Bi-Borough Science Curriculum
Grade Two

Developed 2017

In Accordance with New Jersey Student Learning Standards for Science

Oradell Public School District
River Edge Public School District

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BI-BOROUGH SCIENCE CURRICULUM - GRADE TWO

UNIT ONE

Structure and Properties of Matter-

(First Trimester- September, October, November)

INTRODUCTION OF UNIT

(Excerpt from New Jersey Model Curriculum- Grade 2, Units 2 & 3, "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.

Students are 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.

NEW JERSEY STUDENT LEARNING STANDARDS

Science

Disciplinary Core Ideas

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)

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)

Science and Engineering Practices

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- 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

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based

accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Construct an argument with evidence to support a claim. (2- PS1-4)

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.(2-PS1-1)

Cause and Effect

- Events have causes that generate observable patterns. (2-PS1-4)
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

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

- Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)

Connections to Engineering, Technology, and Applications of Science

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)

NEW JERSEY STUDENT LEARNING STANDARDS

Connections to:

Technology http://www.state.nj.us/education/cccs/2014/tech/

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge

- 8.2 Technology Education, Engineering, Design, and Computational Thinking -

  Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

ELA http://www.state.nj.us/education/cccs/2016/ela/

Reading - Informational Text

- RI.2.1 Ask and answer such questions as *who, what, where, when, why*, and *how* to demonstrate understanding of key details in a text.
- RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- RI.2.4 Determine the meaning of words and phrases in a text relevant to a *grade 2 topic or subject area.*
- RI.2.10 Read and comprehend informational texts, including history/social studies, science, and technical texts, at grade level text complexity proficiently with scaffolding as needed.

Writing

- W.2.7 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).
- W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Speaking and Listening

- SL.2.1 Participate in collaborative conversations with diverse partners

about *grade 2 topics and texts* with peers and adults in small and larger groups.

- SL.2.5. Use multimedia; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.

Mathematics http://www.state.nj.us/education/cccs/2016/math/standards.pdf

Mathematical Practices

- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.

Measurement and Data

- 2.MD.D.1 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.

21st Century Life and Careers
http://www.state.nj.us/education/cccs/2014/career/9.pdf

- 9.2.4.A.3 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- 9.3.12.ED.1 Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.

BIG IDEA/COMMON THREAD

Materials can be identified and classified by their observable properties.

ENDURING UNDERSTANDINGS

- Matter exists as different substances that have observable different properties.
- Different properties are suited to different purposes.
- Objects can be built up from smaller parts.
- Heating and cooling of substances cause changes that are sometimes reversible and sometimes not.

ESSENTIAL QUESTIONS

- How are materials similar and different from one another?
- How do properties of materials relate to their use?
- How can objects change and are these changes reversible?

ASSESSMENT

- Teacher-created formative assessments, such as:
    - Cumulative projects
    - Data collection (charts/graphs/tables)
- Teacher observations, conferences
- Hands-on lab experiences

UNIT OBJECTIVES

Students will be able to …

- Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. (2-PS1-1)

  [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

  Disciplinary Core Ideas
  - 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

  Science and Engineering Practices
  - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

  Crosscutting Concepts
  - Patterns in the natural and human designed world can be observed.

2-PS1-1

Concepts	Students Can...

• Different kinds of matter exist
  ○ Matter can be either solid or liquid, depending on temperature
• Matter can be described and classified by its observable properties.
• Patterns in the natural and human-designed world can be observed.
	• Plan and conduct an investigation to describe and classify different kinds of material by their observable properties.
	Observations could include:
	  • color
	  • texture
	  • hardness
	  • flexibility
	Patterns could include:
	  • similar properties
	• Plan and conduct an investigation collaboratively to answer a question with evidence.
	• Observe patterns in the world.

Students will be able to …

- Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (2-PS1-2) *

  * See Appendix A, K-2 Engineering Design

  [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture,and absorbency.]
  [Assessment Boundary: Assessment of quantitative measurements is limited to length.]

  Disciplinary Core Ideas
  - Different properties are suited to different purposes

  Science and Engineering Practices
  - Analyze data from tests of an object or tool to determine if it works as intended

  Crosscutting Concepts
  - Simple tests can be designed to gather evidence to support or refute student ideas about causes.

