Unit 03: The Design Loop

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

Brief Summary of Unit

The design loop is a problem-solving structure that will be employed throughout the course to guide the development of solutions. A five-step loop is used. Different tools are used to explore different aspects of the loop. For example, 3D printing and model-making will be used for prototyping. Programming-defining a problem and criteria for a solution-will be explored for a building type that is new to the student, i.e. a senior center or a museum. Developing presentation techniques are explored using the design loop.

Revision Date: July 2023

Essential Questions/Enduring Understandings

Essential Questions

How do architects know what to design?

How do architects solve problems?

Enduring Understandings

The design loop, while iterative has a direction toward completion.

Steps in the design loop relate to milestones toward the achievement of a goal.

Objectives

Students Will Know:

Vocabulary and terms including but not limited to design loop, architectural design loop, programming, design brief, find alternate solutions, schematics, design development, and presentation drawings.

Buildings are designed to meet the needs established in the program.

A program describes the attributes of a proposed building.

That the design loop is an iterative process.

That the design loop provides a path to completing projects.

Students Will Be Skilled At:

Applying the design loop to solve architectural and design problems.

Using the design loop to develop and finish a problem.

Learning Plan

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

Preview the guiding questions: Why are buildings made? What criteria are necessary to design a building? What is the value of having design criteria for a building? What are examples of methods for completing work in other courses? (I.e. a paper in English class or a poster in graphics?) When do you stop designing?

Review the key vocabulary.

Teacher will provide formative and summative assessments of skills attainment.

Describe components of an architectural program. Provide students with INTERNET resources that describe the requirements of a program.

Suggested activity: students write a program for a Library or Senior Center, using an INTERNET based word processing tool. The program is to be graded with a rubric.

Problem-oriented learning and suggested activity: students design a residence using their own program. Students will maintain copies of work to demonstrate the application of the design loop.

Materials

Materials:

Computer lab with AutoCAD software, one computer per student

Whiteboard with projector or Smartboard

CADD Lab including 3D printers, drill press, scroll saw and power drill, soldering iron, xacto knives, and hand tools.

Standards

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.9-12.8.2.12.ED.6	Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
CS.9-12.ED	Engineering Design
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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.
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.
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.
SCI.HS.ETS1.A	Delimiting Engineering Problems
SCI.HS.ETS1.B	Developing Possible Solutions
SCI.HS.ETS1.B	Developing Possible Solutions
SCI.HS.ETS1.C	Optimizing the Design Solution
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.

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-ETS1-3	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-ETS1-4	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	Engineering Design
WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
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.
TECH.K-12.1.1	Empowered Learner
TECH.K-12.1.1.a	articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.
TECH.K-12.1.1.c	use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
TECH.K-12.1.1.d	understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.
TECH.K-12.1.2	Digital Citizen
TECH.K-12.1.2.c	demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.
TECH.K-12.1.2.d	manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.
TECH.K-12.1.3	Knowledge Constructor
TECH.K-12.1.3.a	plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.
TECH.K-12.1.3.c	curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
TECH.K-12.1.4	Innovative Designer
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-12.1.6	Creative Communicator
TECH.K-12.1.6.a	choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
TECH.K-12.1.6.b	create original works or responsibly repurpose or remix digital resources into new creations.

TECH.K-12.1.6.c	communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
TECH.K-12.1.6.d	publish or present content that customizes the message and medium for their intended audiences.
	Range of Reading and Level of Text Complexity
	Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.
	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.
	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.
	Constructing Explanations and Designing Solutions
	Craft and Structure
	Integration of Knowledge and Ideas
	Asking Questions and Defining Problems
	Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
	Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical.
	Key Ideas and Details
	Constructing Explanations and Designing Solutions
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.

Assessment

Formative

answer essential questions

worksheet

participate in class discussions regarding safety rules and procedures.

Demonstrate knowledge and understanding of vocabulary through correct usage.

Write a program that describes in detail the quantitative and qualitative aspects of a proposed building.

Provide evidence of finding alternate ideas, schematic drawings, design development and presentation drawings.

Complete writing prompts: Example: Explain the relationship between each step of the design loop and programming. Beyond sizes and dimensions, what type of information is in a program, and why is it

important?

Summative

assess design logs with a rubric

assess student work in a digital portfolio with a rubric

Benchmark

Midterm Exam/Final Exam

Alternative Assessment

Create a Library or other project that demonstrates the use of the design loop.

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