Grade 1 Science, Unit 3

Mimicking Organisms to Solve Problems

Overview

Unit abstract

In this unit of study, students are expected to develop understanding of how plants and animals use their parts to help them survive, grow, and meet their needs. Students will 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. In the first grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in constructing explanations and designing solutions and in developing and using models. Students are expected to use these practices to demonstrate understanding of the core ideas.

Essential question

- What are some ways plants and animals meet their needs so that they can survive and grow?

Bristol–Warren, Central Falls, Cranston, Tiverton, and Woonsocket, with process support from The Charles A. Dana Center at the University of Texas at Austin

Written Curriculum

Next Generation Science Standards

1. Structure, Function, and Information Processing

Students who demonstrate understanding can:

1-LS1-1. 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.]

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

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

- Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1)

Disciplinary Core Ideas

LS1.A: Structure and Function

- 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)

LS1.D: Information Processing

- 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. (1-LS1-1)

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (1-LS1-1)

Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World

- Every human-made product is designed by applying some knowledge of the natural world and is built by built using materials derived from the natural world. (1-LS1-1)

Connections to other DCIs in first grade: N/A

Articulation of DCIs across grade-levels: **K.ETS1.A** (1-LS1-1); **4.LS1.A** (1-LS1-1); **4.LS1.D** (1-LS1-1); **4.ETS1.A** (1-LS1-1)

Common Core State Standards Connections:

ELA/Literacy –

W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-LS1-1)

<table>
<tr><th colspan="3">K-2. Engineering Design</th></tr>
<tr><td colspan="3">Students who demonstrate understanding can:
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.</td></tr>
<tr><td colspan="3">The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education:</td></tr>
<tr><td>Science and Engineering Practices
Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
▪ Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)</td><td>Disciplinary Core Ideas
ETS1.B: Developing Possible Solutions
▪ Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)</td><td>Crosscutting Concepts
Structure and Function
▪ The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)</td></tr>
<tr><td colspan="3">Connections to K-2-ETS1.A: Defining and Delimiting Engineering Problems include:
Kindergarten: K-PS2-2, K-ESS3-2
Connections to K-2-ETS1.B: Developing Possible Solutions to Problems include:
Kindergarten: K-ESS3-3, First Grade: 1-PS4-4, Second Grade: 2-LS2-2
Connections to K-2-ETS1.C: Optimizing the Design Solution include:
Second Grade: 2-ESS2-1</td></tr>
<tr><td colspan="3">Articulation of DCIs across grade-bands: 3-5.ETS1.A (K-2-ETS1-2); 3-5.ETS1.B (K-2-ETS1-2); 3-5.ETS1.C (K-2-ETS1-2)</td></tr>
<tr><td colspan="3">Common Core State Standards Connections:
ELA/Literacy –
SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (K-2-ETS1-2)</td></tr>
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Clarifying the standards

Prior learning

The following disciplinary core ideas are prior learning for the concepts in this unit of study. In kindergarten, students learn that:

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.

Progression of current learning

Driving question 1
What are some ways that humans mimic how plants and animals use their external parts to help them survive and grow?

Concepts	Practices
• 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.	• 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.

Integration of content, practices, and crosscutting concepts

In this unit of study, students investigate how plants and animals use their external structures to help them survive, grow, and meet their needs. Then students are challenged to apply their learning 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.

In order to recognize ways in which animals and plants use their external structures, students need opportunities to observe and describe how the shape and stability of organisms' structures are related to their functions. Students can make direct observations and use media resources to find relevant examples for both

plants and animals. They should observe that 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. In addition, animals have body parts that capture and convey different kinds of information from the environment, enabling them to respond to these inputs in ways that aid in survival. Plants, like animals, have different parts (roots, stems, leaves, flowers, fruits) that each serve specific functions in survival and growth, and plants also respond to external inputs. For each structure that students observe, they should describe how the shape and stability of that structure is related to its function.

The next step in this unit is to engage in **engineering design**. Students need opportunities to use materials to design a device that solves a specific human problem. Designs should mimic how plants and/or animals use their external parts to help them survive and grow. The engineering design process students engage in should include the following steps:

- As a class or in small groups, students participate in shared research to find examples of human-made products that have been designed and built by applying knowledge of the natural world. For each example, students identify the human problem(s) that the product solves and how that solution was designed using an understanding of the natural world.
- Students brainstorm possible human problems that can be solved by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. Examples could include:
  - Designing clothing or equipment to protect bicyclists that mimics turtle shells, acorn shells, and animal scales.
  - Stabilizing structures that mimic animal tails and plant roots.
  - Keeping out intruders by mimicking thorns on branches and animal quills.
  - Detecting intruders by mimicking eyes and ears.
- In small groups, students use sketches, drawings, or physical models to convey a design that solves a problem by mimicking one or more external structures of plants and/or animals.
- Use materials to create the design solution.
- Share the design solution with others in the class.

Integration of engineering

In this unit, students will use materials to design and/or build a device that solves a specific problem. When designing a solution, students will develop a simple model based on evidence. Students use both observations (firsthand or from media) and simple research to gather evidence that can be used to support possible design solutions. This process is outlined in greater detail in the previous section.

Integration of DCI from other units within this grade level

In Unit 2, Characteristics of Living Things, students observed and compared traits and patterns of behavior in organisms. This learning is foundational for the content and practices in this unit of study.

Integration of English language arts

To integrate the CCSS for English Language Arts into this unit, students participate in shared research and writing projects. Engaging in engineering design provides a perfect opportunity for students to conduct shared research and complete writing projects. Students can use text and media resources to gather information about how the shape and stability of external structures of organisms are related to their functions. In addition, students can conduct simple research to find examples of how humans solve problems using an understanding

of the natural world. Examples of writing projects could include creating a book that includes examples of how humans mimic the characteristics of organisms to design solutions to human problems. Students can also use drawings or other visual displays to accompany their design solutions. Students will need support from teachers to conduct shared research and complete writing projects.

Future learning

The following disciplinary core ideas are future learning related to concepts in this unit of study. By the end of the K-2 grade span, students know that:

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

By the end of Grade 4, students know that:

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions.

By the end of the 3–5 grade span, students know that:

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
- Research on a problem should be carried out before solution design begins. Testing a solution involves investigating how well it performs under a range of likely conditions.
- 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.
- Tests are often designed to identify a design's failure points or difficulties, which suggest the elements of the design that need to be improved.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Number of Instructional Days

Recommended number of instructional days: 25 (1 day = approximately 30-45 minutes)

Note—The recommended number of days is an estimate based on the information available at this 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.