Allamuchy Township School District
Allamuchy, NJ

Science
Grade 2

CURRICULUM GUIDE

August 28, 2017
Updated October 2019

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This curriculum may be modified through varying techniques, strategies and materials, as per an individual student's Individualized Education Plan (IEP).

Approved by the Allamuchy Board of Education
At the regular meeting held on October 28, 2019
And
Aligned with the New Jersey Core Curriculum Content Standards
And Common Core Content Standards

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Philosophy and Rationale

Science, technology, and engineering influence and permeate every aspect of modern life. The primary goal of the science curriculum is to develop substantive science literacy in all students. The program must provide students with opportunities to expand, change, enhance, and modify the ways in which they view the world. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions. Students will be empowered to express and share points of view, solve problems, and make decisions based on evidence. Teachers facilitate an environment that promotes student's thinking, honesty, curiosity, and questioning. As a human endeavor, science seeks to provide an explanation of phenomena occurring in the natural world. This endeavor merges three pillars: Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

Project-based learning activities provide opportunities for students to develop materials that show evidence of their engagement with issues raised in the course and, more practically, that may be adapted for their own courses in the future.

Mission Statement

Building on tradition and success, the mission of the Allamuchy Township School District is to foster a caring and creative environment where students grow as learners and citizens while developing 21st century skills. We provide a culture for social emotional learning that contributes to a positive school climate, increased academic success, and a sense of ownership within the community.

The Allamuchy Learner

The Allamuchy Township School District pursues a holistic approach to encouraging the educational growth of every student. We consider each student as an individual with particular strengths and weaknesses, likes and dislikes and varying motivations. The goal of the Allamuchy educational program is to develop young people who are curious, well rounded, knowledgeable, caring, respectful and responsible so that they can evolve into self-sufficient and confident citizens and members of a diverse society.

Unit 1 - Properties and Changes of Matter

Scope and Sequence
Time: Approximately 42 days

In this unit of study, students demonstrate an understanding of observable properties of materials through analysis and classification of different materials. Students continue to develop an understanding of observable properties of materials through analysis and classification of different materials.

Corresponds to Unit 2 in textbook

Stage 1: Desired Results

Content Standards
2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2-PS1-2: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
2-PS1-3: 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-PS1-4: Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
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.

Essential Questions
How do the properties of materials determine their use?
How can objects change?
Are all changes reversible?

Enduring Understandings
- 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.
- 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 students 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.
- Objects may break into smaller pieces and be put together into larger pieces.
- A great variety of objects can be built up from a small set of pieces.
- 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 sometime they are not.

Knowledge and Skills (SWBAT embedded course proficiencies)
Students who understand the concepts are able to:

- 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 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.
- 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. 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.
- 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.
- 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 wate and butter at different temperatures.
    - Examples of irreversible could include
        - Cooking an egg
        - Freezing a plant leaf
        - Heating paper

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Stage 3: Learning Plan

In this unit of study, students look for patterns and cause-and-effect relationships as they describe and classify materials using physical properties. 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 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 materials 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.

In Unit 2, Properties of Matter, students engage 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.

Because every human-made product is designed by some knowledge of the natural world and is built using material 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 Pits.* 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.
- Select one structure from the list and determine the intended purpose of that structure.
- Select two or threes 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.
- 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.

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 crayons, 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 reversed and some cannot, and they can use evidence from their investigations to support their thinking.
Suggested Activity: Matter: Properties of a Ball (learning-in-action.williams.edu). Use: Root Root Bear Floats to teach states of matter and/or Mock Orange Soda (learninglabresources.com). Structure and Properties of Matter Grade 2 (mccracken.ky.schools.us).

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

The CCSS 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 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 test, teachers can model the comprehension skills 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.

