



Diocese of Alexandria ~ Catholic Schools

Where faith and knowledge grow



DIOCESE OF ALEXANDRIA

As the Diocese of Alexandria seeks to provide a comprehensive learning environment, we are charged to “Teach More” by showing how all learning flows from and relates to our Creator. In this way, we will give our teaching a deeper meaning and purpose than simply the content itself. With this as our goal, the Catholic Schools Office has intertwined our selected curricular standards with the Catholic Standards developed by the Cardinal Newman Society. Through the merging of these two curricula, English Language Arts, Mathematics, Science, and Social Studies, teachers will be provided a roadmap to guide student’s understanding and recognition of the relationship between learning and the connection to our God.

Thomas E. Roque, Sr.  
Superintendent of Catholic Schools



## DIOCESE OF ALEXANDRIA

Through comprehensive review of curricula from high performing districts throughout the United States in combination with parochial schools and Newman Cardinal Standards, the Curriculum Team for the Diocese of Alexandria has generated curricula for English Language Arts, Mathematics, Science, and Social Studies. The development of this framework is designed to guide the instructional path of teachers as they focus on the formation of their students in the areas of faith, academic excellence, responsible citizenry, and effective communication and collaboration. This process is a continuous improvement process with no defined beginning or end.

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# Frameworks



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## HOW TO USE

The frameworks are guides to instruction. The frameworks assist teachers in planning and pacing instruction. Specific dates or weeks that may be included in this document are for reference. Each school and teacher must consider the make-up of their students, focusing on the needs and strengths of each child when pacing and planning instruction.

The cycles for the year help pace instruction and ensure students have consistent coverage of the content. The duration (the suggested amount of time to spend on each cycle) does not accommodate for the scheduling of special events, inclement weather or school events. Teachers, with principal guidance, should adjust pacing as needed to accommodate for these events.

## RESEARCH-BASED HIGH-YIELD PRACTICES FOR INSTRUCTION

These strategies have proven effective in affecting student learning and achievement gains. As you plan daily instruction, consider how and where to integrate these strategies into the instructional sequence. Effect size is in parentheses. Please refer to the works of John Hattie for a complete description of instructional effect size.

- Classroom Discussion/Discourse (.82)
- Teacher Clarity/making the learning visible with expectations for learning (.75)
- Reciprocal Teaching (.74)
- Feedback (.73)
- Metacognitive Strategies (.69)

# Grade 1 - Science



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Unit 1: PATTERNS OF CHANGE IN THE NIGHT SKY

Instructional Days: 25 days

## SUMMARY

*Can we predict how the sky will change over time?*

In this unit of study, students observe, describe, and predict some patterns in the movement of objects in the sky. The crosscutting concept of *patterns* is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *analyzing and interpreting data*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 1-ESS1-1 and 1-ESS1-2.

## Student Learning Objectives

**Use observations of the sun, moon, and stars to describe patterns that can be predicted.** *[Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.]* *[Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.]* **(1-ESS1-1)**

**Make observations at different times of year to relate the amount of daylight to the time of year.** *[Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]* *[Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]* **(1-ESS1-2)**

### Unit Sequence

**Part A:** *What patterns of change can be predicted when observing the sun, moon, and stars?*

Concepts	Formative Assessment
<ul style="list-style-type: none"><li>• Science assumes that natural events happen today as they happened in the past.</li><li>• Many events are repeated.</li><li>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.</li><li>• Patterns in the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.</li></ul>	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"><li>• Observe and use patterns in the natural world as evidence and to describe phenomena.</li><li>• Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.</li><li>• Use observations of the sun, moon, and stars to describe patterns that can be predicted. Examples of patterns could include:<ul style="list-style-type: none"><li>✓ The sun and moon appear to rise in one part of the sky, move across the sky, and set.</li><li>✓ Stars other than our sun are visible at night but not during the day. <i>(Assessment of star patterns is limited to stars being seen at night and not during the day.)</i></li></ul></li></ul>

### Unit Sequence

**Part B:** *What is the relationship between the amount of daylight and the time of year?*

Concepts	Formative Assessment
<ul style="list-style-type: none"><li>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.</li><li>• Seasonal patterns of sunrise and sunset can be observed, described, and predicted.</li></ul>	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"><li>• Observe and use patterns in the natural world as evidence and to describe phenomena.</li><li>• Make observations (firsthand or from media) to collect data that can be used to make comparisons.</li><li>• Make observations at different times of the year to relate the amount of daylight to the time of year. <i>(Note: The emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall; assessment is limited to relative amounts of daylight, not to quantifying the hours or time of daylight.)</i></li></ul>

### Sample of Open Education Resources

[The Dynamic Trio](#): In this lesson, students will learn about the stars, planets, and moons found in our solar system and how they relate to one another. The video segment enhances the learning. After a non-fiction read aloud, students work in groups to create models of the Solar System.

