PLTW Framework - Overview

PLTW Frameworks are representations of the knowledge, skills, and understandings that empower students to thrive in an evolving world. The PLTW Frameworks define the scope of learning and instruction within the PLTW curricula. The framework structure is organized by four levels of understanding that build upon each other: Knowledge and Skills, Objectives, Domains, and Competencies.

The most fundamental level of learning is defined by course Knowledge and Skills statements. Each Knowledge and Skills statement reflects specifically what students will know and be able to do after they've had the opportunity to learn the course content. Students apply Knowledge and Skills to achieve learning Objectives, which are skills that directly relate to the workplace or applied academic settings. Objectives are organized by higher-level Domains.

Domains are areas of in-demand expertise that an employer in a specific field may seek; they are key understandings and long-term takeaways that go beyond factual knowledge into broader, conceptual comprehension.

At the highest level, Competencies are general characterizations of the transportable skills that benefit students in various professional and academic pursuits. As a whole, the PLTW Frameworks illustrate the deep and relevant learning opportunities students experience from PLTW courses and demonstrate how the courses prepare students for life, not just the next grade level.

To thrive in an evolving world, students need skills that will benefit them regardless of the career path they choose. PLTW Frameworks are organized to showcase alignment to in-demand, transportable skills. This alignment ensures that students learn skills that are increasingly important in the rapidly advancing, innovative workplace.

Competencies (C), Domains (D), Objectives (O), Knowledge and Skills (KS)

C1 Problem Solving and Process Thinking

Strategic and systematic design and inquiry processes guide the development of an effective solution to the problem.

D1 Engineering Mindset

Successful engineers typically exhibit specific personal and professional characteristics that lend themselves to the creative, collaborative, and solution-driven nature of the profession.

O1.1 Demonstrate independent thinking and self-direction in pursuit of accomplishing a goal.

KS1.1.1 List and prioritize goals with tangible success criteria.

KS1.1.2 Plan and use time in pursuit of accomplishing a goal without direct oversight.

KS1.1.3 Plan how to gain additional knowledge and learning to accomplish a goal.

O1.2 Demonstrate flexibility and adaptability to change.

KS1.2.1 Adapt to varied roles, job responsibilities, schedules, and contexts.

O1.3 Persevere to solve a problem or achieve a goal.

KS1.3.1 Describe why persistence is important when identifying a problem and/or pursuing solutions.

KS1.3.2 Accept failure as part of an evolution of individual growth and necessary to the expansion of the engineering profession.

KS1.3.3 Reflect critically on past experiences to inform future progress.

D2 Design Process

An engineering design process is an iterative, systematic approach to problem solving.
O2.1 Explain and justify an engineering design process.

KS2.1.1 Explain that there are many versions of a design process that describe essentially the same process.

KS2.1.2 Describe major steps of a design process and identify typical tasks involved in each step.

KS2.1.3 Identify the step in which an engineering task would fit in a design process.

KS2.1.4 Outline how iterative processes inform engineering decisions, improve solutions, and inspire new ideas.

KS2.1.5 Document a design process in an engineering notebook according to best practices.

O2.2 Collect, analyze, and interpret information relevant to the problem or opportunity at hand to support engineering decisions.

KS2.2.1 Explain the role of research in the process of design.

KS2.2.2 Find relevant data in credible sources such as literature, databases, and policy documents.

KS2.2.3 Explain the role of stakeholders and subject matter experts in the design process.

KS2.2.4 Describe criteria for determining the reliability and credibility of information.

O2.3 Synthesize an ill-formed problem into a meaningful, well-defined problem.

KS2.3.1 Explain the importance of carefully and specifically defining a problem or opportunity, design criteria, and constraints, to develop successful design solutions.

KS2.3.2 Identify and define visual, functional, and structural design requirements with realistic constraints, against which solution alternatives can be evaluated.

KS2.3.3 List potential constraints that may impact the success of a design solution. Examples include economic (cost), environmental, social, political, ethical, health and safety, manufacturability, technical feasibility, and sustainability.

O2.4 Generate multiple potential solution concepts.

KS2.4.1 Describe multiple techniques and appropriate guidelines used to generate ideas.

KS2.4.2 Represent concepts using a variety of visual tools, such as sketches, graphs, and charts, to communicate details of an idea.

O2.5 Develop models to represent design alternatives and generate data to inform decision making, test alternatives, and demonstrate solutions.

KS2.5.1 Describe the use of a model to accurately represent the key aspects of a physical system. Include the identification of constraints, such as cost, time, or expertise that may influence the selection of a model.

KS2.5.2 Define various types of models that can be used to represent products, processes, or designs, such as physical prototypes, mathematical models, and virtual representations. Explain the purpose and appropriate use of each.

