# BURCH CHARTER SCHOOL OF EXCELLENCE

2020-2021

## 4th Grade Science

Approved by the Burch Charter School of Excellence Board of Trustees

August 2020

**MISSION STATEMENT OF BURCH CHARTER SCHOOL OF EXCELLENCE:**

Burch Charter School of Excellence (BCSE) was founded in September, 2008. Our primal mission is to enable students to reach their intellectual and personal potential. We strive to instill integrity and respect in our students' in partnership with families and the community. We maintain a blended learning environment that enhances positive character traits that ensures our students become productive 21st century world citizens. The Burch Charter School of Excellence, a public school, is committed to providing best practices for educating our students in an environment that enables them to develop into critical thinkers that evolve into digital, life-long learners. Our curriculum emphasizes literacy and mathematics infused with technology.

We believe:

- Our students will be effective communicators, quality producers, self-directed lifelong learners, community contributors, collaborative workers and complex thinkers;
- All students are entitled to opportunities to maximize their talents and abilities;
- Our ethnic and cultural diversity is our strength and prepares students for success in a global society;
- Setting high expectations for students, teachers and administrators ensures that our students successfully meet or exceed the New Jersey Student Learning Standards.
- Parents are essential partners in the education of their children;
- Maintaining a strong partnership with the Irvington community is integral to student success;
- Understanding, implementing and responding to current trends in technology is intrinsic to success in a 21$^{st}$ century world; In ensuring that the district has a well-trained, highly qualified and competent staff; In maintaining a safe and secure learning environment.

The underlying values and principles that drive our mission and vision are our personal responsibility, a strong work ethic, cooperation, respect for others, honesty, integrity and the firm belief that every child can learn.

# Burch Charter School of Excellence

# 4th Grade Science Model Curriculum Overview

**Unit 1: Weathering and Erosion** **Instructional Days: 10**

In this unit of study, students develop understandings of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. The crosscutting concepts of *pattern*s and *cause and effect* are called out as organizing concepts. Students demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *constructing explanations*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 4-ESS2-1 and 4-ESS1-1.

**Unit 2: Earth Processes**

**Instructional Days: 10**

In this unit of study, students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. The crosscutting concepts of *patterns*, *cause and effect*, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, and constructing explanations and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 4-ESS2-2, 4-ESS3-2, 3-5-ETS1-2, and 3-5-ETS1-3.

**Unit 3: Structures and Functions** **Instructional Days: 10**

In this unit of study, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. The crosscutting concepts of *systems and system models* are called out as organizing concepts for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency *in engaging in argument from evidence*. Students are also expected to use this practice to demonstrate understanding of the core idea.

This unit is based on 4-LS1-1.

**Unit 4: How Organisms Process Information** **Instructional Days: 10**

In this unit of study, students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. The crosscutting concepts of *cause and effect, systems and system models,* and *structure and function* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *developing and using models*. Students are expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 4-LS1-2 and 4-PS4-2.

**Unit 5: Transfer of Energy** **Instructional Days: 15**

In this unit of study, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. The crosscutting *concepts of cause and effect, energy and matter,* and the *interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *obtaining, evaluating, and communicating information.* Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 4-PS3-2 and 4-ESS3-1.

**Unit 6: Force and Motion** **Instructional Days: 15**

In this unit of study, students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object, and are expected to develop an understanding that energy can be transferred from object to object through collisions. The crosscutting concept of *energy and matter* is called out as an organizing concept. Students are expected to demonstrate grade-appropriate proficiency in *asking questions, defining problems,* and *constructing explanations, and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 4-PS3-1 and 4-PS3-3.

**Unit 7: Using Engineering Design with Force and Motion Systems** **Instructional Days: 15**

In this unit of study, students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of *energy and matter* and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*, *planning and carrying out investigations*, *constructing explanations*, and *designing solutions*. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

This unit is based on 4-PS3-4, 3-5-ETS1-1, 3-5-ETS1-2, and 3-5-ETS1-3.

**Unit 8: Waves and Information** **Instructional Days: 15**

In this unit of study, students use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. The crosscutting concepts of *patterns; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and *using models*, *planning and carrying out investigations*, and *constructing explanations, and designing solutions*. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

This unit is based on 4-PS4-1, 4-PS4-3, 3-5-ETS1-2, and 3-5-ETS1-3.

