



Lesson Five

Design Your Own Shark: Engineering Design (5th Grade)

[Section 1: Lesson Plan](#)

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Acknowledgement:

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Overview of the Lesson

Name of Lesson	Design Your Own Shark
Optional Activities	We prepared multiple materials for various students' backgrounds. Please consider your students' background knowledge and adjust accordingly.
Summary of STEM Concepts	<p>Debugging is the process of finding and correcting errors (bugs) in programs.</p> <p>Using Abstraction is identifying patterns and extracting common features from specific examples to create generalizations in order to simplify the development process and manage complexity.</p> <p>Testing and Refining Computational Artifacts: The deliberate and iterative process used to improve a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Responding to the changing needs and expectations of end users improves the performance, reliability, usability, and accessibility of artifacts.</p>
Performance Based Learning Objectives	<p>By the end of this section, the students will be able to:</p> <ol style="list-style-type: none"> 1. Read/memorize/define the grade-level terms in their own language. 2. Describe/explain the machine learning steps. 3. Follow the instructions in the abstraction table or decision tree to classify the cards as sharks and non-sharks.
Materials Needed	Materials are varied. Customize as you need.

ENGAGE (Time: 5 minutes)

How will you invite students into the lesson, access prior knowledge, and excite them?

Goal	What will you say/do	Expected student responses/actions
Review the knowledge learned in the first four units.	<p>Activity: Headband Game</p> <p>Teachers write down the terms that students learned in the former units (e.g., shark, turtle, whale). Each student gets one card without looking at the words and holds the card in front of their forehead.</p>	

	<p>One student asks binary questions about the word on their card (e.g., is my word an animal? Does the animal have gills? et al.), and the rest of the students answer the question with Yes or No.</p> <p>Students take turns to ask questions and they can take the final guess when they are ready.</p>	
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EXPLORE (Time: 15 minutes)

How will you organize student activities and thinking as they explore the STEM concepts in this lesson?

Goal	What will you say/do	Expected student responses/actions
Hands-on Building	<p>Activity: Build your shark</p> <p>Place 2-3 students in each group. Each group gets one Sphero robot and one iPad with the Sphero EDU app.</p> <p>List out all possible materials and how much materials each group can use.</p> <p>Let the students collaboratively design their shark prototype on paper first.</p> <p>After having a prototype, the teacher checks the design and provides the needed materials.</p> <p>The students used the provided materials to build a shark that could swim in water.</p> <p>Possible Materials: bubble wrapper, EVA foam sheets, tapes, rubber bands, plastic pieces, aluminum foil, and Sphero nubby covers (optional).</p>	Students' hands-on working time. Students might need help connecting Sphero with an iPad while testing.
Test the Prototype	Test your design in the baby pool/storage bin, which is filled with water (at least 6 inches).	Students collaboratively work together.

	The teacher can assign different roles to the students, such as “iPad holder” and “robot holder,” when students test the robots in water. The teacher can switch roles according to the time or game round.	
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EXPLAIN (Time: 5 minutes)

How will you help students make sense of the experiences they had in the exploration?

Goal	What will you say/do	Expected student responses/actions
Debug, Reflect, and Improve	<p>Based on the test results, reflect on what works well and what does not. This reflects debugging in CS/CT concepts.</p> <p>Discuss the strategies to improve the design to make the “shark” swim further and faster. Revise and adjust the original design.</p>	Students collaboratively work together.

ELABORATE (Time: 15 minutes)

How will you connect this experience with other ideas or real-world applications?

Goal	What will you say/do	Expected student responses/actions
Shark Olympic Game	<p>Activity: Shark Olympic Game</p> <p>After all students test their prototypes, let all groups bring their robot sharks together for a competition.</p> <p>Possible Rules: All robot sharks start from the edge of the baby pool and swim to the other side of the baby pool. The one who arrives at the other side of the pool first wins.</p>	

	<p>Possible Rules: All robot sharks start at the same spot, follow the same path, and arrive at the final spot. The teacher/judge counts the time each robot shark uses. The one who used less time wins.</p>	
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EVALUATE (Time:5 minutes)

How will you assess the extent to which learning goals are met during/by the end of the lesson?

Goal	What will you say/do	Expected student responses/actions
<p>Wrap up the five units and reflect on the "Design your own shark" activity with the engineering design princess illustration.</p>	<p>Engineering design process illustration</p> <p>Pull up/Print the engineering design process poster and discuss it with the students. Building connections between hands-on activity and the engineering design process.</p> <p>Example Highlights:</p> <ul style="list-style-type: none"> ● Define the problem - let the robot shark swim in the water. ● Identify constraints - use provided materials. ● Brainstorm solutions - possible design of robot shark. ● Prototype solution - hands-on building the robot shark. ● Test prototype - test the robot shark in water. ● Iterate to improve - revise the prototype. ● Communicate solution - collaborate with the team members and discuss what works well and what does not. 	<p>Students describe their designs and share how they came up with solutions, how they solved the problem during the process, and how they improved their solutions.</p>

Section 2 Reference

PBS Learning Media. (n.d.). *Engineering Design Process Illustration*. Retrieved March 12, 2025, from <https://florida.pbslearningmedia.org/resource/eg-design-process/et-design-process/>

K-12 CS Education Glossary
<https://csteachers.org/k12standards/glossary/>