O2.6 Select a solution path from many options to successfully address a problem or opportunity.

KS2.6.1 Explain that there are often multiple viable solutions and no obvious best solution. Trade-offs must be considered and evaluated consistently throughout an engineering design process.

KS2.6.2 Develop and carry out a justifiable scheme to compare and evaluate competing solutions paths. A decision matrix is one tool used to compare and evaluate competing solutions based on design criteria.

O2.7 Make judgments and decisions based on evidence.

KS2.7.1 Explain that a conclusion is valid if the evidence supports the conclusion while acknowledging the limitations, opposing views, and biases.
KS2.7.2 Evaluate evidence and arguments to identify deficiencies, limitations, and biases or appropriate next steps in the pursuit of a better solution.

D3 Engineering Tools and Technology
The practice of engineering requires the application of mathematical principles and common engineering tools, techniques, and technologies.

O3.1 Using a variety of measuring devices, measure and report quantities accurately and to a precision appropriate for the purpose.

KS3.1.1 Explain that all measurements are an approximation of the true value of a quantity.

KS3.1.2 Explain and differentiate between the accuracy and precision of a measurement or measuring device.

KS3.1.3 Use dimensional analysis and unit conversions to transform data to consistent units or to units appropriate for a particular purpose or model.

O3.2 Interpret and analyze data for a single count or measurement variable.

KS3.2.1 Represent data for a single count or measurement with plots on the real number line, for example dot plots, histograms, and box plots.

KS3.2.2 Use statistics appropriate to the shape of the data distribution to determine the center (median, mean) and spread (interquartile range, standard deviation) of a data set and/or compare data sets.

KS3.2.3 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate.

O3.3 Apply mathematical (including graphical) models and interpret the output of models to test ideas or make predictions.

KS3.3.1 Represent data for two quantitative variables on a scatter plot, and describe how the variables are related.

KS3.3.2 Fit a function to the data; use functions fitted to data to solve problems in the context of the data, especially linear, quadratic, and exponential functions.

KS3.3.3 In linear models, interpret the rate of change (slope) and the intercept (constant term) in the context of the data.

KS3.3.4 Distinguish between sample statistics and population statistics and know appropriate applications of each.

C2 Technical Knowledge and Skills
Every career field requires technical literacy and career-specific knowledge and skills to support professional practice.

EDD provides an opportunity for students to apply previous PLTW experience through a course that focuses on a design process, not specific technical knowledge and skills. By nature, the technical skills and knowledge a student learns in this course will vary among schools and among individuals. Adapt this competency to serve the needs of students based on their specific projects.

C3 Professional Practices and Communication
Professional practice is guided by professional ethics and standards and requires effective communication and collaboration.

D4 Collaboration
Demonstrate an ability to function on multidisciplinary teams.

O4.1 Facilitate an effective team environment to promote successful goal attainment.

KS4.1.1 Describe the various individual roles and interdependencies of a collaborative team.
O4.2 Contribute individually to overall collaborative efforts.
  
  KS4.2.1 Critically and realistically self-evaluate personal contributions and collaboration effectiveness within a team.

O4.3 Analyze and evaluate the work of others to provide helpful and effective feedback.
  
  KS4.3.1 Describe the purpose and positive outcomes of a peer review process.
  
  KS4.3.2 Describe the characteristics of effective feedback.

O4.4 Manage project timelines and resources as part of an engineering design process.
  
  KS4.4.1 Explain the process of project management and the importance of elements, such as timelines, schedules, task assignments, and identification and mitigation of potential risks in the effort to complete a project on time.
  
  KS4.4.2 Develop a project plan using a project planning tool such as a Gantt chart.
  
  KS4.4.3 Select and use a system of collaborative tools, such as cloud-based tools, document sharing, and video and text functions, to successfully complete a project.

D5 Communication

Engineering practice requires effective communication with a variety of audiences using multiple modalities.

O5.1 Communicate effectively with an audience based on audience characteristics.
  
  KS5.1.1 Adhere to established conventions of written, oral and electronic communications (grammar, spelling, usage, and mechanics).
  
  KS5.1.2 Follow acceptable formats for technical writing and professional presentations.
  
  KS5.1.3 Describe how the size and characteristics of an audience will affect communication.
  
  KS5.1.4 Modify the content, format, level of technical detail, and length of communications to meet the needs of the audience.
  
  KS5.1.5 Properly cite references for all communication in an accepted format.
  
  KS5.1.6 Clearly label tables and figures with units and explain the information presented in context.
  
  KS5.1.7 Describe characteristics important to oral delivery of information (volume, tempo, eye contact, articulation, and energy). Vary these elements of delivery to convey and emphasize information and engage the audience.