2-PS1-2

Concepts	Students Can...
• Different properties are suited to different purposes • It is useful to compare and test designs when developing solutions to problems • Simple tests can be designed to gather evidence to support a claim	• Determine which materials have the properties that are best suited for an intended purpose Examples of Properties: ○ Strength ○ Flexibility ○ Hardness ○ Texture ○ Absorbency • Analyze data from tests to: ○ Determine if an object or tool works as intended ○ Compare the strengths and weaknesses of each object • Design simple tests to gather

	evidence to support or refute student ideas about causes

Students will be able to …

- 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. (2-PS1-3)

  [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

  Disciplinary Core Ideas
  - Different properties are suited to different purposes.
  - A great variety of objects can be built up from a small set of pieces.

  Science and Engineering Practices
  - Make observations to construct an evidence-based account for natural phenomena.

  Crosscutting Concepts
  - Objects may break into smaller pieces and be put together into larger pieces, or change shapes.

2-PS1-3

Concepts	Students Can...
• Different properties are suited to different purposes. • Many objects can be built up from a small set of pieces. • Objects may break into smaller pieces and be put together into larger pieces or change shapes.	• Make an object from a small set of pieces, disassemble the object, and make a new object.Observe the changes made. • Make observations to construct evidence. • Break objects into smaller pieces and put them together to create larger pieces or to change shapes.

Students will be able to …

- Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (2-PS1-4)

  [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.]

  Disciplinary Core Ideas
  - Heating or cooling a substance may cause changes that can be observed.
  - Sometimes these changes are reversible, and sometimes they are not.

  Science and Engineering Practices
  - Construct an argument with evidence to support a claim.

  Crosscutting Concepts
  - Events have causes that generate observable patterns.

2-PS1-4

Concepts	Students Can...

• Heating or cooling a substance may cause changes that can be observed.
  ○ Sometimes these changes are reversible, and sometimes they are not.
• Cause-and-effect relationships generate observable patterns.
	• Understand that heating or cooling may cause changes.
	• Understand that some changes can be reversed, and some cannot.
	Examples of reversible changes:
	  ○ water
	  ○ butter
	Examples of irreversible changes:
	  ○ Cooking an egg
	  ○ Freezing a plant leaf
	  ○ Heating paper
	• Construct an argument with evidence to support a claim.
	• Observe patterns due to cause-and-effect relationships.

SUGGESTED ACTIVITIES

- **The Properties of Materials and their Everyday Uses:** This wonderful set of lessons engage students in testing materials to understand their properties and discuss appropriate uses for the materials based on those properties. For example, one activity has the students examining the materials that a number of balls are made out of (plastic, rubber, aluminum, etc.) and describing the properties of the materials (light, stretchy, rigid). Next, the students test balls made of those materials for bouncing height and record their data. The students discuss which materials are best for bouncing and why.
  http://ngss.nsta.org/Resource.aspx?ResourceID=426

  http://www.primaryresources.co.uk/science/pdfs/rsc_tc_nc1.pdf

- **Matter song a music video by untamed Science:** This is an engaging music video that defines and gives examples of matter. The video is fun, colorful and explores many different kinds of matter as part of the music video sequence. Young students will love the song and the interactive dance sequences.

  http://ngss.nsta.org/Resource.aspx?ResourceID=303
  https://www.youtube.com/watch?v=jQ5VbjWetUE

- **Physical Science For Children All About Properties:** This short 20 minute video is well-done and engaging for young students in the 2nd grade. The video uses a well paced voice-over, interesting images, highlights vocabulary, and recaps of "what we learned so far". It starts out with "what matter is", "what properties are", and "what properties we can sense using sight, smell, hearing and touch". It has a great pace. At the eighth minute, the video discusses mass, weight, volume and density, which might be skipped over for 2nd grade. At the 17 minutes, the video goes into the states of matter, but includes gases, which is a concept beyond the performance expectation.
  http://ngss.nsta.org/Resource.aspx?ResourceID=603
  https://www.youtube.com/watch?v=8ta4HygRCpk

- **Clean Up Crew:** Students will experiment with different “clean up” items to make predictions and observations on how each item works. For example, students will use different napkins, tissues, paper towels, and a sponge to see how well it soaks up a specific amount of water. Students will discuss their results after the experiment.

- **Sink or Float:** Students will take classroom objects and perform a “sink or float” experiment. Students will make predictions on which objects they think will sink or float. One at a time, the objects will be placed in a tub of water. After making a chart to document which objects floated or sunk, the class will discuss why they think they got those results. What happens if we push the floating objects to the bottom? Will they stay? http://buggyandbuddy.com/science-for-kids-sink-or-float/

- **Building Blocks:** Students will build structures with constructive materials (such as Legos, Duplos, unifix cubes, tangrams, magnetic tiles, etc.) Students will then take apart the developed structure and rebuild another object. The goal of this activity is for students to make observations, in order to determine how a small set of pieces can be assembled, disassembled, and made into a new object.