[Our Super Star](#): This is a three part lesson where students use observations, activities, and videos to learn basic facts about the Sun. Students also model the mechanics of day and night and use solar energy to make a tasty treat. One of the videos is a time-lapse video of a sunrise and a sunset.

[Keep a Moon Journal](#): The National Wildlife Federation's "Keep a Moon Journal" page allows students to get acquainted with the phases of the moon by keeping a moon journal to record their nightly observations for one month. The page has links to diagrams, a student printable, and activities connecting the journal to other content. The page is set up as a "family activity" and could be used as nightly homework for students then discussed weekly in class.

[Patterns of Daylight](#): This is a mini-unit that can be taught directly after Space Part 1 or independently. The author chose to teach the Space Part 1 unit (also available on Better Lesson! at <http://betterlesson.com/lesson/613469/introduction-and-pre-assessment> ) during January, and follows up at the end of the year in a recap in May. This lesson uses prior student knowledge and a video simulation.

[Observing the Sun](#): This lesson is an activity where students create a sun tracker and monitor the sun's position over the course of a day. Examples of student journals and connections within a larger unit are provided.

## Teacher Professional Learning Resources

### [Teaching NGSS in Elementary School—First Grade](#)

The presenters were Carla Sembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director at Michigan Mathematics and Science Centers Network, and Kathy Renfrew, K-5 Science Coordinator, VT Agency of Education and NGSS Curator introduced the *NGSS* Web seminar Series for K-5 educators.

After a brief overview of this *NGSS* for First Grade web seminar, Mary discussed the science and engineering practices in relation to teaching first grade. The web seminar focused on the concept of sound, and how performance expectations should be incorporated into teaching. Sound was further considered as a disciplinary core idea within first grade teaching. Participants viewed a video of a teacher supporting students in developing towards the performance expectations. The science and engineering practices of explanation and argument was considered within the lesson presented. Claim, evidence, reasoning and rebuttal were discussed, and a CER framework was shared. Carla introduced the KLEWS chart and discussed its use in an elementary classroom. Kathy shared the importance of classroom discourse and science talk. The web seminar closed with the sharing of resources in relation to the *NGSS* and teaching K-5 grades. Ted, in closing, shared NSTA resources in relation to the *NGSS*. Visit the [resource collection](#).

### [NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence](#)

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

### [NGSS Core Ideas: Earth's Place in the Universe](#)

The presenter was Julia Plummer from Penn State University. The program featured strategies for teaching about Earth science concepts that answer questions such as "What goes on in stars?" and "What patterns are caused by Earth's movements in the solar system?"

Dr. Plummer began the presentation by discussing what students should know about the disciplinary core idea of Earth's Place in the Universe. She talked about using the scientific and engineering practices to help engage students. Participants shared their ideas about applying this core idea to the classroom, and then Dr. Plummer shared strategies for effective instruction. She also discussed the importance of spatial thinking for students to begin thinking scientifically about these concepts.

**Appendix A: NGSS and Foundations for the Unit**

**Use observations of the sun, moon, and stars to describe patterns that can be predicted.** *[Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.]* *[Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.]* **(1-ESS1-1)**

**Make observations at different times of year to relate the amount of daylight to the time of year.** *[Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]* *[Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]* **(1-ESS1-2)**