***Note:*** *The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 42 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.*

| Grade: 4 | | Content: Science |
|---|---|---|
| **Unit 1: Weathering and Erosion** | | **Time Frame: 10 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-ESS2-1:**<br>Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.<br><br>**Essential Question:**<br>❖ *How can evidence of the effect of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured?* | ❖ Cause-and-effect relationships are routinely identified, tested, and used to explain change.<br>❖ Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.<br>❖ Rainfall helps to shape the land and affects the types of living things found in a region.<br>❖ Living things affect the physical characteristics of their regions. | ❖ I can identify, test, and use cause-and-effect relationships in order to explain change.<br>❖ I can make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.<br>❖ I can make observations and/or measurements to produce evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. |
| **4-ESS1-1:**<br>Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.<br><br>**Essential Question:**<br>❖ *What can rock formations tell us about the past?* | ❖ Science assumes consistent patterns in natural systems.<br>❖ Patterns can be used as evidence to support an explanation.<br>❖ Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes.<br>❖ The presence and location of certain fossil types indicate the order in which rock layers were formed. | ❖ I can support explanations using patterns as evidence.<br>❖ I can identify the evidence that supports particular points in an explanation.<br>❖ I can identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. |

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| **Resources** | | |

**Glaciers, Water, and Wind, Oh My!** This hands-on activity allows students to explore five earth forces that may cause erosion as they model, observe, and record the effects of erosion on earth surfaces. Stations include demonstrations of chemical, wind, water, ice and heat forces as they affect weathering. http://ngss.nsta.org/Resource.aspx?ResourceID=35

**Bill Nye Video-Erosion:** Bill Nye, "The Science Guy", presents a video describing the effects of weathering (wind, water, ice) on landforms. Bryce Canyon is used as an example of the ways in which freezing water, plant roots, and wind weather the earth's surface creating the means for erosion. Students in video simulate effects of weathering which can be duplicated in a classroom setting. Nye also emphasizes the passage of time in millions of years as he explains the slower erosive effects of certain types of weathering. http://ngss.nsta.org/Resource.aspx?ResourceID=44

**Gary's Sand Journal:** This book allows students to observe illustrations of magnified sand particles with guided dialogue from an earth scientist who discusses sand origins. This book can be used to introduce students to types of sand, explain how earth processes were responsible for their creation, and discuss the work of earth scientists. After reading this book, students may use it as a resource when examining their own sand samples. They could list properties, discuss sand origins, and illustrate samples in a science journal. http://ngss.nsta.org/Resource.aspx?ResourceID=45

**Explaining Glaciers, Accurately:** Fourth grade lessons on glacial erosion demonstrate and explain the manner in which glaciers erode the earth. The mechanisms of plucking and abrasion are discussed. Activities (either whole-class or small group) include a teacher creation of a glacier model (using dirt and rocks to simulate a mountain, ice cubes and a small amount of water for glacier), then teacher demonstration of glacier "plucking" earth as it travels in a simulation activity. Students then experiment with rock samples, wood, sandpaper, and ice as they rub materials against each other to explore how glacial striations form and abrade other surfaces. In each simulation, students are asked to predict what would happen when glacial model water freezes, as they draw before and after pictures of the model. Students are also asked to predict how glacial striations were formed as they view photos, then record results of their abrasive materials activity. Students could benefit from the expertise of a mentoring geologist who shares illustrations and information with students and teachers. http://ngss.nsta.org/Resource.aspx?ResourceID=92

**Coastal Erosion:** This engineering design lesson focuses on the effects of erosion on Florida's coastline. It is one lesson offered within a larger weathering and erosion unit. Students groups work to create and use a model able to slow erosion, without damaging the coastal ecosystem. Students are responsible for developing scale diagram of their coastline erosion solution before building and testing their models in a pan to simulate the coastline. Students then complete a redesign cycle. Similar lessons from the developer can be used in conjunction with this lesson to incorporate the effects of erosion on humans and wildlife. http://ngss.nsta.org/Resource.aspx?ResourceID=106