- **Balloon and Baking Soda Experiment:** Students will participate in a hands-on activity to watch the property of matter change. The mixing of baking soda and vinegar creates a change that is clear to see when the balloon begins to inflate. http://littlebinsforlittlehands.com/balloon-baking-soda-vinegar-experiment-kids/

- **Melting and Freezing:** This activity will explore what happens to different substances as they change from a solid to a liquid or a liquid to solid. http://ngss.nsta.org/Resource.aspx?ResourceID=134 http://sciencenetlinks.com/lessons/water-3-melting-and-freezing/

- **Magic School Bus Lesson “Ready Set Dough”:** This is an lesson plan that accompanies the reading or watching of The Magic School Bus Bakes a Cake, or Ready Set Dough. The lesson is a short activity with guided questions that accompany making pretzel dough. In the book and video, which are not included in the resource, The Magic School Bus shrinks down to molecule size to observe

and discuss chemical and physical changes while baking. The resource contains a link to purchase the book. The video can be found through you tube. https://www.scholastic.com/teachers/lesson-plans/teaching-content/magic-school-bus-baked-cake/

- **Ooblek:** Students will make their own "Ooblek" by mixing different ingredients. They will learn about how mixing different ingredients can change the states of matter. http://www.wikihow.com/Make-Oobleck
  Slow Mo Guys Video: https://www.youtube.com/watch?v=RkLn2gR7SyE

- **Matter and Heat/ Irreversible Changes:** This lab activity explores four materials, crayon, pasta, matches, and lemonade, after they have heat added to them. The students collect and analyze information about whether or not the materials change state and if the change is reversible or irreversible. The lesson materials provide detailed steps and include lab books, or a lab book template, with which to collect data.
  https://betterlesson.com/lesson/639234/matter-and-heat-irreversible-changes

UNIT VOCABULARY

absorb: to soak up a liquid

atoms: smallest building blocks of matter

float: rest or move on or near the surface of a liquid without sinking

gas: matter that has no shape, has particles that are not connected to each other, and takes up whatever space is available

length: the measurement of something from end to end

liquid: matter that does not have a definite shape but takes up a definite amount of space

mass: the amount of matter in an object

matter: anything that takes up space and has mass

properties: characteristics that can be observed or measured

sink: to drop below the surface of a liquid

solid: matter that has a definite shape and takes up a definite amount of space

texture: the way an object feels

volume: amount of space an object occupies

weight: how heavy something is

RESOURCES

Exploring Science, National Geographic

Supplies: As per lab manuals

Trade books:
What's the Matter in Mr. Whiskers' Room by Michael Elsohn Ross
Looking at Solids, Liquids, and Gases: How Does Matter Change? by Jackie Gaff
Change It!: Solids, Liquids, Gases and You by Adrienne Mason
What Is the World Made Of? All About Solids, Liquids, and Gases by Kathleen Weidner Zoehfeld
What Is a Solid? by Jennifer Boothroyd
What Is a Liquid? by Jennifer Boothroyd
What Is a Gas? by Jennifer Boothroyd
Solids, Liquids, And Gases by Ginger Garrett
Joe-Joe the Wizard Brews Up Solids, Liquids, and Gases by Eric Braun
Earth's Water by Katherine Scraper
https://www.readinga-z.com/books/leveled-books/book/?id=231&lang=English

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas
www.opened.com - background information for teachers and lesson ideas
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=6 - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
https://jr.brainpop.com/search/?keyword=Matter - videos and follow up activities
https://www.youtube.com/user/scishowkids/playlists - ShiShow Kids YouTube (4 min video clips and experiment ideas)

MODIFICATIONS

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

http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

BI-BOROUGH SCIENCE CURRICULUM - GRADE TWO

UNIT TWO

Earth Systems: Processes That Shape The Earth

(Second Trimester - December, January, February, Early March)

INTRODUCTION OF UNIT:

(Excerpt from New Jersey Model Curriculum- Grade 2, Science Units 4 & 5, "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).

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.