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(1-PS4-3)</li> </ul> <p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2)</li> </ul> <p><b>Analyzing and Interpreting Data</b></p> <ul style="list-style-type: none"> <li>Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1)</li> </ul>	<p><b>ESS1.A: The Universe and its Stars</b></p> <ul style="list-style-type: none"> <li>Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1)</li> </ul> <p><b>ESS1.B: Earth and the Solar System</b></p> <ul style="list-style-type: none"> <li>Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1-ESS1-2)</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2)</li> </ul> <p><i>Connections to Nature of Science</i></p> <p><b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b></p> <ul style="list-style-type: none"> <li>Science assumes natural events happen today as they happened in the past. (1-ESS1-1)</li> <li>Many events are repeated. (1-ESS1-1)</li> </ul>

# Grade 1 - Science



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Unit 2: CHARACTERISTICS OF LIVING THINGS

Instructional Days: 25 Days

## SUMMARY

In this unit of study, students develop an understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs, as well as how the behaviors of parents and offspring help offspring survive. The understanding that young plants and animals are like, but not exactly the same as, their parents is developed. The crosscutting concept of *patterns* is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *obtaining, evaluating, and communicating information* and *constructing explanations*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 1-LS3-1 and 1-LS1-2.

## Student Learning Objectives

**Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.] (1-LS3-1)*

**Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.** *[Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).] (1-LS1-2)*

## Unit Sequence

*Part A: How are young plants and animals alike and different from their parents?*

### Concepts

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.
- Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.
- Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents.

### Formative Assessment

*Students who understand the concepts are able to:*

- Observe and use patterns in the natural world as evidence and to describe phenomena.
- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
  - ✓ Examples of patterns could include features plants or animals share.
  - ✓ Examples of observations could include that leaves from the same kind of plant are the same shape but can differ in size and that a particular breed of puppy looks like its parents but is not exactly the same.

*[Note: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.]*

## Unit Sequence

**Part B:** *What types (patterns) of behavior can be observed among parents that help offspring survive?*

### Concepts

- Scientists look for patterns and order when making observations about the world.
- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.
- Adult plants and animals can have young.
- In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring survive.

### Formative Assessment

*Students who understand the concepts are able to:*

- Observe and use patterns in the natural world as evidence and to describe phenomena.
- Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world.
- Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. Examples of patterns of behaviors could include:
  - ✓ The signals that offspring make, such as crying, cheeping, and other vocalizations.
  - ✓ The responses of the parents, such as feeding, comforting, and protecting the offspring.

## Sample of Open Education Resources

**Chip Off the Old Block:** In this lesson students compare adult plants with young plants and then match pictures of adult animals with their young. They then are asked to identify specific physical traits of plants and animals that can be used to identify them. Note: The Parent/Offspring photo collection on page three incorrectly states the offspring of a horse is a pony.

**Eat Like a Bird! January:** This lesson and activity is one of several lessons about birds. In this lesson, students learn that bird beaks come in many different sizes and shape. Each beak has a specific shape and function to help the bird to get and eat food.

**Why So Yummy?** In this lesson students will investigate how fruits help some plants survive. The background information is important to the overall goals of this lesson. It states, "fruit-bearing plants can be distinguished from other plants, because they contain a reproductive structure that develops into an edible fruit. This reproductive structure is the shelter that protects the seeds until they are mature. This is important, because seeds are not distributed to the earth for germination until they are ripe." The teacher will need to purchase some fruits ahead of time for this lesson. Identifying a variety of fruits and especially fruits children might have less experience with will enhance the experience.

## Teacher Professional Learning Resources

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

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

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

View the resource [collection](#).

### **NGSS Core Ideas: Heredity: Inheritance and Variation of Traits**

The presenter was Ravit Golan Duncan of Rutgers University. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?"

Dr. Duncan began the presentation by discussing the importance of heredity as a disciplinary core idea. She then described how student learning should progress across grade levels and showed examples of common preconceptions. Dr. Duncan also shared strategies and resources for teaching about heredity. Participants had the opportunity to submit their questions and comments in the chat.

Visit the resource [collection](#).

