Unit 09: Industrial Design

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 4**
Length: **4 Weeks**
Status: **Published**

Brief Summary of Unit

Introduction: Students will design, prototype, and make technical drawings in CADD of a functional object that can be prototyped in the CADD Lab. Object types may be chassis, small luminaires, game pieces, and parts. Tools for prototyping will include 3-D printers.

Revision Date: July 2023

Essential Questions/Enduring Understanding

Essential Questions

How are products developed?

Why do different trades use different measuring systems?

What are conventions in technical drawing?

What is industrial design?

Enduring Understandings

Industrial design involves the design of everyday objects around us.

Industrial design involves using the design loop.

Objectives

Students Will Know:

key terms: prototype, philosophy, function, art, scale, detail.

there is a history of architects making functional objects.

wood, steel, and building trades have different measuring systems related to the precision of fabrication.

that the products designed by architects relate to their philosophy, materials, and time.

objects are typically drawn full-size or larger than full-size to show detail.

how to make a prototype of an object.

how to use the design loop can be used to solve problems.

Students Will Be Skilled At:

designing and prototyping a utilitarian object.

making detailed drawings related to an object.

working with metric and imperial measures.

Learning Plan

Pre-assessment to determine the direction of work.

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

Lecture and discussion about the guiding questions.

Formative assessments will be conducted throughout the design problem.

Design problem: design, develop, draw, and prototype an object that uses non-architectural measurement. Examples may include a lamp, boom box, knock-hockey board, corn-hole game, a machine, or teacher-approved object.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem which may include student-driven goals.

Formative assessment will be conducted thorough out the process with class discussion, student writing, practice quiz, and review of student work.

Formative assessments will be conducted throughout the design process.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem which may include student-driven goals.

Assessment

Formative

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

Guiding questions: What is the difference between a chair a coffee maker, a fireplace, and a work of art or sculpture? What are the functional differences? What is the design loop? How does the design loop relate to coffeemakers, fireplaces, and sculpture? How does Louis Sullivan's concept of 'form follows function' relate to the design of an object? Does ornamentation and decoration have a function? Are there criteria to evaluate an object? What is the best way to communicate with an object? Who designs objects today? How detailed is a full-sized prototype?

Meaningfully participate in guided question and answer sessions, and group and individual discussions, show an understanding of the purpose of the unit lesson(s), and their key terms and concepts.

exit ticket

Summative

Design and create presentation drawings, and a prototype for an object, possibly a lamp, that demonstrates the principles explored in a problem. Presentation to be evaluated with the use of teacher and student-designed rubrics.

The presentation will be included in an electronic portfolio and assessed with a rubric.

Complete written tests and quizzes on unit topics and vocabulary

Benchmark

Midterm Exam/Final Exam

Alternative Assessment

Research a stock of 3-D files and modify them for practical use.

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

Materials

Computer lab with AutoCAD software, one computer per student

White board with projector or Smartboard

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

Standards

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.b	build networks and customize their learning environments in ways that support the learning process.
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.
LA.RST.9-10	Reading Science and Technical Subjects
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.
LA.RST.9-10.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
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.
TECH.K-12.1.4	Innovative Designer
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.
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.
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.
TECH.K-12.1.4.c	develop, test and refine prototypes as part of a cyclical design process.
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.
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.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.
SCI.HS-ETS1	Engineering Design
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.
	Asking Questions and Defining Problems
	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
SCI.HS.ETS1.A	Delimiting Engineering Problems
	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
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.
	Constructing Explanations and Designing Solutions
	Constructing explanations and designing solutions 9–12 builds on K – experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.
SCI.HS.ETS1.C	Optimizing the Design Solution
	Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed.
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.B	Developing Possible Solutions
	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider 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.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.9-12.8.2.12.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
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.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.TL	Technology Literacy
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
	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.

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