NEW JERSEY STUDENT LEARNING STANDARDS

Science

Disciplinary Core Ideas

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)

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)

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)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (secondary to 2-ESS2-1)

Science and Engineering Practices

Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a model to represent patterns in the natural world. (2-ESS2-2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- 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)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- 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)

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

Stability and Change

- Things may change slowly or rapidly. (2- ESS1-1),(2-ESS2-1)

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)

NEW JERSEY STUDENT LEARNING STANDARDS

Connections to:

Technology http://www.state.nj.us/education/cccs/2014/tech/

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- 8.2 Technology Education, Engineering, Design, and Computational Thinking -

  Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

ELA http://www.state.nj.us/education/cccs/2016/ela/

Reading - Informational

- RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
- RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- RI.2.9 Compare and contrast the most important points presented by two texts on the same topic.

Writing

- W.2.7 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).
- W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Speaking and Listening

- SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
- SL.2.5 Use multimedia; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.

Mathematics http://www.state.nj.us/education/cccs/2016/math/standards.pdf

Mathematical Practices

- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.

Number and Operations in Base Ten

- 2.NBT.A Understand place value.

Measurement and Data

- 2.MD.D.10 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.

21st Century Life and Careers
http://www.state.nj.us/education/cccs/2014/career/9.pdf

- 9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
- 9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering, and construction to projects.

BIG IDEA/COMMON THREAD

Wind and water can change the shape of the land. Solutions can be designed to slow or prevent such change. Models can be used to represent the shapes/kinds of land and bodies of water on Earth.

ENDURING UNDERSTANDINGS

- Some events on Earth occur very quickly; others can occur very slowly.
- Wind and water change the shape of the land.
- Maps show where things are located. One can map the shapes and kinds of land and water in any area.
- Water is found in many types of places and in different forms on Earth.

ESSENTIAL QUESTIONS

- How does land change and what are some things that cause it to change?
- What are the different kinds of land and bodies of water?

ASSESSMENT

- Teacher-created formative assessments, such as:
    - Cumulative projects (topographical map, engineering design solution)
    - Data collection (charts/graphs/tables)
- Teacher observations, conferences
- Hands-on lab experiences

UNIT OBJECTIVES

Students will be able to …

- Obtain information to identify where water is found on Earth and that it can be solid or liquid. (2-ESS2-3)

Disciplinary Core Ideas
- Understand that water is found in the ocean, rivers, lakes, and ponds.
- Understand that water exists as solid ice and in liquid form.

Science and Engineering Practices
- 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.

Crosscutting Concepts
- Recognize that patterns in the natural world can be observed.

2-ESS2-3

Concepts	Students Can...
• Water is found in the ocean, rivers, lakes, and ponds. • Water exists as solid ice and in liquid form. • Patterns in the natural world can be observed.	• Recognize water as found in ocean, rivers, lakes, and ponds. • Recognize that water exists as a solid (ice) and in liquid form. • Obtain information from multiple sources to answer where water is found on Earth. • Observe patterns of natural landforms. Examples: ○ Mountains are taller than hills ○ Lakes are surrounded by land ○ Streams flow into larger bodies of water

Students will be able to …

- Develop a model to represent the shapes and kinds of land and bodies of water in an area. (2-ESS2-2)

Disciplinary Core Ideas

- Understand that maps show where things are located. (One can map the shapes and kinds of land and water in any area.)

Science and Engineering Practices

- Develop a model to represent patterns in the natural world.

Crosscutting Concepts

- Recognize that patterns in the natural world can be observed.

2-ESS2-2

Concepts	Students Can...
• Maps show where things are located. • Patterns in the natural world can be observed.	• Map the shapes/kinds of land and water in an area. • Develop a model (map) to represent patterns of landforms and bodies of water in an area. • Observe patterns of natural landforms and bodies of water.

Students will be able to …

- Use information from several sources to provide evidence that Earth events can occur quickly or slowly. (2-ESS1-1)

  [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.]

Disciplinary Core Ideas

- Understand that some events happen very quickly
- Understand that some events occur very slowly, over a time period much longer than one can observe.

Science and Engineering Practices

- Make observations from several sources to construct an evidence-based account for natural phenomena.

Crosscutting Concepts

- Recognize that things may change slowly or rapidly.

2-ESS1-1

Concepts	Students Can...
• Some Earth events happen very quickly • Some Earth events occur very slowly (over a time period much longer than one can observe) • Events may change slowly or rapidly.	• Understand that Earth events can occur quickly or slowly. Examples of these natural events include: ○ Volcanic explosions ○ Earthquakes ○ Erosion of rocks • Make observations from several sources to explain a natural event (see examples above).