## Appendix A: NGSS and Foundations for the Unit

**Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.] (1-LS3-1)*

**Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.** *[Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).] (1-LS1-2)*

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Analyzing and Interpreting Data</b></p> <ul style="list-style-type: none"> <li>Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)</li> </ul> <p><b>Obtaining, Evaluating, and Communicating Information</b></p> <ul style="list-style-type: none"> <li>Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (1-LS1-2)</li> </ul>	<p><b>LS3.A: Inheritance of Traits</b></p> <ul style="list-style-type: none"> <li>Many characteristics of organisms are inherited from their parents. (3-LS3-1)</li> </ul> <p><b>LS1.B: Growth and Development of Organisms</b></p> <ul style="list-style-type: none"> <li>Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)</li> <li>Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (1-LS1-2)</li> </ul> <p><b>Connections to Nature of Science</b></p> <p><b>Scientific Knowledge is Based on Empirical Evidence</b></p> <ul style="list-style-type: none"> <li>Scientists look for patterns and order when making observations about the world. (1-LS1-2)</li> </ul>

# Grade 1 - Science



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## Unit 3: MIMICKING ORGANISMS TO SOLVE PROBLEMS

Instructional Days: 35 Days

### Summary

In this unit of study, students develop an understanding of how plants and animals use their parts to help them survive, grow, and meet their needs. Students also need opportunities to develop possible solutions. As students develop possible solutions, one challenge will be to keep them from immediately implementing the first solution they think of and to instead think through the problem carefully before acting. Having students sketch their ideas or make a physical model is a good way to engage them in shaping their ideas to meet the requirements of the problem. The crosscutting concept of structure and function is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in constructing explanations, designing solutions, and in developing and using models. Students are expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 1-LS1-1 and K-2-ETS1-2.

### Student Learning Objectives

**Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.\*** *[Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]* **(1-LS1-1)**

**Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface.\*** *[Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]* **(K-PS3-2)**

**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-ETS1-2)**

## Unit Sequence

*Part A: How can humans mimic how plants and animals use their external parts to help them survive and grow?*

### Concepts

- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.
- The shape and stability of structures of natural and designed objects are related to their function(s).
- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.
- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.
- 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.

### Formative Assessment

*Students who understand the concepts are able to:*

- Observe and describe how the shape and stability of structures of natural and designed objects are related to their functions.
- Use materials to design a device that solves a specific problem or [design] a solution to a specific problem.
- Use materials to design a solution to a human problem that mimics how plants and/or animals use their external parts to help them survive, grow, and meet their needs: Examples of human problems that can be solved by mimicking plant or animal solutions could include:
  - ✓ Designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales.
  - ✓ Stabilizing structures by mimicking animal tails and roots on plants.
  - ✓ Keeping out intruders by mimicking thorns on branches and animal quills.
  - ✓ Detecting intruders by mimicking eyes and ears.
- 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.

### Sample of Open Education Resources

[Eat Like a Bird! January](#): This lesson and activity is one of several lessons about birds. In this lesson, students learn that bird beaks come in many different sizes and shape. Each beak has a specific shape and function to help the bird to get and eat food.

[Why So Yummy](#): In this lesson students will investigate how fruits help some plants survive. The background information is important to the overall goals of this lesson. It states, "fruit-bearing plants can be distinguished from other plants, because they contain a reproductive structure that develops into an edible fruit. This reproductive structure is the shelter that protects the seeds until they are mature. This is important, because seeds are not distributed to the earth for germination until they are ripe." The teacher will need to purchase some fruits ahead of time for this lesson. Identifying a variety of fruits and especially fruits children might have less experience with will enhance the experience.

### Teacher Professional Learning Resources

#### [Connections Between Practices in NGSS, Common Core Math, and Common Core ELA](#)

The presenter was Sarah Michaels from Clark University. In this seminar Dr. Michaels talked about connecting the scientific and engineering practices described in A Framework for K-12 Science Education with the Common Core State Standards in Mathematics and English Language Arts.

#### [Engineering Design as a Core Idea](#)

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

#### [NGSS Core Ideas: From Molecules to Organisms: Structures and Processes](#)

The presenters were Aaron Rogat of Educational Testing Service (ETS) and Barbara Hug of the University of Illinois at Urbana-Champaign. The program featured strategies for teaching about life science concepts that answer questions such as "How do the structures of organisms enable life's functions?" and "How do organisms grow and develop?"

Dr. Hug began the presentation by discussing the arrangement of life science core ideas within NGSS and comparing them to previous standards. Next, Dr. Rogat shared an example of a learning progression, showing how a concept can be taught from early elementary through high school. The presenters then talked about strategies for instruction and shared links to resources. Participants had the opportunity to submit their questions and comments in the chat. Visit the [resource collection](#).

