

Design Process

A design process is a systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve or satisfy human needs or wants and to narrow down the possible solutions to one final choice.

International Technology Education Association (ITEA) Standards for Technological Literacy

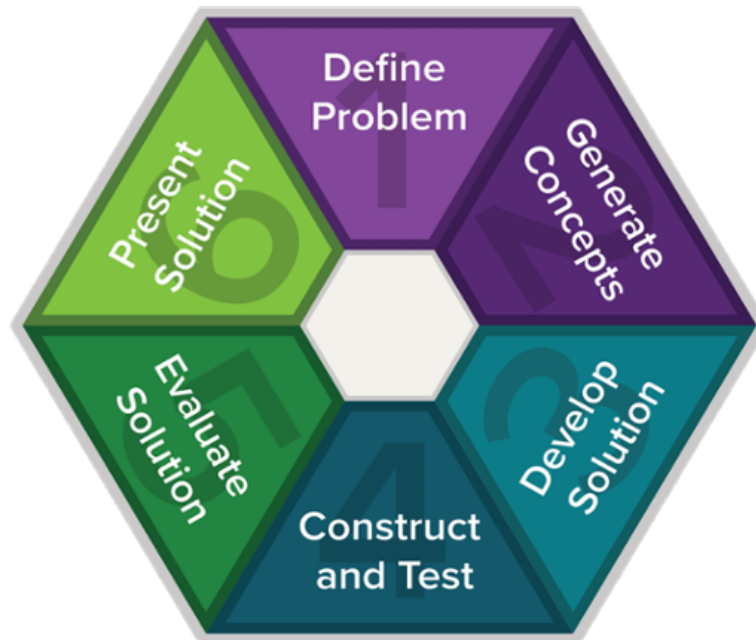
The word “design” is often used as a generic term to refer to anything made by a conscious human effort. Design is also a process used to systematically solve problems. An example in your everyday life could be how you get ready for school, or how you might fix a broken shoe, or even how you might make your cell phone more durable.

Career Awareness

Professionals in nearly every industry and academia apply a design process to solve problems and guide the design and innovation of products and processes.

Consistently applying a single, clearly defined design process provides a basis for understanding. Project Lead The Way courses use one design process, but it is one of many that exist. Many design processes are effective across different technical fields.

The design process serves as both a guide and a series of checkpoints for effective problem-solving.



The design process is **iterative** . The path from identifying a problem to presenting a solution is rarely straightforward. Designers must evaluate, reflect, redefine, and redesign throughout the process. It is common to repeat steps of the design process several times before an optimal solution is found.

1

Define Problem

Problems exist everywhere, and they vary in their degree of complexity and importance. An acceptable problem is one for which there is no known solution, or one for which there is a solution that can be significantly improved upon. It must be valid (that is, not a problem

because you say so, but because other credible sources agree that it is a problem) and justifiable (i.e., the effort to solve the problem is warranted based on need and cost).

- Who says it is a problem?
- What are the needs and wants of the **stakeholders**  ?
- Are there prior solutions to the problem?
- Is the problem worth solving?
- What are the specific criteria and constraints required to solve the problem?

To prove that your problem is valid and justified:

- Include a clear justification of why the problem is worth solving.
- Include multiple, comprehensive considerations from varying viewpoints.
- Include a description of a community or group of people who would benefit from solving the problem.
- Provide credible and properly referenced sources.

In some cases, if the problem is not valid or justifiable, the designer must define a new problem.

2

Generate Concepts

Once you have generated multiple possible solutions, you need to narrow your efforts to one (or a few) solution path. It is often difficult to truly conclude this step of the process, because you could research and brainstorm solution paths indefinitely. At any point in the process, it may also be necessary to adjust the problem statement or start over with a new problem statement.

For example, if it appears that the problem may not be solvable at all with existing technology, you may return to redefine the problem. See

[**Brainstorming Solutions**](#) for more information.

- Research the problem.
- Brainstorm possible solutions.
- Consider any additional design goals.
- Apply STEM principles.
- Select and justify an approach.

If the technology necessary to develop the solution does not exist, scientific research may be necessary to pursue a solution.

3

Develop Solution

Steps 3, 4, and 5 typically overlap. Understand the iterative nature of the design process. The steps can and should be repeated to reach an optimal solution.

- Create a detailed design solution.
- Justify the solution path.

If a solution is found invalid or cannot be justified, the designer must return to a previous step in the design process.

4

Construct and Test

Your group should consider how you will test your final **prototype**  in the design phase. The design will evolve over the prototyping phase.

- Construct a testable prototype.

- Plan prototype testing to ensure performance, usability, and durability.
- Test the prototype.
- Collect and analyze test data.

If a testable prototype cannot be built or test data analysis indicates a flawed design, the designer must return to a previous step of the design process.

5

Evaluate Solution

Based on testing results, you may have to face some tough decisions about next steps. If the results of the tests indicate that the design does not meet the expectations, you may have to return to a previous step in the design process to rethink and revise the design.

- Evaluate solution effectiveness.
- Reflect on the design and recommend improvements.
- Redesign the solution, if necessary.

If the solution does not solve the problem, the designer must return to a previous step of the design process.

6

Present Solution

Presenting your findings is a great learning opportunity. An effective presentation of a design proposal is a critical step in the design process. It must clearly state the main points and precise details to enable a product to evolve from an idea to the marketplace.

- Document the project.

- Communicate the project.

Product improvement or redesign will require the designer to repeat the design process.

Design Process Deliverables

All of your work related to the design process should be carefully documented in your PLTW Engineering Notebook. Opportunities for specific deliverables are at each step of the process.

Step	Deliverables
1 Define Problem	Design Brief - A written plan that identifies a problem to be solved, criteria, and constraints. The brief is used to encourage thinking through all aspects of a problem before attempting a solution. See Writing a Design Brief for more information.
2 Generate Concepts	Decision Matrix - A tool used to compare conceptual design solutions against one another, using specific criteria. See Decision Matrix for more information.
3 Develop Solution	Graphical Model - Representation that provides technical information necessary to produce a product. Graphical models include information such as dimensions and clear details needed to build a working model. Examples include technical/construction drawings, maps, process flow charts, and electrical circuit schematics. Often graphical models are produced using a computer and software. See Modeling Overview for more information.
4 Construct and Test Prototype	Working Model - a representation of the designed object, process, or system that functions according to the design. Test Report - A report that includes the data and analysis of the prototype testing.
5 Evaluate Solution	Project Recommendations - A list of recommendations to optimize or redesign the solution.
6 Present Solution	Formal Presentation - A process of sharing carefully planned information to an audience. Project Portfolio - A collection of documents selected for a particular purpose; portfolios include student reflection. See Project Portfolio for more information.

RESOURCES



Writing a Design Brief



Decision Matrix Template



Design Process Poster (horizontal)



Design Process Poster (vertical)



Design Process Rubric