Unit 3 Guide - Engineering is Human-Centered

Driving Questions

- In what ways does engineering intersect with people?

Description

Students proceed through an engineering design process, define a problem, interact with stakeholders, design and construct a prototype and wrap it up with a Design-a-thon.

Key Concepts

You(th) have the power to engineer real solutions that are relevant to their local communities.
Effective engineering requires external input before, during, and after design.
Effective engineering design work requires effective teamwork.

Learning Outcomes*

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	Use and recognize when to use computational tools.	
ED.G	Create a prototype.	
ED.H	Create and implement a testing plan to evaluate the performance of design solutions.	
ED.I	Apply iteration to improve engineering designs.	

Misconceptions

- We can define a problem and create effective solutions without talking to the stakeholders.
- Looking at what others are doing is "cheating".
- Once we submit our design, we are done.
- Teamwork means assigning each team member a task and then simply coming back together in the end to merge these individual efforts.
- Working in teams makes it harder to complete tasks.
- Professional skills are less important than technical skills in engineering.

Teaching Challenges

- Each school will have its own *unique local community needs*
- Teachers will need to put in a lot of time and energy to *connect with community members* and generate suitable project ideas
- It is challenging to identify *several different needs* within a project scope
- It is challenging to create *meaningful solutions* in such a short time
- The *design-a-thon* will take a lot of time, energy, and planning
- Diverse *resources* will be needed for diverse problems and solutions

Lesson and Content Overview

Lesson Name (duration)	Lesson Description	Activity
3.1: Engineering Empathy [95 minutes] Video: Lesson 3.1	Students design a wallet for a peer as a way to build empathy	Activity 3.1.1 Designing a Wallet for a Classmate [60 minutes] Activity 1.4.2 Writing a Design Brief [30 minutes]

LIVE

Lesson 3.2: Establishing Team Norms [140 minutes] **Video: Lesson 3.2-3.5**	Teams are formed and go through a variety of exercises to support strong team norms.	Activity 1.1.2 Think-Pair-Share [15 minutes] Activity 3.2.1 Team Role Play [25 minutes] Activity 3.2.2 Knowledge Café [45 minutes] Activity 3.2.3 Team Charter Development [30 minutes]
3.3: Exploring the Needs and Problems of a Community [150 minutes]	Students revisit the PlayPump Case Study and explore the needs and problems of a community partner.	Activity 3.3.1 Case Study of PlayPump's Impacts on Communities [30 minutes] Activity 3.3.2 Exploring a Local Community Problem [65 minutes]
3.4: Meeting with Stakeholders [190 minutes]	Students visit the local community and ask questions of the stakeholders.	Activity 3.4.1 Onsite Visit with Local Community Partner [180 minutes]
3.5: Problem Definition [80 minutes]	Teams create rich pictures to help define their problem and then write up a problem definition design brief.	Activity 3.5.1 Using Rich Pictures to Define a Problem [45 minutes] Activity 1.4.2 Writing a Design Brief [30 minutes]
3.6: Generating and Selecting a Design Concept [163 minutes] **Video: Lesson 3.6**	Teams generate potential design solutions and then come to consensus about which design to pursue.	Activity 3.6.1 Function Ideation Strategy [18 minutes] Activity 3.6.2 Chiming with Team Members [40+ minutes] Activity 3.6.3 Design Selection with Decision Matrices [60 minutes]
3.7: Engineering Drawings [235 minutes] **Video: Lesson 3.7**	Teams flesh out the details of their designs using engineering drawings.	Activity 3.7.1 Engineering Drawings [180 minutes]

3.8: Planning [200 minutes] **Video: Lesson 3.8-3.10**	Teams set up a project management plan that supports the construction and testing of their prototypes.	Activity 3.8.1 Prototype Construction Planning [30 minutes] Activity 3.8.2 Prototype Test Planning [40 minutes] Activity 3.8.3 Project Management Planning [60 minutes]
3.9: Prototype Creation [235 minutes]	Teams create their first functional prototype for the purpose of testing at the Design-a-thon.	Activity 3.9.1 Prototype Creation [210 minutes]
3.10: Design-a-thon [185 minutes] **Video: Design-a-thon Prep** **Video: Design-a-thon Event**	Stakeholders test and provide feedback on teams' first prototypes followed by rapid iteration to respond to the feedback.	Activity 3.10.1 Design-a-thon [180 minutes]