Unit 1: The Design Loop & Documentation

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **15 days**
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, work a student performs and 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 2020

LA.RST.9-10	Reading Science and Technical Subjects
	Craft and Structure
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
LA.RST.9-10.6	Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
	Integration of Knowledge and Ideas
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
	Range of Reading and Level of Text Complexity
LA.RST.9-10.10	By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.
LA.WHST.11-12	Writing History, Science and Technical Subjects
LA.WHST.9-10	Writing History, Science and Technical Subjects
	Text Types and Purposes
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.1.A	Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
LA.WHST.11-12.1.B	Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific

	procedures/experiments, or technical processes.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.9-10.2.A	Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
LA.WHST.11-12.2.A	Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
LA.WHST.9-10.2.B	Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
LA.WHST.9-10.2.D	Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
LA.WHST.9-10.2.E	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.9-10.2.F	Provide a concluding paragraph or section that supports the argument presented.
	Production and Distribution of Writing
	Research to Build and Present Knowledge
LA.WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
LA.WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
SCI.HS-ETS1	Engineering Design
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
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.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
CS.9-12.ED	Engineering Design
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when

	it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.
SCI.HS	Engineering Design
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
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.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.CS1	The characteristics and scope of technology.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.C.CS1	The attributes of design.
TECH.8.2.12.C.CS3	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.12.D.6	Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
TECH.8.2.12.D.CS1	Apply the design process.
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
	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.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	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.

Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.

Essential Questions/Enduring Understandings

Essential Questions:

How do engineers document their work?

How do engineers solve problems?

How do engineers protect the rights to their work?

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 has 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 as 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 utility and plant patent, and a design patent is 14 years.

how the design log may be used in patent litigation cases.

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, 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 development of a solution of 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 design of surgeries, computer games, water and energy management strategies.

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

Complete unit test or quiz.

Complete writing prompts.

Websites-concerning 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 a design created was 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 time line. 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,

Benchmark assessment: final exam

Materials

SmartBoard Presentations

Email and e-board

Web sites

CAD and other software programs

Smartboard use for presentation and interactive lessons

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