As students investigate reversible and irreversible changes to matter, they should record observations in science journals, using drawing 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 or irreversible, and supply evidence to support their thinking. Evidence can include information recalled from experiences or information gather from informational texts or other resources. Some possible changes that can be used are:

- Tearing paper
- Bending a spoon
- Baking a cake
- Getting grass stains on a pair of jeans
- Cutting your hair

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 graphs (with a single-unit scale). This can lead to opportunities to analyze data and solve simple put together, take-apart, and compare problem 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.
- Classifying materials by color, shape, texture, or hardness.
- Classifying materials based on potential uses.

With any graph that student create, they should be expected to analyze the data and answer questions that require them to solve problems.

Modifications:

- Provide students with multiple choices of how they can represent their understandings
- 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.

Resources

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 2 - Relationships in Habitats

Scope and Sequence
Time: Approximately 41 days

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.

Corresponds to Unit 3 in textbook

Stage 1: Desired Results

Content Standards
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.
2-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2-LS2-2: Develop a simple model that mimics the function of an animal in dispersing seed or pollinating plants.
2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.

Essential Questions
Why do we see different living things in different habitats?

Enduring Understandings
- 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 place on land and in water.
- Events have causes that generate observable patterns.
- Plants depend on water and light to grow.
- The shape and stability of structures of natural and designed objects are related to their functions.
- Plants depend on animals for pollination or to move their seeds around.
- 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.

Knowledge and Skills (SWBAT embedded course proficiencies)
Students who understand the concepts are able to:
- 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.
- 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.
- Describe how the shape and stability of structures are related to their function.
- Develop a simple model based on evidence to represent a proposed object or tool.
- Develop a simple model that mimics 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.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Stage 3: Learning Plan

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 student's 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 live. Using first-hand 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 for fur so that animals can carry them from place to place.
- Animals eat fruits containing seeds, which are then dispersed through animal's body waste.

Second graders will need multiple opportunities to develop an understanding of the important relationships 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, drawing 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 how bees pollinate flowers.

In this unit of study, students learn that design can be covered 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.

Suggested Activity: Water Module: *Discoveries at Willow Creek* can use as a read-aloud along with the activities (Globe.gov). **Growing Up Wild:** Field Study Fun, pg. 58; Seed Need, pg. 50; Grow as We Go, pg 38. **Project Learning Tree:** The Shape of Things, activity 1. Peppermint Beetle, activity 3.

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 in 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.

Mathematics

Throughout this unit of study, students need opportunities to represent and interpret categorical data by drawing picture graphs and/or bar graphs (with 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 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. 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 collect in bar graphs and picture graphs can easily be used for this purpose.

Modifications:

- Provide students with multiple choices of how they can represent their understandings
- 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.

Resources

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 3 - The Earth's Land and Water

Scope and Sequence
Time: Approximately 27 days

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.

Corresponds to Unit 4 in textbook

Stage 1: Desired Results

Content Standards
2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area.
2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Essential Questions
Where do we find water?

Enduring Understandings
- 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.
- Maps show where things are located. Once can map the shapes and kinds of land and water in any area.

Knowledge and Skills (SWBAT embedded course proficiencies)
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
- Develop a model to represent patterns in the natural world.
- Develop a model to represent that shapes and kinds of land and bodies of water in an area.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Stage 3: Learning Plan

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 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).
Suggested Activity: **Growing Up Wild:** The Deep Blue Sea, pg. 28; Aqua Charades, pg 54; Wildlife Water Safari, pg 56. **Project Wild Aquatic:** Aqua Word, pg 29; Water Plant Art, pg 31; Marsh Munchers, pg 34.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students gather information about the types of landforms and bodies of water from experiences of 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 pieces, 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 year ago, have students show each number in three ways using base-ten blocks, number words, and expanded form.
- A stream is 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 additions 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:

- Provide students with multiple choices of how they can represent their understandings
- 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.

Resources

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 4 - Changes to Earth's Land

Scope and Sequence
Time: Approximately 34 days

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.

Corresponds to Unit 5 in textbook

Stage 1: Desired Results

Content Standards

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

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

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.

Essential Questions

In what ways do humans slow or prevent wind or water from changing the shape of the land?

Enduring Understandings

- 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.
- 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.

