

Component 2 Design Lesson Plan

COURSE:

Engineering Design and Development (Honors)

TEACHER:

Jason D. Redd

DURATION:

15 Days

STANDARDS:

This course connects to standards in the following:

- Common Core State Standards for English Language Arts Anchor Standards
- Common Core Standards for Mathematics
- Next Generation Science Standards
- Standards for Technological and Engineering Literacy

PLTW FRAMEWORK:

Provided by Project Lead the Way (PLTW), the PLTW Framework provides an overview of the levels of understanding that each student will build upon throughout the lesson/unit. It includes: Established Goals, Transfer, Understandings, Knowledge and Skills, and Essential Questions. The most fundamental level of learning is defined by course Knowledge and Skills statements. Each Knowledge and Skills statement reflects

content. Students apply Knowledge and Skills to achieve Learning Objectives, which are skills that directly relate to the workplace or applied academic settings.

Established Goals

It is expected that students will:

- Demonstrate an ability to identify, formulate, and solve engineering problems.
- Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- Demonstrate an understanding of professional and ethical responsibility.
- Demonstrate an ability to function on multidisciplinary teams.
- Demonstrate an ability to communicate effectively.
- Gain knowledge of contemporary issues
- Recognize the need for, and develop an ability to engage in life-long learning.

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- Communicate design concepts using visual and written documentation.
- Communicate professionally with experts and mentors to obtain feedback on the technical feasibility of their design, document the interactions, and implement recommended changes to their product design.
- Evaluate feedback from reviewers and modify design concepts as appropriate.
- Collaborate with teammates to select a solution path to pursue.
- Assess their product design based on a variety of design factors and implement design changes to improve their product.
- Determine and document resource needs, including a bill of materials, tools, equipment, and knowledge required to build a prototype.
- Perform a cost estimate to create a prototype.
- Create a document to present their proposed design and provide justification for further development of a product. (Project Proposal - Preliminary Design Review)

ESSENTIAL QUESTIONS:

Students will keep considering:

- What brainstorming or idea generations techniques did I use to help define possible solutions?
- Why is it important to take the time to thoroughly explore many potential solutions before selecting a solution path?
- How can I show that I kept all of the design requirements in mind throughout the entire process?
- Why would an engineer need to identify the criteria and constraints required for a design solution?
- What was the best solution to try?
- Why was it the best solution to try?
- How do I show that our design ideas and proposed design attributes are based on sound logic and subject related knowledge?
- How is a decision making matrix used to select the best solution path?
- Why does this proposed solution have merit to try?
- How do I show evidence that the proposed design has merit beyond the classroom or lab as a real solution?
- Is the design viable?
- How can I show evidence that the design could realistically get into the hands of the people the design is trying to help in a sustainable way?
- What evidence would I have to offer to honestly ask a family to invest their life savings in this idea?
- What are advantages of using virtual solutions before and sometimes in place of physical prototypes?

EQUIPMENT / MATERIALS / RESOURCES:

Students will need or utilize:

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| ☒ Assignment Handouts / Instructions | ☒ Online Resources |
| ☒ CAD Software | ☒ Other Software |
| ☒ Classroom Materials / Equipment | ☒ Schoology |
| ☒ Computer / Device | ☒ Teacher Handouts |
| ☒ Internet Access | ☐ Other: |
| ☒ Microsoft Office Software | |

AGENDA / ACTIVITIES / INSTRUCTIONAL PROCEDURES:

Teacher Activity (Introduction to New Material)

The teacher will:

- Review the Learning Objectives and Essential Questions for the lesson (at the beginning and throughout).
- Lead a

- Provide an overview of assignments that will be worked on throughout the lesson.
- Demonstrate expectations / skills.
- Provide an example of a Technical Report for students to refer to throughout their project.
- Provide access to the resources for *Component 2 Design* documents and PowerPoint presentations.

Element D Design Concepts Generation, Analysis, and Selection

- *Element D Design Concepts Generation, Analysis, and Selection Overview*
- *Brainstorming Solutions PowerPoint*
- *Concept Development PowerPoint*
- *Isometric Graph Paper with Border*
- *Orthographic Graph Paper with Border*
- *Selecting Solution Path PowerPoint*
- *Product Improvement and Design Documentation*
- *Decision Matrix Template*
- *Product Concept Template*
- *Virtual Solutions*
- *Mock Up*
- *Element D Design Concept Generation, Analysis, and Selection Template*

Element E Application of STEM Principles and Practices

- *Element E Application of STEM Principles and Practices Overview*
- *Element E Application of STEM Principles and Practices Template*

Element F Consideration of Design Viability

- *Element F Consideration of Design Viability Overview*
- *Viability of the Proposed Solution*
- *Element F Consideration of Design Viability Template*

- Provide instructions for *Component 2 Design (Element D, E, and F)*.
- Provide instructions for the *Technical Report*.
- Assess student presentations/work.

Guided Practice

The teacher will:

- Review agenda, learning objectives, and essential questions daily.
- Lead students to recall prior knowledge / experience to make connections to new content.
- Introduce content to be learned.
- Clarify and check for understanding by asking open-ended questions (or by some other type of formative assessment) throughout instruction. Reteach material as needed.
- Pace the classroom instruction to clarify misunderstanding and provide opportunities for student feedback.
- Introduce new content to be learned and how it connects to learning objectives and answers some (or all) of the essential questions.
- Demonstrate skill practices students will gain from this lesson.
- Demonstrate assignment(s) outcome expectations.
- Review resources and equipment needed to problem-solve student assignments.
- Share safety instructions to students. *Safety Instructions: Students should only utilize equipment they have been fully trained to use.*
- Provide review material / resources for students to prepare for summative assessments.

Transition

- ☒ Classroom Expectations / Routines
- ☒ Review Questioning
- ☒ Stimulus or Signal (Example: etc.)
- ☒ Student Reflection
- ☒ Timer

Independent Practice (Varied Learning)

The students will:

- Participate in teacher-led discussions / presentations.
- Complete assigned assignment(s) in class.
- Complete assigned homework assignment(s) outside of class.
- Provide feedback by demonstrating skills.

Closure

The following techniques may be utilized:

- The teacher will lead a classroom discussion to check for understanding and clarify misunderstandings.
- The teacher may ask students to reflect on the outcomes from the lesson.
- The teacher may ask students if they met and how they met the learning objectives for the lesson.
- The teacher may ask students to demonstrate what was learned.
- Teacher and students may play Kahoot! (or some other type of game) to check for mastery.
- Student will share why the lesson is important via guided questions.
- Student will complete some sort of exit ticket.

Assignments and Assessments

The students will:

- Practice active listening skills while observing the teacher-led PowerPoint presentations.
- Review the *Component 2 Design* documents and PowerPoint presentations.
- Complete *Component 2 Design (Element D, E, and F)*.
- Create and continually add to and revise the *Technical Report*

Homework

The students will:

- Complete assignments that were not completed in class.
- Conduct research as needed for assignments.
- Review the lesson/unit concepts, content, and skills as needed to prepare for lesson/unit assessments.

ASSESSMENTS:

Checks for Understanding (Formative and/or Summative):

- ☒ Bell Ringer(s) ☒ Peer Evaluation
- ☒ Check Class Assignment(s) / Homework
- ☒ Class Participation
- ☒ Group Activity
- ☒ Hands On / Lab Activity
- ☒ Independent Practice
- ☒ Oral Responses

TEACHER REFLECTION / ADDITIONAL NOTES: