Unit 1: The Design Loop & Documentation

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **2-3 weeks**
Status: **Published**

Summary

Introduction:

The design loop will be introduced as a strategy for problem-solving and the method for approaching problems throughout the year. The steps, inventions, ideas, actions, and work a student performs and the evaluation of that work, will be documented in a design log. Patent protection can be reliant on quality design logs. A design log will be maintained by every student.

Revision: July 2025

Essential Questions/Enduring Understandings

Essential Questions:

How do engineers document their work and how does effective documentation impact collaboration, innovation, and the long-term viability of an engineering solution?

What systematic processes do engineers use to identify, analyze, and solve complex problems?

How do constraints—such as budget, time, and materials—shape the engineering design process and the final solution?

What legal and ethical considerations guide an engineer's responsibility to protect their intellectual property and that of their employer?

How do patents, copyrights, and trade secrets function as tools for encouraging innovation while safeguarding the rights of creators?

Enduring Understandings:

The design loop is used to solve problems that have a variety of solutions.

Engineers apply knowledge that is developed using the scientific method to solve design problems.

that there are key components to a design log, and a design log may be evidence in patent litigation.

design logs explain how we connect science to the products we produce.

Patents have very limited life spans, which have financial ramifications.

Objectives

Students Will Know:

The steps of the design loop and what artifacts are produced in each step.

how engineers use the design loop to solve problems.

the design loop is an iterative process.

the scientific method is a process used to develop new knowledge.

how engineers document their work using design logs.

how patents are applied for and granted by the US Patent Office.

the three types of patents that are awarded for inventions: utility, design, and plants.

the duration of a patent: 20 years for a utility and plant patent, and a design patent is 14 years.

how the design log may be used in patent litigation.

the key vocabulary and terms related to the unit, including but not limited to: patent, design patent, utility patent, plant patent, trademark, copyright, scientific method, design loop, design log, and litigation.

Students Will Be Skilled At:

how to create a design log that is systematic and contains chronological entries that are dated, witnessed, and contain no blank pages, no erasures, no blank portions of pages, and are written in pen.

solving problems using the design loop.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Lecture and discussion about guiding questions.

Formative assessments will be conducted throughout the process using class discussion, student writing, and practice quizzes.

Provide students with a rubric for assessment of their design logs.

Students will use the design loop as a guide to the development of a solution to a problem, typically lasting one period. They will use a design log to show the development of the project. Design logs are typically bound books for taking notes.

Summative assessment will be conducted by the student and teacher using a rubric specific to the research problem.

The design loop will be used as the structure for problem-solving throughout the course. These problems will be elaborated in other units, but include the design of surgeries, computer games, water and energy management strategies.

The teacher will demonstrate and involve students in presentation techniques using SMART technology and PowerPoint.

Complete unit test or quiz.

Complete writing prompts.

Websites concerning the steps of the design loop.

Assessment

Formative assessment:

meaningfully address the essential and guiding questions of this unit of study.

meaningfully participate in guided question and answer sessions, group and individual discussions, and demonstrate an understanding of the purpose of the unit lessons and the key terms and concepts.

appropriately use unit vocabulary in written and oral communication related to the unit.

Summative assessment:

Demonstrate in design logs the ability to document the design process.

Demonstrate in design logs that the design created was a product of an iterative process.

demonstrate the ability to utilize the design loop as a problem-solving tool.

written quizzes and tests about subject materials.

answer the essential questions.

document their work using design logs that are graded with a rubric, continuously throughout the year.

complete writing prompts: Prescription drugs take a long time to undergo safety and effectiveness trials. Explain how the patent process and duration are affected by this extended timeline. Use the unit vocabulary in the answer. Explain why a design log might be used in a patent rights case. Explain what should be present in the design log to make it a more effective piece of evidence.

Alternative assessment:

Possible activity: Make a poster or webpage that describes what a utility patent is and the process of application.

Written report.

Benchmark assessment:

mid term/final exam

Materials

SmartBoard Presentations

Email and e-board

Web sites

CAD and other software programs

Smartboard use for presentation and interactive lessons

Standards

ELA.L	Language
ELA.L.SS.9–10.1	Demonstrate command of the system and structure of the English language when writing or speaking.
TECH.K-12.1.4	Innovative Designer
	Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
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.c	develop, test and refine prototypes as part of a cyclical design process.
TECH.K-12.1.5	Computational Thinker
	Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
TECH.K-12.1.5.a	formulate problem definitions suited for technology-assisted methods such as data

	analysis, abstract models and algorithmic thinking in exploring and finding solutions.
TECH.K-12.1.5.b	collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
TECH.K-12.1.5.c	break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.
TECH.K-12.1.5.d	understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.
TECH.K-12.1.6	Creative Communicator
	Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.
TECH.K-12.1.6.a	choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
SCI.HS.ESS3.A	Natural Resources
SCI.HS.ESS3.B	Natural Hazards
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
	Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.
SCI.HS.ESS3.A	Natural Resources
SCI.HS.ETS1.B	Developing Possible Solutions
	Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.
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.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
CS.9-12.8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
CS.9-12.ED	Engineering Design
WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.

WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
WRK.9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
WRK.9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.DC	Digital Citizenship
TECH.9.4.12.TL	Technology Literacy
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
TECH.9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
TECH.9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
TECH.9.4.12.IML	Information and Media Literacy
TECH.K-12.P.4	Demonstrate creativity and innovation.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
	Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	An individual's income and benefit needs and financial plan can change over time.
	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.
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.

Integrated Accommodation and Modifications...

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education and those with 504s

See document