## Appendix A: NGSS and Foundations for the Unit

Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.\* *[Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.] (1-LS1-1)*

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. ( K-2-ETS1-2)

The performance expectations above were developed using the following elements from the NRC document  
[\*A Framework for K-12 Science Education:\*](#)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Analyzing and Interpreting Data</b></p> <ul style="list-style-type: none"> <li>Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)</li> </ul> <p><b>Constructing Explanations and Designing Solutions</b></p> <ul style="list-style-type: none"> <li>Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1)</li> </ul> <p><b>Developing and Using Models</b></p> <ul style="list-style-type: none"> <li>Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)</li> </ul>	<p><b>LS1.A: Structure and Function</b></p> <ul style="list-style-type: none"> <li>All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)</li> </ul> <p><b>LS1.B: Growth and Development of Organisms</b></p> <ul style="list-style-type: none"> <li>Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)</li> </ul> <p><b>LS1.D: Information Processing</b></p> <ul style="list-style-type: none"> <li>Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (1-LS1-2)</li> </ul> <p><b>Structure and Function</b></p> <ul style="list-style-type: none"> <li>The shape and stability of structures of natural and designed objects are related to their function(s). (1-LS1-1)</li> <li>The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)</li> </ul> <p><b>Connections to Engineering, Technology, and Applications of Science</b></p> <p><b>Influence of Science, Engineering and Technology on Society and the Natural World</b></p> <ul style="list-style-type: none"> <li>Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from</li> </ul>

	<p>survive. Plants also respond to some external inputs. (1-LS1-1)</p> <p><b>ETS1.B: Developing Possible Solutions</b></p> <ul style="list-style-type: none"><li>• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)</li></ul>	<p>the natural world. (1-LS1-1)</p>
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# Grade 1 - Science



THE DIOCESE  
of ALEXANDRIA

## Unit 4: LIGHT AND SOUND

Instructional Days: 40 Days

### SUMMARY

In this unit of study, students develop an understanding of the relationship between sound and vibrating materials as well as between the availability of light and the ability to see objects. The idea that light travels from place to place can be understood by students at this level by placing objects made with different materials in the path of a beam of light and determining the effect of the different materials.

The crosscutting concept of *cause and effect* is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations*, *constructing explanations*, and *designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

### Student Learning Objectives

**Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.** *[Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]* [\(1-PS4-2\)](#)

**Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.** *[Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).]* *[Assessment Boundary: Assessment does not include the speed of light.]* [\(1-PS4-3\)](#)

**Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.** *[Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]* [\(1-PS4-1\)](#)

## Unit Sequence

**Part A:** *How can you prove that you can only see something when someone shines a light on it or if the object gives off its own light?*

### Concepts

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.
- Objects can be seen if light is available to illuminate them or if they give off their own light.

### Formative Assessments

*Students who understand the concepts can:*

- Design simple tests to gather evidence to support or refute ideas about cause and effect relationships.
- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Make observations (e.g., in a completely dark room, using a pinhole box, using video of a cave explorer with a flashlight) to construct an evidence-based account that objects can be seen only when illuminated (from an external light source or by an object giving off its own light).

### Unit Sequence

**Part B:** *What happens to a beam of light when you put different kinds of things in front of it?*

*How would you design an experiment to prove your thinking?*

#### Concepts

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.
- Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach.
- Mirrors can be used to redirect a light beam. *(Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)*

#### Formative Assessments

*Students who understand the concepts can:*

- Design simple tests to gather evidence to support or refute ideas about cause and effect relationships.
- Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question.
- Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. Materials can be:
  - Transparent (clear plastic, glass)
  - Translucent (wax paper, thin cloth)
  - Opaque (cardboard, construction paper)
  - Reflective (a mirror, a shiny metal spoon)

### Unit Sequence

**Part C:** *How do instruments (band) make sound?*

#### Concepts

- Sound can make matter vibrate, and vibrating matter can make sound.
- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

#### Formative Assessments

*Students who understand the concepts can:*

- Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string.
- Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.

## Sample of Open Education Resources

The “[What it Looks Like in the Classroom](#)” section of this document describes several student sense-making tasks.

The [Utah Education Network](#) has created several resources for fourth grade science teachers.

[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.

