Unit 3: Design Thinking

Content Area: **CTE**
Course(s):
Time Period: **September**
Length: **1**
Status: **Published**

Essential Questions:

- How can a team be successful?
- What are constraints and trade-offs of a project?
- What is the engineering design process?
- What is your role within a collaborative work environment?

Enduring Understandings:

- 3D design
- Collaborating effectively
- Creative Problem Solving
- Engineering Design Process
- global impact of solutions
- identify trade-offs and constraints
- Visual Communication

Lesson Titles:

- Brain teaser Fridays
- Collaborating Effectively
- Design an inclusive Playground
- What is the Engineering Design Process?

Career Readiness, Life Literacies, and Key Skills:

PFL.9.1.8.RM	Risk Management and Insurance Individuals can choose to accept some risk, to take steps to avoid or reduce risk, or to transfer risk to others through the purchase of insurance.
PFL.9.1.8.RM.1	Determine criteria for deciding the amount of insurance protection needed.
PFL.9.1.8.RM.2	Analyze the need for and value of different types of insurance and the impact of deductibles in protecting assets against loss.
PFL.9.1.8.RM.3	Evaluate the need for different types of warranties.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace

	with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
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.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.
WRK.9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
WRK.9.2.8.CAP.11	Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.
WRK.9.2.8.CAP.20	Identify the items to consider when estimating the cost of funding a business.
TECH.9.4.8.DC.7	Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
TECH.9.4.8.DC.8	Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
TECH.9.4.8.TL.5	Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.
TECH.9.4.8.TL.6	Collaborate to develop and publish work that provides perspectives on a real-world problem.
TECH.9.4.8.GCA	Global and Cultural Awareness
TECH.9.4.8.IML.9	Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2).
	There are variety of resources available to help navigate the career planning process.
	There are ethical and unethical uses of information and media.
	Digital tools allow for remote collaboration and rapid sharing of ideas unrestricted by geographic location or time.
	Digital communities are used by individuals to share information, organize, and engage

around issues and topics of interest.

Inter-Disciplinary Connections:

MA.6-8.1.2.8.Cr1a	Generate a variety of ideas, goals and solutions for media artworks using creative processes such as sketching, brainstorming, improvising, and prototyping with increased proficiency, divergent thinking, and opportunity for student choice.
LA.RH.6-8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
MA.6-8.1.2.8.Pr5b	Develop and demonstrate creativity and adaptability, through processes such as testing constraints and divergent solutions, within and through media arts productions.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
MA.7.G.A.2	Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
6-8.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
6-8.MS-ETS1-1.1.1	Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
6-8.MS-ETS1-4.ETS1.B.1	A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.
6-8.MS-ETS1-3.ETS1.C.1	Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.

Equity Considerations

Climate Change Mandate

Topic: Engineering and Design

- Start by identifying real-world problems related to climate change that are appropriate for the students' level - could involve issues like energy efficiency, renewable energy sources, sustainable transportation, or climate-resilient infrastructure.
- Research the chosen problem and its impact on various communities and ecosystems. This helps them

understand the context of their design project and develop a sense of responsibility.

Topic: Design Constraints and Considerations

- When brainstorming solutions, emphasize the need for sustainability and environmental impact considerations. This may involve using renewable materials, minimizing waste, optimizing energy consumption, and ensuring the long-term durability of the design.
- Encourage students to research the environmental life cycle of different materials and technologies to make informed choices for their projects.

Addresses the Following Component of the Mandate: The political, economic, and social impact of climate change, as part of the district's implementation of the New Jersey Student Learning Standards.

Materials Used and Resources:

Engineers for a Sustainable World: https://www.eswglobal.org/

Climate Action Tracker: https://climateactiontracker.org/

Sustainable Design Institute: https://www.gsa.gov/real-estate/design-and-construction/sustainability/sustainable-design

Green Engineering Education Consortium: https://centerforgreenschools.org/green-schools-conference

LGBTQ and Disabilities Mandate

Asian American Pacific Islander Mandate

Holocaust Mandate

Amistad Mandate

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Brain teaser Friday
- collaboration
- cueing and questioning
- digital tool skills
- Intentional grouping
- Let me learn scores
- peer-evaluation
- presentation skills
- researching skills
- self-reflection
- student-centered instruction
- TinkerCAD

Modifications

Modifications are based on individual education plans. Specific modifications and accommodations are provided.

Formative Assessment:

- Journals
- Presentations
- Projects
- Warm-Up

Summative Assessment:

- EOU Presentations
- EOU Project

Benchmark Assessments

Skills-based assessment

Reading response

Writing prompt

Lab practical

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Resources & Materials:

- Google Calendar
- Google Draw
- Google Sites
- Google Slides
- Journals
- TinkerCAD