2023 U05 iSTEM 2 - Group Product Design Challenge

Content Area: **CTE**
Course(s): **iSTEM**
Time Period: **September**
Length: **8 - 9 weeks**
Status: **Published**

Unit Overview:

In this unit students will work as a collaborative team and will experience shared decision-making as they work to solve a new design challenge. Team members will choose a design challenge that will allow them to convey their understanding of the design process, the team will apply skills and knowledge from iSTEM1 to solve the design challenge. The team will document and communicate their proposed solution to the teacher and to the class via ENB and Google Slide Presentation.

Essential Questions:

- What are the advantages and disadvantages of a design team approach versus an individual approach in the problem solving process?
- What strategy would you use to form a design team in order to obtain the best solution possible?
- How can the use of a project schedule positively influence the design process?
- What does it mean to be “ethical” in your work? Do engineers need to be taught to be “ethical”?
- It has been said that, “Having a vision without action is a daydream; Taking action without a vision is a nightmare!” How does this apply to engineering design
- How might the group create the best possible solution to a problem?
- What does the group need to know and understand about the challenge in order to design the solution to a problem?

Enduring Understandings:

- Specific oral communication techniques are used to effectively convey information and communicate with an audience.
- Engineering design and practices are governed by ethics, values, and laws.
- An engineering design process involves a characteristic set of practices and steps.
- Effective design teams can improve the efficiency and effectiveness of the design process. Effective team members have good collaboration skills.
- Brainstorming may take many forms and is used to generate a large number of innovative, creative ideas in a short time.
- Research derived from a variety of sources (including subject matter experts) is used to facilitate effective development and evaluation of a design problem and a successful solution to the problem
- Problem solutions are optimized through evaluation and reflection and should be clearly communicated.
- In order to be an effective team member, one must demonstrate positive team behaviors and act according to accepted norms, contribute to group goals according to assigned roles, and use appropriate conflict resolution strategies.
- Styles and modes of professional correspondence are tailored to the type of audience and intended

goals.
- Project planning tools and management skills are often used in the process of solving engineering design problems.

Lesson Titles:

- Review of Classroom Rules, Teacher / Summer Overview, Review of iSTEM 2 Syllabus

- Mini - Project: Tallest Paper Tower

- Mini - Project: Simple Cardstock Bridge

- Review of tool safety, steps of the design process, brainstorming methods, creating and application of a Gantt Chart, Decision Matrix, and Team Norms, and where they fit in the design process

- Historical Marvels engineered by ancient Spanish cultures

- Design Challenge #6: Product Design

- Product Design Presentation

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

- Direct Instruction: Daily Overviews (Promethean Board, Chromebooks, White Board)
- Direct Instruction: Presentations - Review of course outline / syllabus, Review of classroom rules
- Instruction: Step by Step Videos / Example: Access to 3-D modeling videos for review
- Independent Work: Historical Marvels engineered by ancient Spanish cultures
- Indirect Instruction: Reflective Discussion, Evaluation of Data and Technical Writing - ENB Write Ups, Self Evaluations, Presentation of Projects
- Experiential: Project - Product Design
- Experiential: Mini - Project: Tallest Paper Tower
- Experiential: Mini - Project: Simple Cardstock Bridge
- Cooperative: Partner classwork, short projects, projects and ENB entries

Summative Assessment:

- Mini - Project: Simple Cardstock Bridge
- Mini - Project: Tallest Paper Tower

- Project: Product Design Packet and Presentation
- Quiz: Historical Marvels engineered by ancient Spanish cultures
- Quiz: Product Design Project ENB Write-Up
- Quiz: Simple Cardstock Bridge ENB Write UP
- Quiz: Tallest Paper Tower ENB Write UP

Formative Assessment:

- Anticipatory Set - Overview of items for the day, future activities of the unit, and/or review of previous information from the unit
- Classroom / Student Observation - check in on student work during in-class activities / projects
- Closure of Projects - students provide results of their projects, self-evaluate projects for possible improvements that could be made, and evaluate instruction that could be improved
- Closure of Units - students complete a design project that pertains to the unit at hand as well as prior units
- Conferences between the instructor and student at various points in the semester.
- ENB (engineering notebooks) - reviewed periodically during the school year
- In-class activities where students informally present their results.
- Presentation Sample Slides - Students participate in classroom discussion on topic that is being introduced and reviewed
- Q & A session - Student led question and answer session at the start of class for project information as needed
- Question and answer sessions, formal, planned and informal, spontaneous.
- Warm-Up - review information from current topic or previous topics, preview time for current activity, and/or opportunity for clarity on the previous day's work

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

Standards/Indicators/Student Learning Objectives (SLOs):

9-12.HS-ETS1	Engineering Design
9-12.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.
9-12.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.
9-12.HS-ETS1-4.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows— within and between systems at different scales.
9-12.HS-ETS1-2.6	Constructing explanations and designing solutions in 9–12 builds on K–8 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.
9-12.HS-ETS1-2.6.1	Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-ETS1-4.ETS1.B	Developing Possible Solutions

Career Readiness, Life Literacies, & Key Skills:

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.
TECH.9.4.12.DC.3	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).

Inter-Disciplinary Connections:

LA.SL.9-10.1.B	Collaborate with peers to set rules for discussions (e.g., informal consensus, taking votes on key issues, presentation of alternate views); develop clear goals and assessment criteria (e.g., student developed rubric) and assign individual roles as needed.
LA.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.SL.9-10.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.
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
	Constructing Explanations and Designing Solutions
SCI.HS.ETS1.C	Optimizing the Design Solution

Technology Materials and Standards

- SmartBoard Presentations
- Chromebooks, Google Drive, Google Applications
- MS Office Software as needed
- Smartphones
- Construction Hand Tools and Safety Equipment
- Autodesk Inventor

TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.12.E.2	Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.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.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.

Computer Science and Design Thinking Standards

CS.K-12.1.b	Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.
CS.K-12.2.a	Cultivate working relationships with individuals possessing diverse perspectives, skills, and

	personalities.
CS.K-12.2.b	Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.
CS.K-12.2.c	Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.
CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.

Modifications

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines

- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions
- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary

- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Resources & Materials:

- Project Lead the Way, Introduction to Engineering Design Information
- Walker, Exploring Drafting, II: Goodhart-Wilcox, 1996
- Gradwell & Wekch. Technology, Engineering Our World, IL: Goodhart-Wilcox, 2012
- Autodesk Inventor