Unit 1: The Engineering Design Process

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **10 days**
Status: **Published**

Summary

In this unit students will be introduce to the Engineering Design Process. Students will learn about its steps, the similarities to and differences from the Scientific Method, and how this process is used in the field of engineering. The concepts of following a procedure and iteration will be discussed and students will finish the unit with the completion of a design challenge that will provide them with the opportunity to work through the process in its entirety. Students will complete design challenges that solve problems related to human need and/or environmental issues such as climate change.

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Standards

TECH.K-12.1.4.a	know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
TECH.K-12.1.4.b	select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
TECH.K-12.1.4.c	develop, test and refine prototypes as part of a cyclical design process.
TECH.K-12.1.4.d	exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.
LA.W.8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.W.8.1.D	Establish and maintain a formal style.
LA.W.8.3.D	Use precise words and phrases, relevant descriptive details, and sensory language to capture the action and convey experiences and events.
LA.W.8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
LA.W.8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

LA.W.8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS.ETS1.A	Defining and Delimiting Engineering Problems
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS.ETS1.B	Developing Possible Solutions
SCI.MS.ETS1.B	Developing Possible Solutions
SCI.MS.ETS1.C	Optimizing the Design Solution
WRK.9.2.8.CAP.1	Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
WRK.9.2.8.CAP.18	Explain how personal behavior, appearance, attitudes, and other choices may impact the job application process.

Essential Questions/Enduring Understandings

Essential Questions:

Why is it important to have a plan when undertaking a problem?

How have developments and changes in technological design impacted our world?

Enduring Understandings:

Technology is the human process of finding solutions to solve problems and meet needs.

Technology has both positive and negative effects on our lives and planet.

The process of design in engineering is one that does not end.

Objectives

Students will know that the engineering design process is cyclical in nature.

Students will know how to identify constraints in a design problem

Students will know vocabulary as it applies to the design process: scientific method, alternate solutions,

brainstorming, design brief, evaluation, safety, criteria, constraints, model, prototype, analysis.

Students will be skilled at demonstrating safe work habits when using tools, equipment, and technical processes.

Students will be skilled at explaining the role of trouble shooting, research and experimentation with regards to design.

Students will be skilled at explaining the reasoning behind their design.

Students will be skilled at using this process to solve a problem in technology.

Learning Plan

Steps of the Engineering Design Process: Teacher will present information including the definition of technology, engineering, the scientific method, and the 8 steps of the engineering design process. Students should complete guided notes and/or complete a Google Slide/worksheet highlighting the steps of the process. Teacher will lead discussion on how this process is used in engineering. Concepts may be supported through showing videos that explain the process and how it has been used by engineering throughout history.

Overview of Design Challenge: Students will be provided with an overview of the unit's design challenge to establish understanding of the problem, its constraints, materials, and how the Engineering Design Process will be utilized. Students will be provided with a paper or online document where the steps taken to complete the process will be documented throughout the completion of the unit. Projects may be connected to Climate Change and Environmental Issues

Design Challenge Prototype and Completion: Students will work individually or in small groups to research, design, build, and test a prototype. Challenges may include: Paper Structure Challenge, World's Tallest Golf Tee, Spaghetti Tower, or similar. Teacher will oversee the process, encouraging iteration throughout and supplying materials.

Evaluation and Redesign: Following testing, teacher will guide students through the process of self-evaluation and a written redesign of their solution.

Assessment

Formative Assessments:

Google Forms

Guided notes

Engineering Notebook

Brainstorming Sketches

Benchmark Assessments:

Design Challenge Documentation

Design Challenge Prototype

Summative Assessment:

Evaluation and Redesign written assignment/Google Form

Alternate Assessment:

Checklist

Questioning

Discussion

Integrated Accommodation and Modifications

See attached document:

https://docs.google.com/spreadsheets/d/1bW0L5xhslCD9IsWWnzfbMJoRUI5vOFrgbQJ2saYTgLU/edit?usp=sharing