**Pearson Realize**: **https://www.savvasrealize.com/index.html#/**

## Connections to NJSLS – English Language Arts

**W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.

**W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**W.4.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.

## Connections to NJSLS – Math

**MP.2:** Reason abstractly and quantitatively.

**MP.4:** Model with mathematics.

**MP.5:** Use appropriate tools strategically.

**4. MD.A.1:** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

**4. MD.A.2:** Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

| **Grade: 4** | | **Content: Science** |
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| **Unit 2: Earth Processes** | | **Time Frame: 10 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-ESS2-2:**<br>Analyze and interpret data from maps to describe patterns of Earth's features.<br><br>**Essential Question:**<br>❖ *What can maps tell us about the features of the world?* | ❖ Patterns can be used as evidence to support an explanation.<br>❖ Maps can help locate the different land and water features of Earth.<br>❖ The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.<br>❖ Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.<br>❖ Major mountain chains form inside continents or near their edges. | ❖ I can support an explanation using patterns as evidence.<br>❖ I can analyze and interpret data to make sense of phenomena using logical reasoning.<br>❖ I can analyze and interpret data from maps to describe patterns of Earth's features. |
| **4-ESS3-2:**<br>Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans<br><br>**Essential Question:**<br>❖ *In what ways can the impacts of natural Earth processes on humans be reduced?* | ❖ Cause-and-effect relationships are routinely identified, tested, and used to explain change.<br>❖ Engineers improve existing technologies or develop new ones to increase benefits, decrease known risks, and meet societal demands.<br>❖ A variety of hazards result from natural processes (e.g., earthquakes, floods, tsunamis, volcanic eruptions).<br>❖ Humans cannot eliminate the hazards, but they can take steps to reduce their impacts.<br>❖ Research on a problem should be carried out before beginning to design a | ❖ I can identify and test cause-and-effect relationships in order to explain change.<br>❖ I can generate multiple solutions to a problem and compare them based on how well they meet the criteria and constraints of the design solution.<br>❖ I can generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans |

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| **3-5-ETS1-2:**<br>Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br><br>**Essential Question:**<br><br>*What is the process for developing potential design solutions?* | ❖ Different solutions need to be tested in order to determine which of them best solve the problem, given the criteria and the constraints.<br>❖ Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. | ❖ I can generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br>❖ I can generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include:<br>✓ Drums sending coded information through sound waves;<br>✓ Using a grid of ones and zeroes representing black and white to send<br>✓ information about a picture;<br>✓ Using Morse code to send text. |
| **3-5-ETS1-3:**<br>Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.<br><br>**Essential Question:**<br>*How can various design solution be compared and improved?* | ❖ At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.<br>❖ Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. | ❖ I can plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.<br>❖ I can plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |
| **Resources** | | |

Engineering for the Three Little Pigs: This activity helps to demonstrate the importance of rocks, soils, and minerals in engineering and how using the right material for the right job is important. The students build 3 different sand castles composed of varying amounts of sand, water, and glue. The 'buildings' in this lesson are made of sand and glue, sand being a soil and glue being composed of different minerals. They then test them for strength (load bearing), and resistance to weathering. The students will then compare possible solutions and discuss how well each is likely to work while meeting the criteria and constraints of the problem. The students will be the engineers who figure out which materials are best for the buildings they are making, taking into consideration all the properties of materials that are discussed in the lesson.

Building for the Big One: This lesson plan details a Design Challenge in which students build and test structures while learning about the earthquakes that shake them. It is designed as a review or culmination of an Earthquake unit of study. The lesson plan allows teachers to connect back to previous lessons. The Tech Museum of Innovation also suggests that the lesson might be used as a form of introduction to a unit about earthquakes. The lesson would then be used to determine students' prior knowledge to set the stage for the design challenge. This resource often mentions the effects of tectonic plates on earthquake location. Grade 4 curriculum does not include tectonic plates in their earth science curriculum. Tectonic plate information is included in the lesson as a resource for the teacherEarthquakes in the Classroom: Students investigate which building types are structured to withstand earthquake damage. They take on the role of engineers as they design their own earthquake resistant buildings, then test them in a simulated earthquake activity. Students also develop an appreciation for the job of engineers who need to know about earthquakes and their causes in order to design resistant buildings. This lesson is one of several in the "Earthquakes Rock" unit provided by the Teach Engineering site. The unit "URL" listed here is not being reviewed for the Performance Expectation listed. It is offered as a supplemental concept and lesson background aid for teachers.
https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_natdis/cub_natdis_lesson03.xml

Getting the Right Angle on the Story: This informational text shows students how tsunamis form and behave. It also describes how scientists are collecting data to create models that can be used to predict tsunamis.  Animations/computer models are also included to enhance student knowledge of how tsunami warnings work. Models integrate new, unfamiliar vocabulary. Students could use the resource as a starting point for an earth systems unit; teachers could assign the site as a form of research where students gather data, take notes, and draw inferences from text. As students begin their study, they could generate a list of the earth's natural disasters and define their impact on human life and the environment. Their possible solutions for lessening that impact could also be incorporated as an informal formative assessment to determine student prior knowledge.

DLESE Earth Science Literacy Maps are a tool for teachers and students to find resources that relate to specific Earth science concepts. These maps illustrate connections between concepts and how they build upon one another across grade levels. Clicking on a concept within the maps will show DLESE resources related to the concept, as well as information about related AAAS Project 2061 Benchmarks and National Science Education Standards.

**Pearson Realize**: **https://www.savvasrealize.com/index.html#/**

## Connections to NJSLS – English Language Arts

**RI.4.1:** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

**RI.4.7:** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

**W.4.7:** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

**RI.4.9:** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

**RI.5.1:** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

**RI.5.1:** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

**RI.5.9:** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

**W.5.7:** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**W.5.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

**W.5.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.

## Connections to NJSLS – Math

**4. MD.A.2:** Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

**MP.2:** Reason abstractly and quantitatively.

**MP.4:** Model with mathematics.

**4.OA.A.1**: Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

**MP.5:** Use appropriate tools strategically.

**3-5.OA:** Operations and Algebraic Thinking

| Grade: 4 | | Content: Science |
|---|---|---|
| **Unit 3: Structures and Functions** | | **Time Frame: 10 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-LS1-1:**<br>Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction<br><br>**Essential Question:**<br>❖ *How do internal and external parts of plants and animals help them to survive, grow, behave, and reproduce?* | ❖ A system can be described in terms of its components and their interactions.<br>❖ Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. | ❖ I can describe a system in terms of its components and their interactions.<br>❖ I can construct an argument with evidence, data, and/or a model.<br>❖ I can construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction |

**Resources**

Animal Mouth Structures

In this lesson, students gather evidence to understand features that enable them to meet their needs. In particular, they examine the mouth structures of different animals to help them understand how animals are adapted to obtain food in their environment. http://www.pbslearningmedia.org/resource/tdc02.sci.life.colt.lp_mouths/animal-mouth-structures/

**Pearson Realize**: **https://www.savvasrealize.com/index.html#/**

**Connections to NJSLS – English Language Arts**

**W.4.1:** Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

**Connections to NJSLS – Math**

**4. G.A.3:** Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

| **Grade: 4** | | **Content: Science** |
|---|---|---|
| **Unit 4: How Organisms Process Information** | | **Time Frame: 10 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-LS1-2:**<br>Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.<br><br>**Essential Question:**<br><br>❖ *How do animals receive and process different types of information from their environment in order to respond appropriately?* | ❖ A system can be described in terms of its components and its interactions.<br>❖ Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain.<br>❖ Animals are able to use their perceptions and memories to guide their actions. | ❖ I can describe a system in terms of its components and their interactions.<br>❖ I can use a model to test interactions concerning the functioning of a natural system.<br>❖ I can use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. |
| **4-PS4-2:**<br>Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.<br><br>**Essential Question:**<br><br>❖ *What happens when light from an object enters the eye?* | ❖ Cause-and-effect relationships are routinely identified.<br>❖ An object can be seen when light reflected from its surface enters the eyes. | ❖ I can identify cause-and-effect relationships.<br>❖ I can develop a model to describe phenomena.<br>❖ I can develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. |