Students will be able to …

- Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. (2-ESS2-1) *

  * See Appendix A, K-2 Engineering Design

Disciplinary Core Ideas

- Understand that wind and water can change the shape of the land.

Science and Engineering Practices

- Compare multiple solutions to a problem.

Crosscutting Concepts

- Recognize that things may change slowly or rapidly.

2-ESS2-1

Concepts	Students Can...
• Wind and water can change the shape of the land. • There is always more than one possible solution to a problem • It is useful to compare and test designs. K-2 Engineering Design includes: ○ Defining the problem ○ Asking questions ○ Making observations ○ Gathering information ○ Designing through sketches/drawings/models • Things may change slowly or rapidly. • The shape and stability of natural and designed structures are related to their function/s. (K-2. Engineering Design)	• Recognize how wind and water can change the shape of the land. • Compare designed solutions that slow or prevent wind or water from changing the shape of the land. Examples of solutions could include: • Dikes or dams • Windbreaks • Shrubs, grass, and/or trees to hold back the land. • Develop a simple sketch, drawing, or physical model to show how the structure can slow or prevent changing the shape of the land. • Describe how the shape and stability of structures are related to their function.(K-2. Engineering Design)

SUGGESTED ACTIVITIES

- **Save the Village!** In a metal/ tin tray, students will set up a town on one side and plan for water to take up the space on the other side. Just like in the real world, we must think of a way to keep the houses protected from the environment. How can we save the village? Students will have access to items such as clay, sand and pebbles to try to engineer a solution. They will plan a design and then begin to save their village by using their resources. The final step would be to add water and see how their design worked. Students will make reflections on their design and think about what worked well and what they could have done differently to make it better.

- **3D Map:** Students will take their knowledge on landforms and create their own topographical map. This map should include the different landforms and show their patterns. For example, their mountains should be taller than their hills, streams will flow into another body of water, or an island would be shown in an ocean/ sea. Students can use different building resources such as legos, blocks, clay, or paper to engineer and label their topographical map.

- How Can Water Change the Shape of the Land? In this lesson plan children investigate water erosion. Students make a sand tower and observe the erosion as they drop water on it. Students observe, illustrate, and record notes about the process. Short videos and a read aloud also further support understanding of the Performance Expectation.http://ngss.nsta.org/Resource.aspx?ResourceID=390

- How Can Wind Change the Shape of the Land? Students will discover how water changes the earth. For this lesson, students take part in a teacher-led investigation to show how wind changes the land. The children use straws to blow on a small mound or hill of sand. As each child takes a turn, the other students record their detailed observations that will later be used to draw conclusions. Students also watch a short video on wind erosion and discuss the new learning with partners.
  http://ngss.nsta.org/Resource.aspx?ResourceID=401

- Finding Erosion At Our School In this lesson, students walk around the school grounds, neighborhood, or another area of their community to locate evidence of erosion. Various problems caused by erosion are discussed and a solution is

developed for one of the problems. This lesson is one in a series on erosion by Jeri Faber. A follow-up lesson is available where students compare their erosion design solutions.
http://ngss.nsta.org/Resource.aspx?ResourceID=391

- Soil Erosion Simulation This is a simulation that shows the effect of rainfall on soil.http://www.unitedstreaming.com/videos/dsc/externalApplications/virtual_labs-es/Erosion/index.html

- Quick or Slow? I've Got to Know! The children will use several sources to find evidence that natural events, such as earthquakes, volcanoes, or erosion happen quickly or slowly. First they will use their learned knowledge to make a claim and then they will search for evidence to back up their claim by looking in different books. They will use text features, such as table of contents and indexes to help them locate information. To end the lesson, we discuss their claims as a whole group.
https://betterlesson.com/lesson/635811/quick-or-slow-i-ve-got-to-know

- Water and Landform Unit These 10 lessons provide activities for students to learn about water and landforms on Earth.
https://betterlesson.com/user/464854/68211/162772/jeri-faber/curriculum

- Earth's Changes Unit- These 21 lessons provide activities for students to learn how Earth's land changes.
https://betterlesson.com/user/464854/68211/162773/jeri-faber/curriculum

- BrainPOP Weathering Video- Where do soil and sand come from? In this BrainPOP movie, Tim and Moby introduce you to the fundamentals of weathering. Discover how rocks break down into soil and how slow, natural forces can actually change the shape of Earth's surface. You'll learn the four causes of mechanical weathering, as well as the difference between mechanical and chemical weathering. You can also find out about some of the cool natural phenomena that chemical weathering can cause — like caves!
https://www.brainpop.com/science/weather/weathering/

