

PLTW Engineering Development and Design (EDD)

Curriculum/Content Area: Applied Technology & Engineering	Course Length: Two Terms
Course Title: Engineering Design and Development (EDD)	Date last reviewed: May 8, 2015
Prerequisites: Previous completion of one of the PLTW foundation courses.	Board approval date: June 16, 2015

Desired Results

Course description and purpose:

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an engineering research, design and fabrication course in which students work in teams to design, develop and fabricate an original solution to a valid open-ended technical problem by applying the engineering design process. The course applies and concurrently continues to develop knowledge and skills from the foundation PLTW courses as well as mathematics, science, and technology. Since the projects on which students work can vary with student interest, the curriculum focuses on the full engineering process from problem identification through presentation of a complete solution that is modeled by a working prototype.

Utilizing an activity-project-problem-based (APPB) environment, students will perform research to choose, validate, and justify a technical problem. After carefully defining the problem, teams of students will design, build, and test their solution. Finally, student teams will present and defend their original solution to an outside panel of experts in the various aspects of engineering and business. While progressing through the engineering design process, students will utilize community experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem solving abilities, and their understanding of the design process. A material fee is charged for this course.

Enduring Understandings (EUs): <ul style="list-style-type: none">• The work of engineers impacts our society.• Relevant principles and practices of Science, Technology, Engineering, and Mathematics (STEM) is used to inform and justify design choices.• An open-ended design process involves identifying a justifiable problem and developing an original solution that attempts to solve it.• Project management is the discipline of planning, organizing, motivating, utilizing resources to achieve specific goals.• Large projects require precise time management for on-time completion.• There are principles and practices related to documenting an engineering design process that allow teams to work effectively, preserve the work allowing continuation at a later date, and protect the designer's intellectual property.• The ability to communicate as a professional is a critical skill in the business world.	Essential Questions (EQs): <ul style="list-style-type: none">• What are the roles and responsibilities of engineering in society?• What role does the market place play in engineering design?• What are the fundamental aspects of any engineering design process?• Why is it important for engineers and designers to utilize known scientific and mathematical principles?• Why do engineers implement well defined problem statements prior to beginning the solution process?• What determines the next step in a design process?• What are the critical attributes of successful project planning and management?• Why is the intellectual property so important in engineering design?• Why is teaming often more effective than
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<ul style="list-style-type: none"> • Testing is a critical component to any problem solution. • Presentation of a design and project findings are critical to the overall system's success. 	<p>individuals working alone when solving a complex problem?</p> <ul style="list-style-type: none"> • What are the drawbacks to poor business communication? • What are the general steps used to develop a solution testing procedure. • What key points are most important to engineers when given limited time to present findings?
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Assessment Evidence

<p>Performance assessments:</p> <ol style="list-style-type: none"> 1. One major project consisting of: full project documentation, complete system design with modifications and fabrication of a functioning system prototype. 2. A final project presentation targeted at either informing or persuading audiences about a design solution. 	<p>Other assessments:</p> <ol style="list-style-type: none"> 1. Formative activities including group work used to introduce content, provide feedback, and evaluate understanding. 2. Summative quizzes used to determine content mastery. 3. Periodic evaluations of the project's documentation with emphasis on the Engineer's Notebook.
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<p>Standards - Course Wide</p>
<p>Wisconsin Engineering and Technology Standards ENG4.b.3.m: Apply a design process to solve problems in and beyond the laboratory-classroom. ENG4.b.5.h: Develop and produce a product or system using a design process.</p>

<p>Learning Targets - Course Wide</p>
<p>I can...</p> <ol style="list-style-type: none"> 1. Apply concurrent engineering practices to reach a solution with genuine commercial application. 2. Work effectively in a team and apply the design process to develop an acceptable solution to a verified problem. 3. Apply appropriate design principles to create a design solution. 4. Develop and fabricate a marketable product.

<p>Unit #1: Project Management</p>
<p>A. Design Process</p>
<p>Standards:</p>
<p>CCSS CCSS.ELA-Literacy.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p>

Wisconsin Engineering and Technology Standards

ENG1.a.1.e: Design is a creative process.