| Resources |
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| Pinhole Cameras and Eyes:<br><br>In this activity, students make a pinhole camera and see images formed on an internal screen. They then use a lens to see how this affects the images. Students investigate variables in its construction, and explore how it models the human eye's ability to receive and process information.<br><br>The Life of Environments<br><br>This unit is designed to address the concept that organisms sense the environment in order to live. It is a far-ranging and comprehensive unit that is designed to address multiple NGSS performance expectations (4-LS1-2, 4LS1-2, 4-PS3-2, 4-PS4-2) in seven explorative sections, with an additional summative assessment step.<br><br>Time to Think?<br><br>This resource allows the user to accurately measure and experiment with human reaction time. An interactive program measures reaction times in milliseconds and compares them in different cases (from simply reacting to a visual cue to having to read and then make a decision before reacting). This site provides a wide range of information and activities on the connection between the brain and behavior. Note: Link is to main introductory page. Scroll down to find links for the activity and others pages that allow users to view the results of other participants and guidance for conducting further research.<br><br>Catch It!<br><br>This lesson sequence involves student investigation of human reaction time and variables that may affect it. An initial phase has students practice catching a dropped ruler and converting the distance it drops to the length of time it took to react. This provides an opportunity for data collection, graphing, and writing a conclusion. After this guided inquiry phase, students may conduct research on human senses and reaction time, or move on to designing their own investigations of the effects of variables of their choosing on their reaction times.<br><br>**Pearson Realize**: **https://www.savvasrealize.com/index.html#/** |
| **Connections to NJSLS – English Language Arts**<br>**SL.4.5:** Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.<br>**Connections to NJSLS – Math**<br><br>**MP.4:** Model with mathematics.<br><br>**4. G.A.1:** Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. |

| **Grade: 4** | | **Content: Science** |
|---|---|---|
| **Unit 5: Transfer of Energy** | | **Time Frame: 15 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **<u>4-PS3-2:</u>**<br>Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.<br><br>**Essential Question:**<br>❖ *How does energy move?* | ❖ Energy can be transferred in various ways and between objects.<br>❖ Energy can be moved from place to place through sound, light, or electric currents.<br>❖ Energy is present whenever there are ~~moving objects~~, sound, light, or heat.<br>❖ Light also transfers energy from place to place.<br>❖ Energy can also be transferred from place to place by electric currents; the currents may have been produced to begin with by transforming the energy of motion into electrical energy. | ❖ I can make observations to produce data that can serve as the basis for evidence for an explanation of a phenomenon or for a test of a design solution.<br><br>❖ I can make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. |
| **<u>4-ESS3-1:</u>**<br>Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.<br><br>**Essential Question:**<br>❖ *From what natural resources are energy and fuels derived? In what ways does the human use of natural resources affect the environment?* | ❖ Cause-and-effect relationships are routinely identified and used to explain change.<br>❖ Knowledge of relevant scientific concepts and research findings is important in engineering.<br>❖ Over time, people's needs and wants change, as do their demands for new and improved technologies.<br>❖ Energy and fuels that humans use are derived from natural sources.<br>❖ The use of energy and fuels from natural sources affects the environment in multiple ways.<br>❖ Some resources are renewable over time, and others are not. | ❖ I can identify cause-and-effect relationships in order to explain change.<br>❖ I can obtain and combine information from books and other reliable media to explain phenomena.<br>❖ I can obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. |

| Resources |
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| Switch Energy Project: The Educator Portal provides free access to a documentary, energy labs, videos, and study guides.<br><br>Wind Generator: Windmills have been used for hundreds of years to collect energy from the wind in order to pump water, grind grain, and more recently generate electricity. There are many possible designs for the blades of a wind generator and engineers are always trying new ones. Design and test your own wind generator, then try to improve it by running a small electric motor connected to a voltage sensor.<br><br>Thermal Energy Transfer: Explore the three methods of thermal energy transfer: conduction, convection, and radiation, in this interactive from WGBH, through animations and real-life examples in Earth and space science, physical science, life science, and technology.<br><br>**Pearson Realize**: **https://www.savvasrealize.com/index.html#/** |
| **Connections to NJSLS – English Language Arts**<br><br>**W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.<br><br>**W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.<br><br>**W.4.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.<br>**Connections to NJSLS – Math**<br><br>**MP.2:** Reason abstractly and quantitatively.<br><br>**MP.4:** Model with mathematics.<br><br>**4.OA.A.1:** Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. |