- Where Do Mountains Come From? A short video on how mountains are formed, then make your own mountain after watching this clip!
https://www.youtube.com/watch?v=Fd_XqYE2BWY

UNIT VOCABULARY

cliff: high, steep rock wall

compass: tool that shows direction

compass rose: shows the directions on a map

dam: a barrier to block the flow of water

dike: a long wall built to prevent flooding from the sea

earthquakes: a sudden shaking of the ground caused by land moving

erosion: the movement of rocks or soil caused by wind, water, or ice

flood: water covers land that was dry before

glacier: area of thick ice that stays frozen all year

globe: a model of the Earth

island: area of land with water all around it

lake: body of water with land all around it

landslide: soil and rocks move from higher ground to lower ground

lava: melted rock that flows from a volcano

levee: a wall that keeps water away from dry land

map key: explains what the symbols on a map mean

ocean: salty water that covers much of Earth's surface

river: water that flows across land

sand dune: a hill of sand made by the wind

sandbar: a sandy place in a river

seismograph: a tool that measures earthquakes

soil: top layer of land where plants grow

valleys: low places that lie between mountains or hills

volcano: an opening on Earth from which lava flows

weathering: breaking of rocks into smaller pieces

windbreak: a row of trees or shrubs used to block the wind

RESOURCES

Exploring Science, National Geographic

Supplies: As per lab manuals

Trade books:
National Geographic Kids: Everything Volcanoes and Earthquakes by Kathy Furgang
National Geographic Kids: Volcanoes by Anne Schreiber
Water is Water: A Book About the Water Cycle by Miranda Paul
National Geographic Readers: Water by Melissa Stewart
Cracking Up: A Story About Erosion by Jacqui Bailey
Weathering and Erosion by Torrey Maloof
Earth's Landforms and Bodies of Water by Natalie Hyde
Erosion: Changing Earth's Surface by Robin Koontz
Volcanoes and Earthquakes, What and Why? by Baby Professor

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas

www.opened.com - background information for teachers and lesson ideas
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
https://www.youtube.com/user/scishowkids/playlists - SciShow Kids YouTube (4 min video clips and experiment ideas)

MODIFICATIONS

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

http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

BI-BOROUGH SCIENCE CURRICULUM - GRADE TWO

UNIT THREE

Life Science - Interdependent Relationships in Ecosystems

(Third Trimester- Late March, April, May, June)

INTRODUCTION OF UNIT:

(Excerpt from New Jersey Model Curriculum- Grade 2, Science Unit 1, "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.

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.

Students also focus on 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.

Students also 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 representations 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.

NEW JERSEY STUDENT LEARNING STANDARDS

Science

Disciplinary Core Ideas

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)

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)

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)

Science and Engineering Practices

Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1)
- Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2-LS4-1)

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns. (2-LS2-1)

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)

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)

NEW JERSEY STUDENT LEARNING STANDARDS

Connections to:

Technology http://www.state.nj.us/education/cccs/2014/tech/

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge
- 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

ELA **http://www.state.nj.us/education/cccs/2016/ela/**

Reading - Informational Text

- RI.2.1 Ask and answer such questions as *who, what, where, when, why*, and *how* to demonstrate understanding of key details in a text.
- RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
- RI.2.4 Determine the meaning of words and phrases in a text relevant to a *grade 2 topic or subject area.*
- RI.2.10 Read and comprehend informational texts, including history/social studies, science, and technical texts, at grade level text complexity proficiently with scaffolding as needed.

Writing

- W.2.7 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).
- W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Speaking and Listening

- SL.2.1 Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.
- SL.2.5 Use multimedia; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.

Mathematics **http://www.state.nj.us/education/cccs/2016/math/standards.pdf**

Mathematical Practices

- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.

Measurement and Data

- 2.MD.D.10 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.

21st Century Life and Careers
http://www.state.nj.us/education/cccs/2014/career/9.pdf

- 9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
- 9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering, and construction to projects.
- 9.3.12.AG-PL.1 Develop and implement a crop management plan for a given production goal that accounts for environmental factors.
- 9.3.12.AG-PL.2 Apply the principles of classification, plant anatomy and plant physiology to plant production and management.
- 9.3.12.ED.1 Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.

BIG IDEA/COMMON THREAD

Plants need water and sunlight to grow. Plants depend on animals for seed dispersal and pollination. Different habitats offer a diversity of life.

