

Core Concept: Prototyping

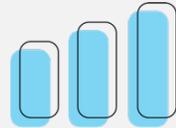
Engineering Literacy Dimension: Engineering Practices

Practice: Engineering Design

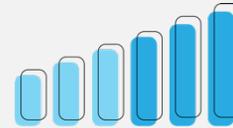
Overview: *Prototyping* is the process of transforming an idea into a form (physical or digital) that communicates the idea with others with the intention to improve the idea, over time, through testing and the collection of feedback. Sophistication in this process requires knowledge related to (a) *computer-aided design and manufacturing*, (b) *material selection for low, mid-, and high-fidelity prototypes*, (c) *manufacturing processes for manipulating the materials*, and (d) *procedures for testing and modifying physical and digital prototypes*. This core concept is important to the practice of Engineering Design as it allows engineering professionals to communicate, test, and optimize their design solutions.

Performance Goal for High School Learners

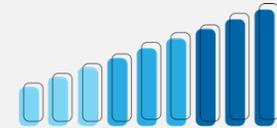
I can successfully build a prototype of an idea using the appropriate tools and materials for the desired prototype fidelity level while establishing the appropriate testing/data collection procedures to improve my design.



Basic



Proficient



Advanced

COMPUTER AIDED DESIGN & MANUFACTURING

I can describe different types of computer-aided design and manufacturing tools.

I can apply computer-aided design and manufacturing tools to produce a digital prototype that communicates my design intentions.

I can apply computer-aided design and manufacturing tools to demonstrate the production processes for a prototype of my design.

MATERIAL SELECTION FOR LOW, MID, & HIGH-FIDELITY PROTOTYPES

I can select materials, based on their ease of use and low costs, for creating a low-fidelity prototype (a functionally incomplete prototype or mock-up) in order to communicate my design and gather early feedback on the concept.

I can select materials, based on their characteristics and costs, for creating a mid-fidelity prototype (a prototype that may not represent the final design as a whole) in order to gather feedback on specific functions and/or aesthetics.

I can select materials, based on their characteristics and costs, for creating a high-fidelity prototype that represents the complete design in its final medium in order to gather feedback on the functionality, user-experience, and aesthetics.

MANUFACTURING PROCESSES FOR MANIPULATING MATERIALS

I can produce a physical prototype to communicate my design using low cost and easy to manipulate materials.

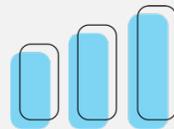
I can produce a physical prototype to test the functionality/usability of my design using materials that represent the final medium of the product.

I can evaluate the processes of manufacturing, tooling, and production operations for altering materials based on their characteristics in order to produce my polished design.

Core Concept: Prototyping Cont.

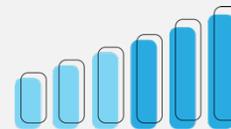
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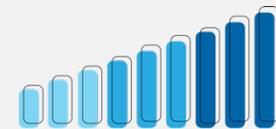
Basic

I can identify an appropriate test procedure (destructive, non-destructive, or customer/user focused) to analyze the effectiveness of a component or function of my design.



Proficient

I can conduct a prototype testing procedure while collecting data in order to identify areas for improvement or evaluate assumptions related to the usability of my design.



Advanced

I can evaluate data and feedback collected through the process of prototype testing in order to improve my design through multiple iterations.

PROCEDURES FOR TESTING & MODIFYING PHYSICAL & DIGITAL PROTOTYPES
