



Foundations of Engineering Unit 1: Engineering Design Process

Unit Focus

In this unit, students will learn and apply the 8 step Engineering Design Process that is the basis of any engineering process. They will also learn basic safety protocol before they attempt to solve challenges in a shop-based environment. Students will take a short safety exam to ensure that they can work in a safe and respectful manner. The goal of each student is to learn Computer Aided Design (CAD) software to develop and then build an individual link that will become part of a class chain. The student will ensure that their design fits within the class chain which requires significant problem solving both in the initial CAD design and build as well as troubleshooting via collaboration with other students to ensure a proper fit.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p>Connecticut Goals and Standards <i>Computer Aided Drafting and Design: 12</i></p> <ul style="list-style-type: none"> Apply dimensioning to various objects and features. <i>CADD.03.04</i> Edit a dimension by using various editing methods. <i>CADD.03.05</i> Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts. <i>CADD.08.03</i> <p><i>Technology Education (CTE)</i></p> <ul style="list-style-type: none"> Safety: Describe and apply safe practices in the lab environment. <i>TE.ET.B</i> Design Process: Describe and apply the design process to identify and solve a problem. <i>TE.ET.H</i> Design, Measurement, and Layout: Interpret technical drawings, rough drawings and sketches, and the use fractional measurement. <i>TE.WT.C</i> <p><i>Wood Technology: 12</i></p> <ul style="list-style-type: none"> Demonstrate safe material handling practices. <i>WM.02.01</i> Demonstrate and explain knowledge of personal safety practices pertaining to eye wear, footwear, clothing, and personal protective equipment (PPE) used in wood technology.*(A3) <i>WM.02.03</i> Describe safety practices for specific machines. <i>WM.02.04</i> Describe safety practices for the following machines: table saw, drill press, stationary sander, router table, and miter saw.*(A4) <i>WM.02.09</i> Demonstrate and explain knowledge of proper use and storage of portable power tools.*(A6) <i>WM.03.04</i> Follow laboratory safety rules and procedures. <i>WM.03.15</i> 	<p><i>Students will be able to independently use their learning to...</i></p> <p>T1 Explore and hone techniques, skills, methods, and processes to create and innovate</p> <p>T2 Demonstrate professionalism through exhibiting attentiveness, growing from feedback, and adhering to industry standards (safety).</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
	<p><i>Students will understand that...</i></p> <p>U1 Both the tools I am using and the way I am using them impact the quality of the result, the safety of the shop environment, and the longevity of the equipment.</p> <p>U2 Engineers need communication skills to present their information to other people in a manner which is both clear and effective.</p> <p>U3 Engineering design is a systematic process used to initiate and refine ideas, solve problems, and create new products and systems.</p>	<p><i>Students will keep considering...</i></p> <p>Q1 How do I navigate this tool to get the desired result?</p> <p>Q2 How do my behaviors and actions affect the safety of myself and others?</p> <p>Q3 What is the problem I am trying to solve through the design? How do I design this based on the constraints?</p> <p>Q4 How do I make what I designed? When does the design need to be changed?</p>
	Acquisition of Knowledge and Skill	
Knowledge	Skill(s)	
<p><i>Students will know...</i></p> <p>K1 Basic CAD overview - sketching, smart dimensioning, scale printing</p>	<p><i>Students will be skilled at...</i></p> <p>S1 Collaborate with others to ensure that the parts link together and fit correctly (constraints from EQ #3)</p>	

Stage 1: Desired Results - Key Understandings

- Identify and select the proper cutting process based on grain direction. *(E23) *WM.04.13*
- Utilize the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results. *WM.05.01*

ITEEA - Standards for Technological Literacy

Technological Literacy: K-12

- Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (3)
- Students will develop an understanding of the attributes of design. (8)
- Students will develop an understanding of engineering design. (9)
- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (10)
- Students will develop the abilities to use and maintain technological products and systems. (12)

Madison Public Schools Profile of a Graduate

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)
- Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)

K2 technical writing involves communicating complex information to those who need it to accomplish some task or goal.

K3 Part files created in a solid modeling software can be used in a variety of applications/processes ranging from 3D printing, CNC Milling and CNC routing.

K4 Vocabulary: Engineering design process, subtractive prototyping, additive prototyping, CNC, table saw, bandsaw, miter saw, belt sander, scroll saw, tape measure, t-square, file and chisel.

- S2** Use CAD software to design a working prototype in solving a challenge/problem.
- S3** Demonstrate how to use a variety of power and hand tools safely in creating a prototype.
- S4** Utilize the Engineering Design Process to develop a solution to a given challenge/problem.
- S5** Demonstrate proper safety etiquette according to school safety expectations and procedures.
- S6** Express technical knowledge used in solving a problem in a clear, concise, and coherent manner within an engineering report.