Big Idea

How can we design a solution to a human problem that mimics how plants and/or animals use their external parts to help them survive?

Guided Question:

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

21st Century Themes/Skills:

DCI (Disciplinary Core Ideas)	*Science and Engineering Practices*	*Cross Cutting Concepts*	*Student Learning Objectives*	*Differentiated Activities (Consider the 5 Es)*	*Resources/Technology*	*Formative Assessments*	*Benchmark Assessment*
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)	**Analyzing and Interpreting Data** •Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)	**Patterns** • Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (1-LS1-2)	Understand that systems often offer solutions to problems Plan and design a system that solves a problem or meets a need Design a test for an object and use the results to improve it Improve an object by replacing or repairing one of its parts	**ENGAGE 1:** Ask students: How do animals lift and carry objects? What parts of their body do they use? After generating some ideas from the students, show them the following three Discovery Education Images: Elephant Waving, Leaf Cutter Ant, and Broad-tailed hummingbirds. Discuss how elephants can use their trunks to lift and carry items. Leaf cutter ants can use their backs to carry objects. Adult birds use their beaks to carry food to feed their baby birds. Ask students: What parts of your body can you use to carry and lift things? (Possible responses might be: hands can be used for grasping items, objects can be carried in their arms or on their backs, etc.) Tell students to think about what they might do to lift a very heavy object. Then play the video segment: The Lever from the beginning to 0:14. Discuss how people invent systems to solve problems, and then show the video: More Science Please: Some Assembly Required. Discuss how even children can invent systems to solve problems. Show students the video segment: United States: Young Inventor Wins First Place. Next, ask: How is Marissa's invention (The Puff-N-Fluff) an example of a system? (It uses a hairdryer and a special bag that work together to complete the task of drying the dog.) Ask: Have you ever invented anything to solve a problem? How do you think inventions are made? Discuss. Say to students: We just viewed a video segment about an invention to help blow dry dogs. People are always coming up with new inventions. In fact, there is even an invention to put away toys! But have you ever thought about how toys are made? Show the video segment: Toy Engineering and Design. You may wish to pause the video to discuss the presentation. See the teacher notes for suggested questions. video segments: Toy Engineering and Design (4:49) What are the steps involved when designing inventions? Building towards: ETS1.A: Defining and Delimiting Engineering Problems Discuss how just as inventors design new toys for the purpose of entertaining children, there are people who have invented systems to solve the problem of transportation. Show students the following image: An eighteenth century "horseless carriage" and discuss how before cars were invented, engineers designed this particular form of transportation that was similar to two bicycles put together. Over time, people have improved on this invention to come up with the modern vehicles we travel in today. Post the Lesson Questions that constitute what students will be learning. For younger children, read each question out loud and encourage them to follow along. For older children, you may ask for volunteer readers.	Unit 3 Resources	Students answer the constructed-response items. Students use the Board Builder tool to create a board that shows what they know about the focus question. Emphasis should be placed on the evidence they have collected to support their findings.	

LS1.B: Growth and Development of Organisms • 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)	**Constructing Explanations and Designing Solutions** Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1)	**Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function (s). (1-LS1-1) • The shape and stability of structures of natural and designed objects are related to their function (s). (K-2-ETS1-2)	**EXPLORE 1:** Present students with the Lesson Questions: Why do people try to improve things that are working? and What are some changes we can make to improve a design? Have them complete the first section of the Scientific Explanation student sheet using these questions. Students may type their responses directly into the digital resource, or they may write or draw their responses on a printed copy of the resource. The digital resource includes a link to a PDF version of the student sheet. Guide students to think about what they already know about each Lesson Question. Additionally, encourage students to think about how they know what they do (evidence and reasoning). In the first box of the student sheet, students should record this information for each Lesson Question. Introduce the section: "Evidence I found," explaining to students that they will complete this section as they work through the rest of this Explore. Have students begin the "Evidence I found" section by recording information gathered during Engage. **EXPLORE 2:** Explain that an engineer is a person who makes designs for structures, machines, and systems. Have students brainstorm specific things that an engineer might design, and record their ideas on the board. Tell students that engineers make new designs, but they also make designs to improve things, even those that are already working. Ask student why engineers might want to improve something that is already working. Have students explore the Interactive Glossary, which contains several terms that will help to develop students' understanding of engineering and design. **EXPLORE 3:** Instruct students to write the two Lesson Questions on a sheet of paper, leaving room below each question for notes. Or, provide them with a sheet a paper that already has the questions written on it. Ask: Have you ever used an object or tool that you thought could do a better job? (If students struggle to answer, provide an example such as a mechanical pencil that always broke.) Show the video segment: Innovations and Inventions. As students view, they should take notes below the first question, focusing on the reason that the Chinese improved the farm plow. Remind students that they may record information as text, drawings, or diagrams. Discuss their notes as a class. Next, ask students what changes were made to the farm plow in order to improve it. Show the video segment: Example 2: Explaining a Plane. As before, students should take notes below the lesson question. This time, they should focus on specific changes that were made to improve the flight accuracy of the plane. Were these changes made to the design of the plane? video segments: Innovations and Inventions (2:32) Example 2: Explaining a Plane (2:25) Why do people try to improve things that are working? What are some changes we can make to improve a design? Asking Questions and Defining Problems Have students read the reading passage: Building a Better Bicycle. Students may read the passage or use the "Text to Speech" tool to listen to it, or you may read the passage aloud for them. As students read or listen, they should note the changes that were made to the bicycle in order to improve its design. Students can use drawings or diagrams, as well as text, to take notes.			
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)	•Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	**Influence of Science, Engineering and Technology on Society and the Natural World** • Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (1-LS1-1)	**EXPLAIN 1:** Have students use the evidence that they collected in the Explore session to complete the section of the Scientific Explanation student sheet (sections "My Claim" and "My claim is true because"). Students should complete these sections for the second and fourth Lesson Questions only. Students may type their responses directly into the digital resource, or they may write or draw their responses on a printed copy of the resource. The digital resource includes a link to a PDF version of the student sheet. Have groups of 2–4 students share their explanations with each other. Students should then revise or enhance their explanations based on group discussion.			
			EXPLORE 2: Present students with the remaining two Lesson Questions and have them complete the first section of the Scientific Explanation student sheet ("My Question") using that question. Students may type their responses directly into the digital resource, or they may write or draw their responses on a printed copy of the resource. The digital resource includes a link to a PDF version of the student sheet. Guide students to think about what they already know about this Lesson Question. Additionally, encourage students to think about how they know what they do (evidence and reasoning). In the first box of the student sheet, students should record this information for this Lesson Question. Introduce the section: "Evidence I found," explaining to students that they will complete this section as they work through this Explore. During the previous Explore, as well as during the Engage, students will likely have developed an understanding of the design process and how			