## Teacher Professional Learning Resources

### **NSTA Web Seminar: *NGSS Core Ideas: Waves and Their Applications in Technologies for Information Transfer***

This web seminar took place on September 24, 2013, from 6:30 p.m. to 8:00 p.m. eastern daylight time. The presenter was Ramon Lopez from the University of Texas at Arlington. The program featured strategies for teaching about physical science concepts that answer questions such as “How are waves used to transfer energy and information?” and “How are instruments that transmit and detect waves used to extend human senses?”

The web seminar is available at: [http://learningcenter.nsta.org/resource/?id=10.2505/9/WSNGSS13\\_Oct22](http://learningcenter.nsta.org/resource/?id=10.2505/9/WSNGSS13_Oct22)

### **Science Shorts: Making Waves**

Children do not have to live near the coast to experience effects of water waves. They can throw stones into a pond and see the waves ripple outward, bob up and down while floating in a swimming pool, and splash water about while in a bathtub. As students discover how waves form and move, they can apply this understanding to other types of waves such as sound waves, light waves, and microwaves. (Adams, B., 2007)

This journal article is available at: [http://learningcenter.nsta.org/resource/?id=10.2505/4/sc07\\_044\\_05\\_50](http://learningcenter.nsta.org/resource/?id=10.2505/4/sc07_044_05_50)

### **NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence**

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

The web seminar is available at: [http://learningcenter.nsta.org/products/symposia\\_seminars/NGSS/webseminar49.aspx](http://learningcenter.nsta.org/products/symposia_seminars/NGSS/webseminar49.aspx)

## Appendix A: NJSL-S and Foundations for the Unit

**Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.** *[Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]* [\(1-PS4-2\)](#)

**Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.** *[Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [Assessment Boundary: Assessment does not include the speed of light.]* [\(1-PS4-3\)](#)

**Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.** *[Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]* [\(1-PS4-1\)](#)

The performance expectations above were developed using the following elements from the NRC document [A Framework for K-12 Science Education](#):

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(1-PS4-3)</li> </ul> <p><b>Constructing Explanations and Designing Solutions</b></p> <ul style="list-style-type: none"> <li>Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1-PS4-2)</li> <li>Use tools and materials provided to design a device that solves a specific problem. (1-PS4-4)</li> </ul> <p><i>Connections to Nature of Science</i></p>	<p><b>PS4.A: Wave Properties</b></p> <ul style="list-style-type: none"> <li>Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1)</li> </ul> <p><b>PS4.B: Electromagnetic Radiation</b></p> <ul style="list-style-type: none"> <li>Objects can be seen if light is available to illuminate them or if they give off their own light. (1-PS4-2)</li> <li>Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light</li> </ul>	<p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Simple tests can be designed to gather evidence to support or refute student ideas about causes. (1-PS4-1),(1-PS4-2),(1-PS4-3)</li> </ul> <p style="text-align: center;"><b>Connections to Engineering, Technology, and Applications of Science</b></p> <p><b>Influence of Engineering, Technology, and Science, on Society and the Natural World</b></p> <ul style="list-style-type: none"> <li>People depend on various technologies in their lives; human life would be very different without technology. (1-PS4-4)</li> </ul>

<p><b>Scientific Investigations Use a Variety of Methods</b></p> <ul style="list-style-type: none"><li>• Science investigations begin with a question. (1-PS4-1)</li><li>• Scientists use different ways to study the world. (1-PS4-1)</li></ul>	<p>sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1-PS4-3)</p> <p><b>PS4.C: Information Technologies and Instrumentation</b></p> <ul style="list-style-type: none"><li>• People also use a variety of devices to communicate (send and receive information) over long distances. (1-PS4-4)</li></ul>	
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# Grade 1 - Science



THE DIOCESE  
of ALEXANDRIA

Unit 5: COMMUNICATING WITH LIGHT AND SOUND

Instructional Days: 25 Days

## SUMMARY

*How would we communicate over a distance without the use of any of the devices that people currently use?*

In this unit of study, students continue to develop their understanding of the relationship between sound and vibrating materials as well as between the availability of light and the ability to see objects. Students apply their knowledge of light and sound to engage in engineering design to solve a simple problem involving communication with light and sound. The crosscutting concepts of *structure and function and influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *constructing explanations and designing solutions, asking questions and defining problems, and developing and using models*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

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

## Student Learning Objectives

**Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.\*** *[Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]* [\(1-PS4-4\)](#)

**Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.** [\(K-2-ETS1-1\)](#)

**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.** [\(K-2-ETS1-2\)](#)

## Unit Sequence

*Part A: How can light or sound be used to communicate over a distance?*

### Concepts

- The shape and stability of structures of natural and designed objects are related to their function(s).
- People depend on various technologies in their lives; human life would be very different without technology.
- People also use a variety of devices to communicate (send and receive information) over long distances.
- 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.