| **Grade: 4** | | **Content: Science** |
|---|---|---|
| **Unit 6: Force and Motion** | | **Time Frame: 15 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-PS3-1:**<br>Use evidence to construct an explanation relating the speed of an object to the energy of that object<br><br>**Essential Question:**<br><br>❖ *What is the relationship between the speed of an object and its energy?* | ❖ Energy can be transferred in various ways and between objects.<br>❖ The faster a given object is moving, the more energy it possesses. | ❖ I can describe various ways that energy can be transferred between objects.<br>❖ I can use evidence (e.g., measurements, observations, patterns) to construct an explanation.<br>❖ I can use evidence to construct an explanation relating the speed of an object to the energy of that object. |
| **4-PS3-3:**<br>Ask questions and predict outcomes about the changes in energy that occur when objects collide<br><br>**Essential Question:**<br><br>❖ *In what ways does energy change when objects collide?* | ❖ Energy can be transferred in various ways and between objects.<br>❖ Energy can be moved from place to place by moving objects or through sound, light, or electric currents.<br>❖ Energy is present whenever there are moving objects, sound, light, or heat.<br>❖ When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.<br>❖ When objects collide, the contact forces transfer energy so as to change the objects' motions. | ❖ I can describe the various ways that energy can be transferred between objects.<br>❖ I can ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.<br>❖ I can ask questions and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact |

| Resources |
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| Spool Racers: This resource includes three parts: a video clip from the TV show, Zoom, to introduce the activity, an essay with background information about energy, and a set of printable instructions. Students use a spool, a toothpick, a washer, a rubber band, and a pencil to build a racer. They conduct tests with the racer by varying the number of twists in the rubber band or changing other design features. These websites provide additional ideas for modifying the basic rubber band racer design: http://www.scienceworld.ca/resources/activities/popcan-porsche and http://pbskids.org/designsquad/build/rubber-band-car/.<br><br>Force and Motion: This video segment from IdahoPTV's D4K defines gravity, force, friction and inertia through examples from amusement park rides. Examples and explanations of Sir Isaac Newton's Three Laws of Motion are also included.<br><br>Advanced High-Powered Rockets: Students select a flight mission (what they want the rocket to do) and design and construct a high-power paper rocket that will achieve the mission. They construct their rocket, predict its performance, fly the rocket, and file a post-flight mission report. Missions include achieving high altitude records, landing on a "planetary" target, carrying payloads, testing a rocket recovery system, and more.<br><br>**Pearson Realize**: **https://www.savvasrealize.com/index.html#/** |
| **Connections to NJSLS – English Language Arts**<br><br>**RI.4.1:** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.<br><br>**RI.4.3:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.<br><br>**RI.4.9:** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.<br><br>**W.4.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.<br><br>**W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.<br><br>**W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.<br><br>**W.4.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.<br><br>. |

| Grade: 4 | | Content: Science |
|---|---|---|
| **Unit 7: Using Engineering Design with Force and Motion Systems** | | **Time Frame: 15 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-PS3-4:**<br>Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.<br><br>**Essential Question:**<br>❖ *How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?* | ❖ Science affects everyday life.<br>❖ Most scientists and engineers work in teams.<br>❖ Engineers improve existing technologies or develop new ones.<br>❖ People's needs and wants change over time, as do their demands for new and improved technologies.<br>❖ Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.<br>❖ Energy can be transferred in various ways and between objects.<br>❖ Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.<br>❖ The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.<br>❖ Possible solutions to a problem are limited by available materials and resources (constraints). | ❖ I can describe the various ways that energy can be transferred between objects.<br>❖ I can apply scientific ideas to solve design problems.<br>❖ I can apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.)<br>✓ Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound or passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device. |

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| **3-5-ETS1-1:**<br>Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.<br><br>**Essential Question:**<br><br>❖ *What is a design for?*<br>❖ *What are the criteria and constraints of a successful solution?* | ❖ The success of a designed solution is determined by considering the desired features of a solution (criteria).<br><br>❖ Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. | ❖ I can define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.<br><br>❖ I can define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. |
| **3-5-ETS1-2:**<br>Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br><br>**Essential Question:**<br><br>❖ *What is the process for developing potential design solutions?* | ❖ Different solutions need to be tested in order to determine which of them best solve the problem, given the criteria and the constraints.<br><br>❖ Research on a problem should be carried out before beginning to design a solution.<br><br>❖ Testing a solution involves investigating how well it performs under a range of likely conditions. | ❖ I can generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br><br>❖ I can generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include:<br><br>✓ Drums sending coded information through sound waves;<br><br>✓ Using a grid of ones and zeroes representing black and white to send<br><br>✓ information about a picture;<br><br>✓ Using Morse code to send text. |

