Unit 1: Design and Problem Solving 22

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Semester 1**
Length: **10 weeks**
Status: **Published**

Standards

CS.9-12.8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.1.12.CS.4	Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
CS.9-12.8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
CS.9-12.8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
CS.9-12.8.2.12.ED.3	Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
CS.9-12.8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product.
CS.9-12.8.2.12.NT.2	Redesign an existing product to improve form or function.
CS.9-12.DA	Data & Analysis
CS.9-12.ED	Engineering Design
CS.9-12.NT	Nature of Technology

Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.

Engineers use science, mathematics, and other disciplines to improve technology. Increased collaboration among engineers, scientists, and mathematicians can improve their work and designs. Technology, product, or system redesign can be more difficult than the original design.

Individuals select digital tools and design automated processes to collect, transform, generalize, simplify, and present large data sets in different ways to influence how other people interpret and understand the underlying information.

Choices individuals make about how and where data is organized and stored affects cost, speed, reliability, accessibility, privacy, and integrity.

The accuracy of predictions or inferences made from a computer model is affected by the amount, quality, and diversity of data.

A computing system involves interaction among the user, hardware, application software, and system software.

Enduring Understandings

Students will understand that …

- **U1** – An engineering design process involves a characteristic set of practices and steps used to develop innovative solutions to problems.
- **U2** – Brainstorming may take many forms and is used to generate a large number of innovative, creative ideas in a short time.
- **U3** – Technical professionals clearly and accurately document and report their work using technical writing practice in multiple forms.
- **U4** – Sketches, drawings, and images are used to record and convey specific types of information depending upon the audience and the purpose of the communication.
- **U5** – Engineering consists of a variety of specialist sub-fields, with each contributing in different ways to the design and development of solutions to different types of problems.

Essential Questions

- **EQ1** -- When solving an engineering problem, how can we be reasonably sure that we have created the BEST solution possible? What is the evidence?
- **EQ2** – What is the most effective way to generate potential solutions to a problem? How many alternate solutions are necessary to ensure a good final solution?
- **EQ3** – What engineering accomplishment of the 20th century has had the greatest impact on society? Justify your answer.
- **EQ4** – What will be the biggest impact that engineering will have on society and your life in the 21st century? Justify your answer.
- **EQ5** – Engineering tends to be a male-dominated profession. Why is that?

Knowledge and Skills

KNOWLEDGE: Students will …

- **K1 –** Identify the steps in an engineering design process and describe the activities involved in each step of the process. U1
- **K2 –** Explain the concept of proportion and how it relates to freehand sketching.
- **K3 –** Identify and describe a variety of brainstorming techniques and rules for brainstorming.
- **K4 –** Differentiate between invention and innovation.
- **K5 –** Identify and differentiate between the work of an engineer and the work of a scientist.
- **K6 –** Identify and differentiate between mechanical, electrical, civil, and chemical engineering fields.

SKILLS: Students will …

- **S1** – Generate and document multiple ideas or solution paths to a problem through brainstorming
- **S2** – Describe the design process used in the solution of a particular problem andreflect on all steps of the design process.
- **S3** – Utilize an engineering notebook to clearly and accurately document the design process according to accepted standards and protocols to prove the origin and chronology of a design.
- **S4** – Create sketches or diagrams as representations of objects, ideas, events, or systems.
- **S5 –** Explain the contributions of engineers from different engineering fields in the design and development of a product, system, or technology.
- **S6 –** Review and evaluate the written work of peers and make recommendations for improvement.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing

Resources

1.1.A InstantChallengeCableCar.docx
1.2.A InstantChallengeAero.docx
1.3.A ConceptSketching.docx
1.3.A EngineeringNotebook.pptx
1.3.A.RU ConceptSketchingRubric.docx
1.3.A.SR EngineeringNotebookSamples.docx
1.4.A ProductImprovement.docx
1.4.A BrainstormingSolutions.pptx
1.5.A DeepDive.docx
1.5.A DesignProcess.pptx
1.5.A WritingDesignBrief.pptx
1.6.A DiscoverEngineering.docx
1.6.A EngineeringDisciplines.pptx
1.6.A EngineeringOverview.pptx
1.6b.A Engineering_STEM Careers.docx
1.7.A.RU WhatIsItElevatorPitchRubric.docx
1.7.A.RU WhatIsItEssayRubric.docx

1.8.A InstantChallengePaperBridge.docx
1.8.A InstantChallengePaperBridge.pptx
1.9.A DesignInnovation.docx
1.9.A IntroResearch.pptx
1.9.A ProductDesignEvolution.pptx
1.9.A.RU DesignInnovationRubric.docx