				objects and tools help meet our needs. Have students begin the "Evidence I found" section with information gathered during the previous Explore and the Engage. **EXPLORE 3:** Have students read through the Hands-On Activity. Review the directions with them and answer any questions they might have about the procedures. Working in pairs or small groups, students should complete the activity per the instructions. Instruct students to cite evidence as they add newly acquired information to their Scientific Explanation student sheet. Have students share and compare their shades with the class. Discuss how they are similar and how they are different. Ask students how the differences might impact the way the shade works.			
				EXPLAIN 2: Have students use the evidence that they collected in the Explore session to complete the "My Claim" and "My claim is true because" sections of the Scientific Explanation student sheet. Students should complete these sections for the first and third Lesson Questions only. Students may type their responses directly into the digital resource, or they may write or draw their responses on a printed copy of the resource. The digital resource includes a link to a PDF version of the student sheet. Have groups of 2–4 students share their explanations with each other. Students should then revise or enhance their explanations based on group discussion.			
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)				**ELABORATE:** Invite students to discuss the information they have learned so far about improving systems. Sometimes, through studying systems that have already been done or by testing models of systems, we can make them better. They may view Example 2: Drawing Bridges, which shows the major parts of a structure and how those design elements can be reused in greater numbers to do a bigger job. Discuss how objects can be made of many parts, and that the parts work together as part of a system. Tell students that they will apply what they have learned about improving systems by designing a model of a raft that will be used to transfer cargo across a river. Have students read through the Engineering Project: Build a Better System. Review the procedure with them and answer any questions they might have. Working in pairs or small groups, students should complete the activity per the instructions. Allow at least 15 to 20 minutes at the end of the activity to have students share their models and discuss how they are similar and different. To help students apply their understanding of improving systems, you may wish to have them complete some or all of the following projects. The time required to complete each project will vary; some may require students to work outside the classroom. Re-design a toy: Students can chose a favorite toy they would like to re-design and improve. Have them make a drawing of the toy as it is now, as a "before" improvements drawing. Then have them make a drawing of the toy with the improvements they would like to make, as an "after" improvements drawing. Students should name and label the parts of the toy in both the "before" and "after" drawings. Also, have them make a list of materials they would need to build the improved toy. Allow students to be creative in their ideas as they may wish to make improvements that they themselves cannot actually build. This is acceptable as long as they are able to explain how and why they wish to re-design the toy as they did. Build a model bridge: Invite students to try their hand at building a model bridge. Useful materials may include craft sticks, paper towel tubes, or straws. Remind students that they should test their bridges and see if they can find ways to make improvements. Students may do this in class or at home with their families. Improve a kite: Students should make a basic kite (or research a design they like and make it). They may do this by following a few instructions from the teacher or by making one at home with their family. Then, have students test the kite, either at school, or at a park with a parent. After testing, students should decide on a way to improve how the kite flies, either by changing the shape of the kite, the length of the tail, or the material it is made of. Have students improve the kite and re-test it. In class, ask students to present their improved kites and explain the basic design, what they decided to improve and why, and how well the improvements worked.			
