



Engineering Extensions in Elementary Science

Fifth Grade

Suggestion: Prior to introducing students to their first engineering design challenge, it is recommended that teachers begin with the following two *model lessons:

- Technology all Around Us
- Engineering is in the Design

These model lessons have been prepared to introduce students to the engineering design process referenced in the following engineering standards:

Listed below are Engineering Design Standards 3-5 ETS 1

ETS1.A: Defining and Delimiting Engineering Problems

- 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.

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- 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 failure points or difficulties, which suggest the elements of the design that need to be improved.

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

(ETS=Engineering, Technology, and Applications of Science)

In addition, in working with ETS1 the Science and Engineering Practices are an important part of the engineering design process:

1. Asking Questions (for science) and Defining Problems (for engineering)
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations (for science) and Designing Solutions (for engineering)
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

(*Model Lessons-are sample lessons that have been fully developed using the engineering design process)



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Suggested Engineering Extension Lessons for Fifth Grade Classrooms

Grade	Strand	FOSS CA Module	Standards	Engineering Application	Science Connection	Notes
5	Earth Science 12 Weeks	Water Planet	ETS1.A ETS1.B ETS1.C	Challenge <ul style="list-style-type: none"> Design a solar water heater? Focus Question <ul style="list-style-type: none"> What scientific knowledge do you need to know about solar radiation to meet this challenge? 	Scientific Knowledge: <ul style="list-style-type: none"> Solar radiation in the form of light is absorbed by dark materials, resulting in increased kinetic energy of the molecules (heat). Heat from a solar collector can be transferred to water or air. 	Once students have completed: FOSS CA – Water Planet Investigation 3 (Parts 1-4) Investigation 4 (Parts 1-3) Students will have enough content knowledge to engage in the Designing a Solar Water Heater Challenge .
5	Physical Science 9 Weeks	Mixtures & Solutions	ETS1.A ETS1.B ETS1.C	Challenge <ul style="list-style-type: none"> Design a process for separating a mixture. Focus Question <p>What scientific knowledge do you need to know about the properties of matter to meet this challenge?</p>	Scientific Knowledge: <ul style="list-style-type: none"> Mixtures can be separated into its parts. Tools can be used to assist in separating a mixture or a solution. 	Once students have completed: FOSS CA – Mixtures & Solutions Investigation 1 (Parts 1-3) Investigation 3 (Parts 1-3) Students will have enough content knowledge to engage in the Mix It Up and Separate . (*MODEL LESSON)
5	Life Science 7 Weeks	Living Systems	ETS1.A ETS1.B ETS1.C	Challenge <ul style="list-style-type: none"> Design a model of one of the body's transport systems (circulatory, respiratory, digestive, or excretory system) Focus Question <ul style="list-style-type: none"> What scientific knowledge do you need to know about the function of multicellular organisms basic needs to meet this challenge? 	Scientific Knowledge: <ul style="list-style-type: none"> Multicellular organisms have systems for transporting nutrients and wastes from the cells. 	Once students have completed: FOSS CA – Living Systems Investigation 1 (Parts 1-3) Investigation 2 (Parts 1-2) Students will have enough content knowledge to engage in the This is How I Roll Challenge .

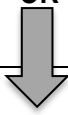
(*Model Lessons-are sample lessons that have been fully developed using the engineering design process)

The Engineering Challenges listed in the table can be designed as extensions of the specified FOSS Investigations



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Suggested Lesson Sequence for Engineering Extensions for 2017-2018

Grade	Trimester	Lesson	Purpose	Location
5	1	Technology All Around Us	Introduction to Technology: This is an introductory lesson to engineering. It provides students a basic understanding of what technology is and how it impacts engineering.	Technology Lesson
5	2	Engineering is in the Design	Introduction to Engineering: This is a basic lesson introducing the Engineering Design Process (EDP) for elementary engineering. The EDP is foundational for students to understand how to design and test engineering solutions like real engineers.	Engineering Design Lesson
5	3	Mix It Up & Separate OR 	Model Engineering Lesson: This follows the Mixtures and Solutions FOSS CA Physical Science Module and provides an example of how to extend from a science unit into an engineering unit.	5th Grade Model Engineering Lesson
		Other FOSS CA Engineering Extensions	EDP Lesson Template: This can be used to extend the other FOSS CA connections listed on page 2 into an engineering unit.	EDP Template