Knowledge and Skills (SWBAT embedded course proficiencies)

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. Some examples include:
    - Volcanic explosions
    - Earthquakes
    - Erosions of rocks
- 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.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Stage 3: Learning Plan

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. 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 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 erath event. For Example:
    - Different designs of dikes or dams to hold back water
    - Different designs of windbreaks to hold back wind
    - Different designs of using plants to hold back the land
- Nest, 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) 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, drawing, or models, and present them to the class.

Suggested Activity: Suggestion: Do this activity outside: Activity to demonstrate the power or rain (water is the primary source of weathering and erosion):
Supplies you will need:

- play sand
- small pebbles
- soil
- 2 Large broiler or other shallow pans
- Baster
- Watering Can
- Water

Mix up sand, soil, and pebbles with water to create a small landform on one end of the pan. Let it dry overnight. Set the pan at a slant with 2nd pan positioned to catch the mess. Use the baster to drop water on the landform, a few drops at first. Then use the watering can and give your landform a nice shower. Let students write down what happens in each step. Then at the end, flood it.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

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, 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, ora forest that began growing 200 years ago.

Modifications:

- Provide students with multiple choices of how they can represent their understandings
- 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.

Resources

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 5 - Engineering Design Process

Scope and Sequence
Time: Approximately 27 days
In this unit of study, students ask questions, make observations, and gather information to define and solve a problem.

Corresponds to Unit 1 in textbook

Stage 1: Desired Results

Content Standards
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.

Essential Questions
What is the design process?
How can we compare design solutions?

Enduring Understandings
- The shape and stability of structures of natural and designed objects are related to their functions.
- Analyze data from tests of an object or tool to determine if it works as intended.
- Ask questions to find more information.
- Define a simple problem.. of a new or improved object or tool.

Knowledge and Skills (SWBAT embedded course proficiencies)
Students who understand the concepts are able to:
- Ask questions, make observations, and gather information to define a problem to be solved through a design process.
- Observe and gather information in order to plan and build a solution to design something better.
- Analyze and compare multiple design solutions.
- Compare the strengths and weaknesses of different design solutions.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods (formative, summative, other evidence and/or student self- assessment)

Stage 3: Learning Plan

In this unit of study, students focus on how to define and solve problems. The lesson begins with students exploring the five steps of a design process engineers use to solve problems. Students will ask questions, make observations, and gather information. The lesson continues with students using drawings and models to solve real-life problems. Students will explore how to improve their designs and how the structure of their design is related to its purpose.
Students will then focus on comparing solutions to a problem. Students first analyze the strengths and weaknesses of a design, then follow the steps of a design process to build, tests, and compare.
Suggested Activity: Build a Satellite to Orbit the Moon (nasa.gov).

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students will ask and answer questions to show their understanding of key details in a text. With guidance and a adult support, use a variety of digital tools to produce and publish writing, including in collaboration with peers. Recall information from experiences or gather information from provided sources to answer questions.

Mathematics

Students have multiple opportunities to reason abstractly and quantitatively while modeling with mathematics through the use of bar graphs.. Draw picture graph and a bar graph (with single-unit scale) to represent a data set up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Modifications:

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New Jersey Core Curriculum and Common Core Content Standards

http://www.state.nj.us/education/cccs/

Integration of 21st Century Theme(s)

The following websites are sources for the following 21st Century Themes and Skills:
http://www.nj.gov/education/code/current/title6a/chap8.pdf
http://www.p21.org/about-us/p21-framework .
http://www.state.nj.us/education/cccs/standards/9/index.html

21st Century Interdisciplinary Themes (into core subjects)

- **Global Awareness**
- **Financial, Economic, Business and Entrepreneurial Literacy**
- **Civic Literacy**
- **Health Literacy**
- **Environmental Literacy**

Learning and Innovation Skills

- **Creativity and Innovation**
- **Critical Thinking and Problem Solving**
- **Communication and Collaboration**

Information, Media and Technology Skills

- **Information Literacy**
- **Media Literacy**
- **ICT (Information, Communications and Technology) Literacy**