### Formative Assessment

*Students who understand the concepts can:*

- Describe how the shape and stability of structures are related to their function.
- Ask questions based on observations to find more information about the natural and/or designed world.
- Define a simple problem that can be solved through the development of a new or improved object or tool.
- Ask questions, make observations, and gather information about a situation people want to change in order to 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.
- Use tools and materials provided to design a device that solves a specific problem.
- Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. Examples of devices could include:
  - ✓ A light source to send signals
  - ✓ Paper cup and string telephones
  - ✓ A pattern of drum beats

### Sample of Open Education Resources

[Assessing Light Knowledge - two lessons](#): In these lessons the students work as partners planning and designing a communication device that will signal across the gym or hallway from one partner to the other partner. The communication device must only use light and objects that block or change the light.

### Teacher Professional Learning Resources

#### [Assessment for the Next Generation Science Standards](#)

The presenters were Joan Herman, Co-Director Emeritus of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA; and Nancy Butler Songer, Professor of Science Education and Learning Technologies, University of Michigan.

Dr. Herman began the presentation by summarizing a report by the National Research Council on assessment for the *Next Generation Science Standards (NGSS)*. She talked about the development of the report and shared key findings. Next, Dr. Songer discussed challenges for classroom implementation and provided examples of tasks that can be used with students to assess their proficiency on the *NGSS* performance expectations. Participants had the opportunity to submit questions and share their feedback in the chat.

View the resource [collection](#).

#### [NGSS Crosscutting Concepts: Patterns](#)

The presenter was Kristin Gunckel from the University of Arizona. This was the first seminar in a series of seven focused on the crosscutting concepts that are part of the Next Generation Science Standards (NGSS).

#### [NGSS Crosscutting Concepts: Structure and Function](#)

The presenters were Cindy Hmelo-Silver and Rebecca Jordan from Rutgers University. This was the sixth web seminar in a series of seven focused on the crosscutting concepts that are part of the Next Generation Science Standards (NGSS).

## Appendix A: NGSS and Foundations for the Unit

**Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.\*** *[Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats.]* *[Assessment Boundary: Assessment does not include technological details for how communication devices work.]* **(1-PS4-4)**

**Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.** **(K-2-ETS1-1)**

**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.** **(K-2-ETS1-2)**

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(1-PS4-3)</li> </ul> <p><b>Constructing Explanations and Designing Solutions</b></p> <ul style="list-style-type: none"> <li>Use tools and materials provided to design a device that solves a specific problem. (1-PS4-4)</li> </ul> <p><b>Asking Questions and Defining Problems</b></p> <ul style="list-style-type: none"> <li>Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)</li> <li>Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)</li> </ul>	<p><b>PS4.C: Information Technologies and Instrumentation</b></p> <ul style="list-style-type: none"> <li>People also use a variety of devices to communicate (send and receive information) over long distances. (1-PS4-4)</li> </ul> <p><b>ETS1.A: Defining and Delimiting Engineering Problems</b></p> <ul style="list-style-type: none"> <li>A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)</li> <li>Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)</li> <li>Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)</li> </ul>	<p><b>Structure and Function</b></p> <ul style="list-style-type: none"> <li>The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)</li> </ul> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p><b>Influence of Engineering, Technology, and Science, on Society and the Natural World</b></p> <ul style="list-style-type: none"> <li>People depend on various technologies in their lives; human life would be very different without technology. (1-PS4-4)</li> </ul>

<p><b>Developing and Using Models</b></p> <ul style="list-style-type: none"><li>• Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)</li></ul>	<p><b>ETS1.B: Developing Possible Solutions</b></p> <ul style="list-style-type: none"><li>• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)</li></ul>	
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