

**Course: Engineering Design**  
**Unit #2: Creativity & the Design Process**

**Year of Implementation: 2019-2020**

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### **Stage One - Desired Results**

**Link(s) to New Jersey Student Learning Standards for this course:**

<https://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf>

<https://www.state.nj.us/education/aps/cccs/career/>

**Unit Standards:**

8.1 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.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.

C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others

D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources

8.2 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.

- A. The Nature of Technology: Creativity and Innovation Technology systems impact every aspect of the world in which we live
- B. Technology and Society: Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in the global society.
- C. Design: The design process is a systematic approach to solving problems.
- 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.

9.3 Career and Technical Education:

- 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.
- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
- 9.3.12.AC-DES.1 Justify design solutions through the use of research documentation and analysis of data.
- 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues
- 9.3.ST-ET.1 Use STEM concepts and processes to solve problems involving design and/or production.
- 9.3.ST-ET.2 Display and communicate STEM information.
- 9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.
- 9.3.ST-ET.4 Apply the elements of the design process.

**Transfer Goal(s):** Students will be able to independently use their learning to create a plan to organize and manage a project utilizing the design process.

*Enduring Understandings*

Students will understand that. . .

*EU 1*

the design process gives structure to creativity.

*EU 2*

organization allows engineers to be timely and efficient.

*Essential Questions*

*EU 1*

- How does the engineering design process relate to problem solving and critical thinking?
- Is there a place for creativity in engineering design?
- Why follow a process?
- Why a loop and not a line?

*EU 2*

	<ul style="list-style-type: none"> <li>• What is the relationship between the design process and the project plan?</li> <li>• How does organization affect the project plan?</li> <li>• What role does documentation play in Engineering?</li> </ul>
<p><i>Knowledge</i> Students will know. . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> <li>• that creativity is a process.</li> <li>• the components of each step of the design process</li> <li>• the functions of each step of a design process.</li> </ul> <p><i>EU 2</i></p> <ul style="list-style-type: none"> <li>• the difference between a Gantt Chart and the Critical Path Method.</li> <li>• the components of an organizational chart.</li> <li>• the difference between dependent, concurrent and independent tasks.</li> </ul>	<p><i>Skills</i> Students will be able to. . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> <li>• how to identify and brainstorm solutions to problems.</li> <li>• identify and describe each step of the design process.</li> <li>• explain how each step is connected to the other.</li> <li>• for a given object, describe examples of creative revisions/refinements of a design.</li> </ul> <p><i>EU 2</i></p> <ul style="list-style-type: none"> <li>• construct an organizational chart for a given project.</li> <li>• illustrate the Critical Path method for a given project.</li> <li>• create a Gantt Chart for a given project.</li> </ul>
<p><b>Stage Two - Assessment</b></p>	
<p><i>Other Evidence:</i></p> <ul style="list-style-type: none"> <li>• Quizzes/Tests on the components of a Gantt Chart.</li> <li>• Observation of the student during the learning activities.</li> <li>• Self-Assessment by student of their learning activities.</li> <li>• Graphically represent the design loop.</li> <li>• Application of design process to given projects</li> </ul>	

## Stage Three - Instruction

***Learning Plan:* Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.**

- Teacher lead discussion of the design loop. **(A, EU1)**
- For an established common object, research and provide a timeline of design innovations. **(A, EU1)**
- Create and illustrate a design process on poster paper. **(A, M, EU1)**
- Evaluate the current state of an object and propose a new innovation for the object. **(M, EU1)**
- Research various design processes and have the class integrate findings together into one class design process. **(M, EU1)**
- Presented with an object, identify possible innovations that have previously occurred to that object and explain why they have been done. **(T, M, EU1)**
- Identify components of an organizational chart. **(A, EU2)**
- Compare and contrast the Critical Path Method and a Gantt Chart. **(A,M, EU2)**
- Discuss the importance of using an organizational chart. **(A, M, EU2)**
- For given time parameters and step criteria, create a corresponding Gantt Chart. **(M, T, EU2)**
- Share the proposed innovation (performance task) with a group of classmates and use their feedback to revise/refine the innovation. **(M, T, EU1)**