ENG1.a.11.h: Argue design processes vary slightly. However, key elements of any design process include: defining a problem, identifying criteria, generating solutions, creating a model or prototype, testing and evaluating, refining the design and communicating processes and results.

ENG4.a.3.m: Specify criteria and constraints for the design.

ENG4.a.5.h: Identify the design problem to solve and determine how to address it.

Learning Targets:

I can...

1. Identify the critical components required for a major project.
2. Work with a team to identify the strengths and weaknesses of each member.
3. Create a balanced allocation of project tasks for each member based on their skills.
4. Create a method for tracking progress and communicating items among team members.

Unit #2: Define a Problem

A. Identifying a valid problem

B. Justifying the problem

Standards:

CCSS

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CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Wisconsin Engineering and Technology Standards

ENG1.a.2.e: Everyone can design solutions to a problem.

ENG3.a.5.h: Explain technological problems must be researched before they can be solved.

ENG3.a.6.h: Not all problems are technological and not every problem can be solved using technology.

ENG4.b.1.e: Investigate how things are made and how they can be improved.

Learning Targets:

I can...

1. Deconstruct an issue to identify root cause.
2. Verify the validity of a problem based on demand and existing solutions.
3. Evaluate a potential solution for inclusion under one of the intellectual property protections.

Unit #3: Design a Solution

A. Select a solution path

B. Develop a design proposal

Standards:

CCSS

CCSS.ELA-Literacy.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Wisconsin Engineering and Technology Standards

ENG2.a.5.m: Discuss the engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it and presenting the results.

ENG2.b.1.e: Expressing ideas to others, verbally and through sketches and models, is an important part of the design process.

ENG3.a.7.h: Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.

ENG4.c.1.e: Discuss the process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.

Learning Targets:**I can...**

1. Identify the process steps needed to develop a solution to a defined problem.
2. Summarize what will be done to arrive at a working prototype for a given problem.

Unit #4: Design and Prototype a Solution

- A. Plan for the prototype
- B. Build the prototype

Standards:**CCSS**

CCSS.ELA-Literacy.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Wisconsin Engineering and Technology Standards

ENG4.b.2.e: Build or construct an object using the design process.

ENG4.c.3.e: Improve the design solutions.

Learning Targets:**I can...**

1. Develop a schedule for the necessary steps needed to fully develop a solution to a problem including their interdependency.
2. Create a working prototype of a solution to a defined problem.

Unit #5: Test, Evaluate and Refine the Solution

- A. Plan the test
- B. Test the prototype

Standards:

CCSS

CCSS.ELA-Literacy.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Wisconsin Engineering and Technology Standards

ENG1.a.9.h: Examine how the design needs to continually be evaluated and the ideas of the design must be redefined and improved.

ENG2.b.4.h: A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

ENG4.c.2.e: Test and evaluate the solutions for the design problem.

ENG5.b.8.h: Troubleshoot, analyze and maintain systems to ensure proper function, accuracy and precision.

ENG6.a.2.m: Design and use instruments and technology to gather data.

ENG6.b.1.e: Determine if the human use of a product or system creates positive or negative results.

Learning Targets:

I can...

1. Develop a testing process for a given solution.
2. Execute and collect data for a given test process.
3. Analyze data from a test procedure.

Unit #6: Communicate the Process and the Results

- A. Documentation
- B. Project presentation

Standards:

CCSS

CCSS.ELA-Literacy.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CCSS.ELA-Literacy.WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Wisconsin Engineering and Technology Standards

ENG4.c.6.h: Evaluate final solutions and communicate observation, processes and results of the entire design process, using verbal, graphic, quantitative, virtual and written means, in addition to design models.

ENG5.a.3.e: Recognize and use everyday symbols such as numbers and symbols to communicate key ideas.

ENG5.a.7.h: Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

ENG5.b.2.e: Use computers and technology to access and organize information.

ENG5.b.5.m: Use computers, calculators and technology in various applications.

Learning Targets:**I can...**

1. Maintain appropriate project documentation, according to accepted guidelines meeting patent criteria.
2. Develop a presentation, with an agenda targeted at a specific audience, which is to be delivered in either first person, written or audio form.