

*The knowledge and skills students acquire throughout PLTW Engineering come together in EDD as they identify an issue and then research, design, and test a solution, ultimately presenting their solution to a panel of engineers. Students apply the professional skills they have developed to document a design process to standards, ready to take on any post-secondary program or career.*

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an open-ended engineering research course in which students work in teams to design and develop an original solution to a well-defined and justified open-ended problem by applying an engineering design process.

Students will perform research to select, define, and justify a problem. After carefully defining the design requirements and creating multiple solution approaches, teams of students select an approach, create, and test their solution prototype. Student teams will present and defend their original solution to an outside panel. While progressing through the engineering design process, students will work closely with experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem solving abilities, and their understanding of the design process.

Engineering Design and Development is a high school level course that is appropriate for 12th grade students. Since the projects on which students work can vary with student interest and the curriculum focuses on problem solving, EDD is appropriate for students who are interested in any technical career path. EDD should be taken as the final capstone PLTW course since it requires application of the knowledge and skills introduced during the PLTW foundation courses.

The Engineering Design and Development course of study includes:

### **Engineering Design Processes**

- Project Management
- Documenting an Engineering Design Process
- Teamwork and Professional Skills
- Problem Identification and Justification
- Research
- Intellectual Property
- Design Requirements
- Project Proposals
- Design
- Virtual Design and Testing
- Preliminary Design Reviews
- Prototyping
- Testing a Prototype
- Presenting the Process and Results

The structure of Engineering Design and Development is aligned to the Engineering Design Process Portfolio Rubric. Students in this course are encouraged to format their Engineering Design Process Portfolio according to the Components and Elements defined within this rubric.

Student may also wish to capture the Engineering Design Process Portfolio through the online Innovation Portal eportfolio system. This free collaborative tool allows students to share their work securely with key stakeholders and experts in order to receive feedback throughout the design process.

Below is the Engineering Design and Development course structure.

### **Component 0: Project Management**

- (α) – The EDD Design Process and Project Management
- (β) – Documenting the Engineering Design Process
- (γ) – Teams, Timelines, and Contacting Experts
- (δ) – Project Evaluations and Classroom Management
- (ε) – Intellectual Property

### **Component 1 – Research**

- Element A – Identification and Justification of the Problem
- Element B – Documentation and Analysis of Prior Solution Attempts
- Element C – Presentation and Justification of Solution Requirements

### **Component 2 – Design**

- Element D – Design Concept Generation, Analysis, and Selection
- Element E – Application of STEM Principles and Practices
- Element F – Consideration of Design Viability

### **Component 3 – Prototype and Test**

- Element G – Construction of a Testable Prototype
- Element H – Prototype Testing and Data Collection Plan
- Element I – Testing, Data Collection, and Analysis

### **Component 4 – Evaluation of Project and Process**

- Element J – Documentation of External Evaluation
- Element K – Reflection on the Design Project
- Element L – Presentation of Designer's Recommendations

### **Component 5 – Reflection and Presenting the Design Process**

- Element M – Presentation of the Project and Project Portfolio
- Element N – Writing Like an Engineer

### **Component 6 – Going Beyond EDD**

### **Component 0 – Project Management**

Major focuses of the course are project management and professional skills required to successfully complete and document an engineering design process. Topics student will study and skills they will refine are:

- (α) – The EDD Design Process and Project Management
- (β) – Documenting the Engineering Design Process
- (γ) – Teams, Timelines, and Contacting Experts
- (δ) – Project Evaluations and Classroom Management
- (ε) – Intellectual Property

### **Component 1 – Research**

This component requires students to identify a problem for which they will design a solution during the remainder of the course. In the first lesson, students will write a clear problem statement and validate the problem by documenting credible sources that indicate that the problem exists. Validation is carried out through research and input from experts and mentors. Once their work is defined, students are asked to perform additional research in order to justify the problem by confirming that the expense and effort involved with solving the problem is warranted based on need and cost. Students will explore and analyze prior solution attempts. Based on their research, student will create a testable design requirement which will be used to explore possible solutions. The students will present a project proposal to ensure the project is justified and that all prior solution attempts have been explored.

- Element A – Identification and Justification of the Problem
- Element B – Documentation and Analysis of Prior Solution Attempts
- Element C – Presentation and Justification of Solution Requirements

### **Component 2 – Design**

Based on the design requirement identified through research, students develop multiple solution possibilities. Through an evaluation process that involves feedback from experts and stakeholders and the application of a decision matrix or data-driven process, students will select the best potential solution to pursue. Students will refine the final selected solution path and provide evidence that the solution selected is viable.

- Element D – Design Concept Generation, Analysis, and Selection
- Element E – Application of STEM Principles and Practices
- Element F – Consideration of Design Viability

### **Component 3 – Prototype and Test**

Student will create a testable prototype and an unbiased testing plan based on the defined design requirements to determine the effectiveness of the solution created.

- Element G – Construction of a Testable Prototype
- Element H – Prototype Testing and Data Collection Plan
- Element I – Testing, Data Collection, and Analysis

### **Component 4 – Evaluation of Project and Process**

At this point in the design process, it is critical to seek and document feedback from all stakeholders. The designer(s) should reflect on all design decisions and the analysis that was generated from the testing process. Finally, the designer(s) can begin to formulate next steps.

Element J – Documentation of External Evaluation  
Element K – Reflection on the Design Project  
Element L – Presentation of Designer’s Recommendations

### **Component 5 – Reflection and Presenting the Design Process**

At the conclusion of the design process, students will be asked to present and defend the process and decision.

Element M – Presentation of the Project and Project Portfolio  
Element N – Writing Like an Engineer

### **Component 6 – Going Beyond EDD**

Many opportunities exist for students to receive tangible value for their work beyond the classroom walls. These opportunities range from competitions, scholarships, and university admission notoriety, to interest from business representatives to further develop the ideas created in EDD classrooms.

This section of the curriculum is dedicated to providing resources, examples, and suggestions for helping your students obtain tangible value for their work. Below you will find examples of student success stories related to College Recognition, Competitions, and Business Opportunities.

- Design and Problem Solving Competitions
- Scholarship and Internship Opportunities
- Product and Business Development Opportunities
- Patents
- Admission Preference or College Level Recognition