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| **3-5-ETS1-3:**<br>Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.<br><br>**Essential Question:**<br>*How can various design solution be compared and improved?* | ❖ At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.<br><br>❖ Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. | ❖ I can plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.<br><br>❖ I can plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |

**Resources**

The Sound of Science: Students are given a scenario/problem that needs to be solved: Their school is on a field trip to the city to listen to a rock band concert. After arriving at the concert, the students find out that the band's instruments were damaged during travel. The band needs help to design and build a stringed instrument with the available materials, satisfying the following criteria and constraints: 1) Produce three different pitched sounds. 2) Include at least one string. 3) Use only available materials. 4) Be no longer than 30 cm / 1 foot. The challenge is divided into 4 activities. Each activity is designed to build on students' understanding of the characteristics and properties of sound. By using what they learn about sound from these activities, students are then encouraged to apply what they know about sound to complete the engineering design challenge.

Energy Makes Things Happen: The Boy Who Harnessed the Wind: This article from Science and Children provides ideas for using the trade book, The Boy Who Harnessed the Wind, as a foundation for a lesson on generators. This beautiful book is the inspiring true story of a teenager in Malawi who built a generator from found materials to create much-needed electricity. The lesson allows students to explore the concept of energy transfer using crank generators. Students then design improvements to the crank mechanism on the generator. The lesson may be extended by having students build their own generators.

Light Your Way: Using the engineering design process, students will be designing and building a lantern that they will hypothetically be taking with them as they explore a newly discovered cave. The criteria of the completed lantern will include: hands need to be free for climbing, the lantern must have an on/off switch, it must point ahead when they are walking so they can see in the dark, and the lantern must be able to stay lit for at least 15 minutes. The constraints of the activity will be limited materials with which to build. At the completion of the activity, the students will present their final lantern to the class explaining how they revised and adapted the lantern to meet the criteria of the project. Students will include in the presentation the sketch of the model they created prior to building showing the labeled circuit they designed. This activity was one of numerous engineering lessons from the Virginia Children's Engineering Council geared towards Grades 1-5.
http://www.childrensengineering.org/technology/designbriefs.php.

**Pearson Realize**: **https://www.savvasrealize.com/index.html#/**

## Connections to NJSLS – English Language Arts

**W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.

**W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**RI.5.1:** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

**RI.5.1:** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

**RI.5.9:** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

**W.5.7:** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**W.5.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

**W.5.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.

## Connections to NJSLS – Math

**4. OA.A.3:** Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

**3.OA:** Mathematics Operations and Algebraic Thinking

**MP.2:** Reason abstractly and quantitatively.

**MP.4:** Model with mathematics.

**MP.5**: Use appropriate tools strategically.

**3-5.OA:** Operations and Algebraic Thinking

| Grade: 4 | | Content: Science |
|---|---|---|
| **Unit 8: Waves and Information** | | **Time Frame: 15 Days** |
| **Next Generation Science Standards** | **Skills** | I Can Statements |
| **4-PS4-1:**<br>Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.<br><br>**Essential Question:**<br><br>❖ *If a beach ball lands in the surf, beyond the breakers, what will happen to it?* | ❖ Science findings are based on recognizing patterns.<br>❖ Similarities and differences in patterns can be used to sort and classify natural phenomena.<br>❖ Waves, which are regular patterns of motion, can be made in water by disturbing the surface.<br>❖ When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.<br>❖ Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks | ❖ I can sort and classify natural phenomena using similarities and differences in patterns.<br>❖ I can develop a model using an analogy, example, or abstract representation to describe a scientific principle.<br>❖ I can develop a model (e.g., diagram, analogy, or physical model) of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move |
| **4-PS4-3:**<br>Generate and compare multiple solutions that use patterns to transfer information.<br><br>**Essential Question:**<br><br>❖ *Which team can design a way to use patterns to communicate with someone across the room?* | ❖ Similarities and differences in patterns can be used to sort and classify designed products.<br>❖ Knowledge of relevant scientific concepts and research findings is important in engineering.<br>❖ Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.<br>❖ Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—that is, convert it from | ❖ Sort and classify designed products using similarities and differences in patterns.<br>❖ Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. |