ENDURING UNDERSTANDINGS

- Plants depend on water and light to grow.
- Plants also depend on animals for pollination or to move their seeds around.
- Different organisms live in different places.

ESSENTIAL QUESTIONS

- How does the diversity of plants and animals compare among different habitats?
- What do plants need to live, grow, and reproduce?

ASSESSMENT

- Teacher-created formative assessments, such as:
    - Cumulative projects
    - Data collection (charts/graphs/tables)
- Teacher observations, conferences
- Hands-on lab experiences

UNIT OBJECTIVES

Students will be able to …

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

  Disciplinary Ideas
    - Understand that plants depend on water and light to grow.

  Science and Engineering Practices
    - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

  Crosscutting Concepts
    - Recognize that events have causes that generate observable patterns.

2-LS2-1

Concepts	Students Can...
• Plants depend on water and light to grow. • Events have causes that generate observable patterns.	• Conduct an investigation to determine whether plants need sunlight and water to grow. *(Note: test one variable at a time.)* • Plan and conduct an investigation collaboratively to collect data. • Observe patterns in events generated by cause-and-effect relationships.

Students will be able to …

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

Disciplinary Core Ideas
- Understand that plants depend on animals for pollination or to move their seeds around.
- Understand that designs can be conveyed through sketches, drawings, or physical models.

Science and Engineering Practices
- Develop a simple model based on evidence to represent a proposed object.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Crosscutting Concepts
- The shape and stability of structures of natural and designed objects are related to their function(s).

2-LS2-2

Concepts	Students Can...
• Plants depend on animals for pollination or to move their seeds around. • Designs can be conveyed through sketches, drawings, or physical models to communicate solution ideas. • The shape and stability of structures of natural and designed objects are related to their function.	• Understand the function of an animal in dispersing seeds or pollinating plants. • 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. • Develop a simple model based on evidence to represent a proposed object or tool. • Describe how the shape and stability of structures are related to their function.

Students will be able to …

- Make observations of plants and animals to compare the diversity of life in different habitats. (2-LS4-1)

  [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.]

  Disciplinary Core Ideas
  - Understand that there are many different kinds of living things in any area, and they exist in different places on land and in water.

  Science and Engineering Practices
  - Make observations (firsthand or from media) to collect data which can be used to make comparisons.

  Crosscutting Concepts
  - Events have causes that generate observable patterns.

2-LS4-1

Concepts	Students Can...
• There are many different kinds of living things in any area, and they exist in different places on land and in water. • People look for patterns and order when making observations about the world.	• Make observations of plants and animals to compare the diversity of life in different habitats. • Make observations to make comparisons. • Look for patterns and order when making observations about the world.

SUGGESTED ACTIVITIES

- **Who Needs What?** Students design an experiment to test whether or not plants need light and water in order to grow. Students plant sunflower seeds in plastic cups, and measure growth of plants exposed to the different conditions https://www.teachengineering.org/lessons/view/duk_sunflower_mary_less

- **Do Plants Need Sunlight?** Students cover leaves with dark paper to see if sunlight is necessary. http://www.reachoutmichigan.org/funexperiments/agesubject/lessons/sunlight.html

- **I Scream, You Scream, We All Scream for Vanilla Ice Cream!** In this lesson, students will view a video about pollinating vanilla by hand design and make their own vanilla plant pollinator so that the great vanilla flavored ice cream can continue to be produced. This is an end-of-the-unit task, taking about 3 days to complete. Video: https://www.youtube.com/watch?v=i_Pguwl9c1Q https://betterlesson.com/lesson/628130/i-scream-you-scream-we-all-scream-for-vanilla-ice-cream

- **The Bug Chicks-Mission: Pollination (Episode 5):** The Bug Chicks' five minute video provides a fun, animated way of learning about the fascinating world of pollination and insects. In this video, the students observe interesting museums and habitats to look at lesser known insect pollinators. The student challenge at the end leads students into their environment to look for other pollinators and encourages them to bring their observations back to the classroom to discuss. https://pollinatorlive.pwnet.org/teacher/bug_chicks.php?movie_file=BugChicks5.flv

- **Modelling Seed Germination:** Give each group a small clear plastic bag, a little sugar, a short length of string and a piece of plastic plant. Ask them to put the sugar, string and plant in the bag so it represents a seed. Remind them how a seed starts to grow – first the root comes out, using the sugar for energy. Ask them to pull part of the string out of the bag. Remind them that the stem and leaves grow next, and ask them to pull part of the plastic plant out of the bag. Now the bag resembles a seedling