Life and Career Skills

- **Flexibility and Adaptability**
- **Initiative and Self-Direction**
- **Social and Cross-Cultural Skills**
- **Productivity and Accountability**
- **Leadership and Responsibility**

Integration of Digital Tools

- **Classroom computers/laptops/Chromebooks**
- **Technology Lab**
- **Voice amplification device**
- **Other software programs**

Website Resources Grade 2 Science

- **https://www.state.nj.us/education/modelcurriculum/sci/videos**
- **https://nstahosted.org/pdfs/ngss/resources/MatrixForK-12ProgressionOfScienceAndEngineeringPracticsInNGSS.8.14.14.pdf**
- **https://www.state.nj.us/education/aps/cccs/science/resources/QR68.pdf**

Curriculum Modifications

Special Education and 504 Students

Modification are available to children who receive services under IDEA or Section 504 of the Rehabilitation Act.

GENERAL MODIFICATION:

- Larger Font
- Less content on each page
- Accept student pointing to answer rather than verbal or written
- Reduce difficulty
- Lower reading level
- Portfolio assessment rather than written
- Read aloud to student on worksheet, quiz, tests
- Science word wall with pictures for each word
- Scientific Method posters for young learners
- Record predictions together "I wonder" and "I think"
- Sequence work
- Cut and paste instead of writing
- Reward student for on task behavior
- Snap Type - for students who have difficulty writing, can take a picture from I-pad so that they are able to type in answers and other information

BEHAVIOR MODIFICATIONS:

- Breaks between tasks
- Cue expected behavior - discuss with student what cue will be
- Daily feedback to student using a behavior chart (have parents sign off daily)
- Positive reinforcement
- Use of proximity
- Chart progress and maintain data
- Use peer supports and mentoring

STUDENTS AT RISK OF SCHOOL FAILURE:

Students who are considered to have a higher probability of failing academically or dropping out of school.

- Appropriate and discrete sensory stimulation
- Placement in small groups
- Additional support
- Alernative assignment with same outcomes
- Insert meaning of vocabulary several times throughout the lesson
- Use of headphones during certain times to block out noises, ie tests, quizzes, projects
- Use of closed strategies - makes question and answering easier. Closed strategies narrow the depth of the curriculum and help the student understand the focus. Also, allows students to practice answering questions in a systematic format. Helps alleviate anxiety.

ENGLISH LANGUAGE LEARNER STUDENTS (ELL)

ELL students are students who are unable to communicate fluently or learn effectively in English, wo oftem come from non-English speaking homes and backgrounds, and who typically require specialized or modified instruciton in both the English language and in their academic courses.

- Alternate Responses
- Extended Time
- Simplified Instruction (written and verbal)
- Use lots of visuals
- Repeat/Rephrase often
- Use lower level materials when appropriate
- Provide extra practice in English
- If possible translate some things into the fluent language

GIFTED AND TALENTED STUDENTS:
Inclusion, infusion, and differential instruction across the curriculum meets the individual needs of gifted and talented students.

- Differentialed curriculum for the gifted learner
- Educational opportunities consisting of a continuum of differentiated curricula options, instructional approaches and materials
- Flexible groupings of students to facilitate differntiated instruction and curriculum
- Groups students to work on a higher level activity or book together

LEARNING ENVIRONMENTS:

- Extensive outside reading
- Active classroom discussion
- Innovative oral and written presentations
- Interactive, independent and interdiciplinary activities

ADDITIONAL ASSESSMENT METHODS (formative, summative, other evidence and/or student self-assessment):

- Portfolio
- Ask questions
- Define Problems
- Deveope and use models
- Plan and carry out investigations
- Analyze and interpret data
- Teacher observations
- Class discussion
- Venn diagram
- 3-D Foramtive Assessment - integrated perspective, engaging in science and engineering practice (SEP's) as part of sustained and meaningful investigations while applying disciplinary core ideas (DCIs) and cross-cutting concepts (CCCs).