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| | digitized form to voice and vice versa. | |
| **3-5-ETS1-2:**<br>Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br><br>**Essential Question:**<br><br>❖ *What is the process for developing potential design solutions?* | ❖ Different solutions need to be tested in order to determine which of them best solve the problem, given the criteria and the constraints.<br><br>❖ Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. | ❖ I can generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<br><br>❖ I can generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include:<br><br>✓ Drums sending coded information through sound waves;<br><br>✓ Using a grid of ones and zeroes representing black and white to send<br><br>✓ information about a picture;<br><br>✓ Using Morse code to send text. |

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| **3-5-ETS1-3:**<br>Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.<br><br>**Essential Question:**<br>*How can various design solution be compared and improved?* | ❖ At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.<br><br>❖ Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. | ❖ I can plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.<br><br>❖ I can plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |

**Resources**

The "What it Looks Like in the Classroom" section of this document describes several student sense-making and engineering tasks.

The Utah Education Network has created several resources for fourth grade science teachers. http://www.uen.org/Lessonplan/LPview.cgi?grade=4

Michigan NGSS Moodle: The purpose of this website to provide K-5 Science teachers with resources, lessons, and activities based on the NGSS which were created by teachers in our region. http://moodle.tbaisd.org/course/view.php?id=1021

**Pearson Realize**: **https://www.savvasrealize.com/index.html#/**

**Connections to NJSLS – English Language Arts**

**RI.4.9:** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

**SL.4.5:** Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

**RI.5.1:** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

**RI.5.9:** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

**W.5.7:** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**W.5.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

**W.5.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.

**Connections to NJSLS – Math**

**MP.2:** Reason abstractly and quantitatively.

**MP.4:** Model with mathematics.

**MP.5:** Use appropriate tools strategically.

**3-5.OA:** Operations and Algebraic Thinking

**4. G.A.1:** Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

## Differentiated Instruction

***(content, process, product and learning environment)***

| At Risk Students | English Language Learners |
|---|---|
| **Modifications for Classroom**<br><br>Pair visual prompts with verbal presentations<br><br>Use of lab or experiments to give visual representation of concept<br><br>Ask students to restate information, directions, and assignments.<br><br>Work within group or partners<br><br>Repetition and practice<br><br>Model skills / techniques to be mastered.<br><br>Use metacognitive work<br><br>Extended time to complete class work<br><br>Provide copy of class notes<br><br>Student may request to use a computer to complete assignments.<br><br>Use manipulatives to examine concepts<br><br>Assign a peer helper in the class setting<br><br>Provide oral reminders and check student work during independent work time | **Modifications for Classroom**<br><br>Native Language Translation<br>(peer, online assistive technology, translation device, bilingual dictionary)<br><br>Preteach vocabulary<br><br>Use graphic organizers or other visual models<br><br>Use of manipulatives to<br>visualize concept<br><br>Highlight key vocabulary-chart or vocabulary bank<br><br>Use of nonverbal responses<br>(thumbs up/down)<br><br>Use sentence frames<br><br>Design questions for different proficiency levels<br><br>Utilize partners and partner talk |
| **Special Education** | **Gifted and Talented** |

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| **Modifications for Classroom**<br><br>Pair visual prompts with verbal presentations<br><br>Use of lab or experiments to give visual representation of concept<br><br>Ask students to restate information, directions, and assignments.<br><br>Preteach vocabulary<br><br>Repetition and practice<br><br>Model skills / techniques to be mastered.<br><br>Use manipulatives and visual representation to examine<br>Breakdown large assignments<br>into smaller tasks<br><br>Extended time to complete<br>class work<br><br>Provide copy of class notes<br><br>Preferential seating to be mutually determined by the student and teacher<br><br>Use of online component of book<br><br>Extra textbooks for home. Student may request books on tape / CD / digital media, as available and appropriate.<br><br>Assign a peer helper in the class setting<br><br>Provide oral reminders and check student work during independent work time<br><br>Assist student with long and short term planning of assignments | **Extension Activities**<br>Conduct research and provide presentation of cultural topics.<br><br>Design surveys to generate and analyze data to be used in discussion.<br><br>Use of Higher Level<br>Questioning Techniques<br><br>Provide assessments at a<br>higher level of thinking<br><br>Create alternative assessment which requires writing,<br>research and presentation |