- **Seed Dispersal Techniques:** Explain that some seeds have ways of getting away from the plant that made them, to have more room to grow. Give the students various types of seeds and point out their adaptations:

a. Tulip poplar tree – has a hook that sticks to deer and gets carried away before falling off. Also, it floats. Optional: give bowls of water and let them see it float.
b. Maple tree – spins like a helicopter. Spinning slows it down so the wind can catch it and carry it away. Let students drop them to see spinning.
c. Dandelion – fluffy part helps it float down slowly and get caught by wind.
d. Pine cone – floats, so can be carried downstream if it falls in a stream.
e. Strawberry or other sweet fruit or berry – gets eaten because many animals like sweet foods, and seeds have a hard coat that keeps them from getting digested, so they come out the back end in a different location.

- **Puppet show**: Perform the "Seed Dispersal" puppet show from *Hands-On Nature* by Jenepher Lingelbach. Simple puppets can be made by taping pictures to craft sticks.

- **Nature Walk**: Take the class outdoors to look for seeds and discuss their dispersal adaptations.

- **Modelling Pollination:** Hide around a dozen small bowls in a large indoor or outdoor area containing flour and colored pony beads (one color per bowl.) Give each student a half piece of pipe cleaner (their "pollinator) and let them bend them in a way that will help them collect as much "pollen" (flour) as possible. Let them hunt for the bowl and collect flour on their pipe cleaner and pony beads in a small bag. The students who collect the most flour and beads get to be entertained by the rest of the class doing a waggle dance for them, like bees telling hive mates about the location of nearby flowers.

- **Paper Helicopters (Whirlybirds):** make paper helicopters, and compare their flight to maple seeds. Printable templates are available on various websites such as http://ihmhealth.com/paper-helicopter-template.html

- **Over in the Ocean:** Do the "Over in the Ocean" activity from *More Picture-Perfect Science Lessons*

- **Cumulative Ecosystem or Habitat Project:**
  Students chose an ecosystem that is familiar to them. They think about the characteristics of this ecosystem. Then, students will create an animal that would be able to live in this ecosystem. Each child will create their ecosystem in a box or shoe box and then create their animal that would live in this ecosystem.

  habitat: the home of an animal or a plant (basic)

  ecosystems: all of the living things in a given area, interacting with each other, and also with their environments This version includes predators (challenge)

http://www.teachingideas.co.uk/animals-and-habitats/create-your-own-animal
http://utahscience.oremjr.alpine.k12.ut.us/sciber00/7th/genetics/sciber/creature.htm

UNIT VOCABULARY

biologist: a scientist that studies living things

depend: to need something in order to live

ecosystems: all of the living things in a given area, interacting with each other, and also with their environments

germination: the sprouting of a new plant from a seed

habitat: the home of an animal or a plant

interdependent: people, animals, plants, or things that depend on each other

plants: a living thing that uses sunlight to create it's own food.

pollinate: to move pollen from one flower to another.

seedling: a young plant

seeds: the small parts produced by plants from which new plants grow.

soil: the top layer of the Earth which plants grow in

RESOURCES

Exploring Science, National Geographic

Supplies: As per lab manuals
Hands-On Nature by Jenepher Lingelbach (for seed dispersal puppet show script)
More Picture-Perfect Science Lessons by Karen Ansberry and Emily Morgan

Trade books:
Over In the Ocean: In a Coral Reef by Marianne Berkes
Coral Reef Animals (Animals in their Habitats series) by Francine Galko
Seeds and Fruits (Plant Parts) by Melanie Waldron
Flip,Float, Fly:Seeds on the Move by JoAnn Early Macken and Pam Paparone
Up in the Garden and Down in the Dirt by Kate Messner

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas
www.opened.com - background information for teachers and lesson ideas
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
https://www.youtube.com/user/scishowkids/playlists - ShiShow Kids YouTube (4 min video clips and experiment ideas)

MODIFICATIONS

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles
    - http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA
- See NGSS Appendix D
    - http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

Appendix A
K-2 Engineering Design Standards

Students who demonstrate understanding can:
K-2-ETS1-1. 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-ETS1-2. 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-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Disciplinary Core Ideas

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)

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)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.

- Ask questions based on observations to find more information about the natural and/or designed world. (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)

Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of
- an object or tool to determine if it works as intended. (K-2-ETS1-3)

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2)