Engineering Extensions in Elementary Science

Fourth 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)

Engineering Extensions in Elementary Science

Suggested Engineering Extension Lessons for Fourth Grade Classrooms						
Grade	**Strand**	**FOSS CA Module**	**Standards**	**Engineering Application**	**Science Connection**	**Notes**
4	Earth Science 11 Weeks	Solid Earth	ETS1.A ETS1.B ETS1.C	Challenge • Design a flood control system using a stream table. Focus Question • What scientific knowledge do you need to know about flooding and erosion to complete this challenge?	**Scientific Knowledge:** • The amount of erosion is related to the energy of the wind or water. • The flow of water in a stream is affected by barriers in its path.	Once students have completed: FOSS CA – Solid Earth Investigation 5 (Parts 1-5) Students will have enough content knowledge to engage in the **Engineering a Flood Control System Challenge**.
4	Physical Science 11 Weeks	Magnetism & Electricity	ETS1.A ETS1.B ETS1.C	Challenge • Plan, design, and create a board game using the principles of electrical conduction. Focus Question • What scientific knowledge do you need to know about circuits to complete this challenge?	**Scientific Knowledge:** • The movement of electrons through conductive material produces a pathway called an electric circuit. • Components can be added to the pathway to convert the electrical energy into other types of energy such as movement, heat and light. • There are different ways to set up circuits.	Once students have completed: FOSS CA – Magnetism & Electricity Investigation 2 (Parts 2-5) Students will have enough content knowledge to engage in the **Designing Board Games Challenge**. **(*MODEL LESSON)**
4	Life Science 11 Weeks	Environments	ETS1.A ETS1.B ETS1.C	Challenge • Design an isopod environment in a terrarium. Focus Question • What scientific knowledge do you need to know about thriving environments and organisms to complete this challenge?	**Scientific Knowledge:** • Every organism has a preferred set of environmental conditions. • Isopods prefer moist, dark environments, and beetles prefer dry dark environments.	Once students have completed: FOSS CA – Environments Investigation 1 (Parts 1-2) Investigation 2 (Parts 1-4) Students will have enough content knowledge to engage in the **Oh Give Me a Home 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

Suggested Lesson Sequence for Engineering Extensions for 2017-2018

Grade	Trimester	Lesson	Purpose	Location
4	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
4	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
4	3	**Designing a Board Game Challenge** **OR** **Other FOSS CA Engineering Extensions**	**Model Engineering Lesson:** This follows the Magnetism and Electricity CA Physical Science Module and provides an example of how to extend from a science unit into an engineering unit. **EDP Lesson Template:** This can be used to extend the other FOSS CA connections listed on page 2 into an engineering unit.	4th Grade Model Engineering Lesson EDP Template