps students understand that a situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in clearly understanding the problem. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. In this unit of study, students need the opportunity to engage in the engineering design process in order to generate and compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Students are not expected to come up with original solutions, although original solutions are always welcome. The emphasis is on asking questions, making observations, and gathering information in order to compare multiple solutions designed to slow or prevent wind or water from changing the land. This process should include the following steps:

- ✓ As a class, with teacher guidance, students brainstorm a list of natural Earth events, such as a volcanoes, earthquakes, tsunamis, or floods. The class selects one Earth event to research in order to gather more information.
- ✓ As a class or in small groups, with guidance, students conduct research on the selected Earth event using books and other reliable sources. They gather information about the problems that are caused by the selected event, and gather information on the ways in which humans have minimized the effects of the chosen earth event. For example,
  - ➢ Different designs of dikes or dams to hold back water,
  - ➢ Different designs of windbreaks to hold back wind, or
  - ➢ Different designs for using plants (shrubs, grass, and/or trees) to hold back the land.
- ✓ Next, students look for examples in their community of ways that humans have minimized the effect of natural Earth events. This can be accomplished through a nature walk or short hike around the schoolyard, during a field trip, or students can make observations around their own neighborhoods. If available, students can carry digital cameras (or other technology that allows them to take pictures) in order to document any examples they find.
- ✓ Groups select one solution they have found through research and develop a simple sketch, drawing, or physical model to illustrate how it minimizes the effects of the selected Earth event.

Groups should prepare a presentation using their sketches, drawings, or models, and present them to the class.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts Students participate in shared research to gather information about Earth events from texts and other media and digital resources. They will use this information to answer questions and describe key ideas and details about ways in which the land can change and what causes these changes. Students should also have opportunities to compose a writing piece, either independently or collaboratively with peers, using digital tools to produce and publish their writing. Students should describe connections between Earth events and the changes they cause, and they should include photographs, videos, poems, dioramas, models, drawings, or other visual displays of their work, when appropriate, to clarify ideas, thoughts, and feelings. *Mathematics* Students have multiple opportunities to reason abstractly and quantitatively as they gather information from media sources. Students can organize data into picture graphs or bar graphs in order to make comparisons. For example, students can graph rainfall amounts. Students can use the data to solve simple addition and subtraction problems using information from the graphs to determine the amount of change that has occurred to local landforms. For example, a gulley was 17 inches deep before a rainstorm and 32 inches deep after a rainstorm. How much deeper is it after the rainstorm? Students must also have an understanding of place value as they encounter the varying timescales on which Earth events can occur. For example, students understand that a period of thousands of years is much longer than a period of hundreds of years, which in turn is much longer than a period of tens of years. In addition, teachers should give students opportunities to work with large numbers as they describe length, height, size, and distance when learning about Earth events and the

changes they cause. For example, students might write about a canyon that is 550 feet deep, a river that is 687 miles long, or a forest that began growing about 200 years ago.

Modifications	
Special Education: • 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. multi-sensory 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	**English Language Learners (ELLs):** ● Model Thinking Aloud ● Encourage Partner Talk ● Repeat and Clarify ● Provide a Sequence ● Encourage self-selection of topics ● Target vocabulary ● Scaffold comprehension when reading is used to promote reader response ● Scaffold content-literacy reading ● Allow products to demonstrate student's learning ● Provide on-going feedback

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. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	
Students at Risk of School Failure: ● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	**Gifted Students:** • Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of

	Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning
Kindergarten Unit 1: Pushes and Pulls • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Future Learning

Grade 3 Unit 7: Using Evidence to Understand Change in Environments

- 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)*

Grade 4 Unit 1: Weathering and Erosion

- 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.

Grade 4 Unit 2: Earth Processes

- Testing a solution involves investigating how well it performs under a range of likely conditions. *(secondary)*

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- 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)*
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.*(secondary)*

Grade 5 Unit 5: Earth Systems

- 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.

Appendix A: NGSS and Foundations for the Module		
Use information from several sources to provide evidence that Earth events can occur quickly or slowly. *[Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.]* [Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]* **(2-ESS1-1)**		
Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.**[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]* **(2-ESS2-1)**		
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. (K-2-ETS1-1)		
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. (K-2-ETS1-2)		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions • Make observations from several sources to construct an evidence-based account for natural phenomena. (2-ESS1-1) • Compare multiple solutions to a problem. (2-ESS2-1) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new	**ESS1.C: The History of Planet Earth** • Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1) **ESS2.A: Earth Materials and Systems** • Wind and water can change the shape of the land. (2-ESS2-1) **ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to	**Stability and Change** • Things may change slowly or rapidly. (2-ESS1-1) • Things may change slowly or rapidly. (2-ESS2-1) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2) -

or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	be solved through engineering. (K-2-ETS1-1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1) **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)	***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** • Developing and using technology has impacts on the natural world. (2-ESS2-1) - ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World** • Scientists study the natural and material world. (2-ESS2-1)

