Unit 7 Guide - Engineering is Personal

Engineering Connection

What is engineering?
What does it mean to engineer?
What is my identity as an engineer?
How is engineering valuable to me?

Description/Summary

Students examine their day-to-day lives to find problems that can be tackled by teams of 3 to 4 students. The process is student-driven, teacher-guided, and highly informed by the experiences from the previous units. This is the culminating team project of the course that incorporates all facets of the engineering design process. Unit 7 is an open-ended, creative, and empowering opportunity for students to realize that engineering can have a meaningful impact.

Unit Overview

Connect with Engineering

Students will reflect on any ethical implications of their designed solutions.

Engineering in Society

Students will reflect upon bringing their solution to scale as part of a reflection.

Engineering Professional Skills

Teams will interact with customers and stakeholders, and present their results as they proceed through the design process.

Engineering Design

Students will go through a complete design process with iterations.

Learning Outcomes

Connect with Engineering

	CE.A	Iterate and evolve the definition of what it means to engineer and be an engineer.
	CE.B	Recognize the value of engineering for all regardless of one's potential career.
	CE.C	Explain and apply ethical considerations when exploring an engineering problem.

Engineering in Society

	ES.A	Explore the impacts of past engineering successes and failures on society as a whole.
	ES.B	Recognize and investigate the world's greatest challenges and the role that engineering plays in solving these challenges (e.g., Engineering Grand Challenges, UN sustainability goals, etc.).
	ES.C	Integrate diverse disciplinary thinking and expertise to inform design solutions that add value to society.
	ES.D	Identify and analyze issues when bringing a solution to scale.

Engineering Professional Skills

	PS.A	Use various engineering communication methods.
	PS.B	Collaborate effectively in a team.
	PS.C	Develop, implement, and adapt a project management plan.

Engineering Design

	ED.A	Identify and describe a problem that can be solved with a potentially new product or process.
	ED.B	Identify appropriate stakeholders and content experts and evaluate their input.
	ED.C	Plan and conduct research by gathering relevant and credible data, facts, and information.
	ED.D	Articulate appropriate STEM practices and principles in the design
	ED.E	Evaluate solution alternatives and select a final design by considering assumptions, tradeoffs, criteria, and constraints.
	ED.F	Create a prototype.
	ED.G	Create and implement a testing plan to evaluate the performance of design solutions.
	ED.H	Apply iteration to improve engineering designs.
	ED.I	Articulate and reflect on how an engineering design process could be applied to solving a problem.

Misconceptions
Iteration should be dropped if there is not enough time.
A student's design will at some point be fully finished.

Teaching Challenges
Students may have a difficult time producing suitable project ideas.
Time will likely be crunched at the end of the year. Take care to adapt the lessons while still maintaining time for iteration and reflection. If Unit 7 is dropped, teachers should still ensure to do Unit 8 as it is the wrap-up for the course.
The final portfolio for assessment of the E4USA course may be due before the end of the school year.
Teachers must build in time to acquire materials between the time when students submit proposals (Lesson 7.5 and Lesson 7.9) and when they start to construct their prototypes.

Related Lessons and Activities and Unit Schedule

Lesson Name	Lesson Description	Activity
7.1A Uncover Problems (Teacher-led) [70 minutes] (or) 7.1B Uncover Problems (Student-driven) [95 minutes]	Student projects for Unit 7 are identified, largely teacher-guided (7.1a) or student driven (Lesson 7.1b)	7.1.1 Problem Scoping
7.2 Team Charter [55 minutes]	Development of the Team Charter	3.2.3 Team Charter Development
7.3 Documenting Prior Solutions and Setting Solution Design Requirements [195 minutes]	Solution design requirements using lessons learned in past iterations	7.3.1 Problem Specifications

7.4 Finding the Right Design Idea [75 minutes]	Teams establish a final design idea	3.6.3 Design Selection with Decision Matrices
7.5 Project Proposal [200 minutes]	Development of a project proposal is crucial to success of the final design	7.5.1 Preparing a Proposal 3.8.3 Project Management Planning
7.6 Design Drawings [215 minutes - may vary significantly]	Design drawings in 2-D and CAD	3.7.1 Engineering Drawings
7.7 Create a Functional Prototype and Design Tests [210 minutes - may vary significantly]	Physical prototype and test-plans	3.8.1 Prototype Construction Planning 3.9.1 Prototype Creation
7.8 Evaluating Performance of First Prototype [90 minutes]	Test of functional prototypes	7.8.1 Testing Prototypes
7.9 Debriefing and Plan Iterations [135 minutes]	Iteration of the initial design	7.5.1 Preparing a Proposal
7.10 Drawings of Improved Design [75 minutes]	2-D and CAD drawings	3.7.1 Engineering Drawings
7.11 Improved Functional Prototype [210 minutes]	Development of a refined prototype	3.8.1 Prototype Construction Planning 3.9.1 Prototype Creation 2.10.1 Design Iteration 3.8.2 Prototype Test Planning

7.12 Evaluating Performance of Second Prototype [90 minutes]	Test and evaluation of improved prototype	7.8.1 Testing Prototypes
7.13 Teams and Design Debrief [135 minutes]	Debrief and reflection	7.13.1 External Evaluation 7.13.2 Debrief Teamwork