English Language Arts	Mathematics
Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-ESS1-1), (K-2-ETS1-1) **RI.2.1** Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS1-1) **RI.2.3** With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS1-1), (K-2-ETS1-1) **W.2.6** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-ESS1-1) **W.2.7** Recall information from experiences or gather information from provided sources to answer a question. (2-ESS1-1), (K-2-ETS1-1) **W.2.8** Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. (2-ESS1-1) **SL.2.2** Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS2-1) **RI.2.3** Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when	Reason abstractly and quantitatively. (2-ESS1-1), (2-ESS2-1), (K-2-ETS1-1) **MP.2** Model with mathematics. (2-ESS1-1), (2-ESS2-1) **MP.4** Use appropriate tools strategically. (2-ESS2-1, (K-2-ETS1-1) **MP.5** Understand place value. (2-ESS1-1) **2.NBT.A** Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. (2-ESS2-1) **2.MD.B.5** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (K-2-ETS1-1) **2.MD.D.10**

appropriate to clarify ideas, thoughts, and feelings. (K-2-ETS1-2) **SL.2.5** Compare and contrast the most important points presented by two texts on the same topic. (2-ESS2-1) **RI.2.9**	

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)* **Core Lesson #1: "What's on Earth's Surface?"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Develop a model to represent the shapes and kinds of land and bodies of water in an area. • Obtain information to identify where water is found on Earth and that it can be solid or liquid.	2.ESS2.2 2.ESS.2.3 ESS2.B ESS2.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will start by analyzing a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	70 minutes	Part B: • In a **Whole Class Investigation**, you and a partner will make a model of Earth's land and water areas and use it to answer questions about Earth's surface.
		Evaluate/Assess	10-15 minutes	Part C: • You will describe what you land on when you return to Earth from a trip to space.
Key Vocabulary: globe, soil				

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)*
Core Lesson #2: "What Kinds of Land and Water Are Found on Earth?"

Objectives	NJSLS Standard(s)	Segment	Time	Materials
SWBAT: • Obtain information to identify where water is found on Earth and that it can be solid or liquid.	2.ESS2.3 ESS2.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will start by analyzing a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	55 minutes	Part B: • In a **Visual Discovery** activity, you will play lotto and identify different kinds of land and water on Earth's surface. Then you will make a book of the different forms of land and water.
		Evaluate/Assess	10-15 minutes	Part C: • You will show what you know by sketching pictures of the different forms of land and water.

Key Vocabulary:
Glacier, island, lake, river, valley

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)*
Core Lesson #3: "How Do Maps Show Land and Water?"

Objectives	NJSLS Standard(s)	Segment	Time	Materials
SWBAT: • Develop a model to represent the shapes and kinds of land and bodies of water in an area.	2.ESS2.2 ESS2.B	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will start by analyzing a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	110 minutes	Part B: • In a **Science Skill Builder**, you will draw a map of the schoolyard and mark an X on the map to show where you hid a "treasure." Then you will use a map to find a classmate's treasure.
		Evaluate/Assess	5-10 minutes	Part C: • You will show what you know by using a map key to color a map.

Key Vocabulary:
Compass, compass rose, map key

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)* **Core Lesson #4: "How Does Earth's Surface Change?"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	2.ESS1.1 ESS1.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will analyze a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	40 minutes	Part B: • You will read about ways Earth's surface changes over short and long periods of time.
		Evaluate/Assess	10-15 minutes	Part C: • You will look at a picture and explain what happened to Earth's surface.
Key Vocabulary: Flood, landslide				

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)* **Core Lesson #5: How Do Earthquakes and Volcanoes Change the Land?"**				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Materials**
SWBAT: • Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	2.ESS1.1 E221.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will start by analyzing a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson
		Activity	100 minutes	Part B: • In a **Visual Discovery Investigation**, you will see how a new volcano changed the land. You will perform act-it-outs to show how nearby villagers experienced the volcano. Then you will make books to tell the story.
		Evaluate/Assess	10-15 minutes	Part C: • You will show what you know by drawing how land can change because of an earthquake or a volcano.

Key Vocabulary:
Earthquake, lava, seismograph, volcano

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)*
Core Lesson #6 : "How Do Wind and Water Change the Land?"

Objectives	NJSLS Standard(s)	Segment	Time	Materials
SWBAT: • Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	2.ESS1.1 ESS1.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will analyze a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	120 minutes	Part B: • In an **Experiential Exercise**, you will go on a "trip" to the beach to see changes to the land. You will share your experiences with a younger student and explain how wind and water change the land.
		Evaluate/Assess	10-15 minutes	Part C: • You will draw a picture to show how wind or rain might change the land.

Key Vocabulary:

Cliff, sandbar, sand dune

Module #3 "The Earth and Its Changes" *(TCISI – Unit #3 Earth's Surface)*
Core Lesson #7: "How Can Problems Causes by Wind and Water be Solved?"

Objectives	NJSLS Standard(s)	Segment	Time	Materials
SWBAT: • Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. • Analyze data from two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	2.ESS2.1 K.2.ETS1.3 ESS2.A ETS1.C	*Introduction/ Anticipatory Set*	5-10 minutes	Part A: • You will start by analyzing a picture. Then you'll be introduced to the lesson phenomenon, which you will be able to explain by the end of the lesson.
		Activity	75 minutes	Part B: • In a **Small Group Investigation**, you will design a way to protect a road from a landslide. You will compare the strengths and weaknesses of all the models.
		Evaluate/Assess	10-15 minutes	Part C: • You will tell how you would compare two solutions to a problem caused by too much water.

Key Vocabulary:
Levee, windbreak