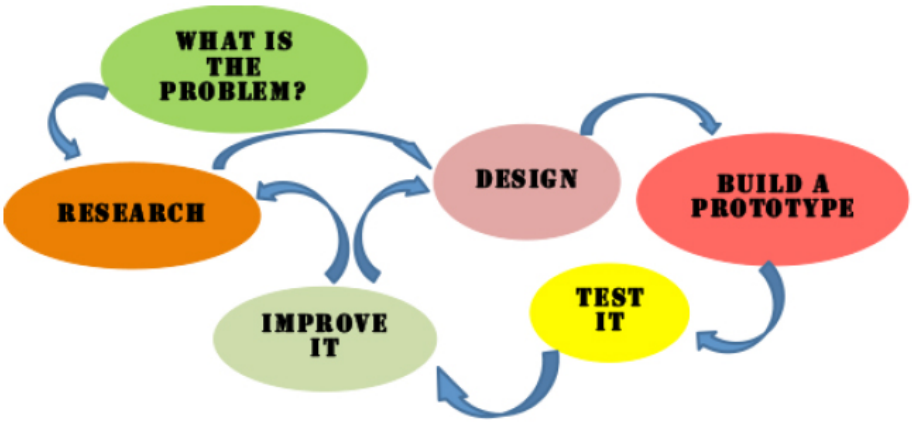
Innovate It! Design a Better Desk

Introduction	In this activity, student teams will use the engineering design process to innovate a new design for a school desk. This is a suggested follow-up for the Tsongas Industrial History Center's Engineer It! program.
Time	2 class periods
Grade	3-8
Lesson Preparation	Materials • Copies of the "Innovate it!" instruction sheet for student groups. • Cardboard, tape, and other found items for students to use in the construction of their prototypes. • Technology to project video from YouTube for classroom viewing Review the engineering design process and the considerations that engineers make when going through the process to innovate a new product. View the "IDEO Shopping Cart" video on YouTube. IDEO (pronounced "eye-dee-oh") is an award winning global design firm that takes a human-centered, design-based approach to helping organizations in the public and private sectors innovate and grow. In this video from ABC's "Nightline," IDEO staff work through the engineering design process to innovate the design of a standard shopping cart. IDEO Shopping Cart - YouTube video
Background Information	The **engineering design process (EDP)** is a series of steps that engineering teams use to guide them as they solve problems. To determine how to build something, engineers gather information and conduct research to understand the needs of the challenge to be addressed. Then they brainstorm many imaginative possible solutions. They select the most promising idea and embark upon a design that includes drawings and decision-making about materials, construction, manufacturing, and fabrication technologies to use. They create and test many prototypes, making improvements until the product design is good enough to meet their needs. 

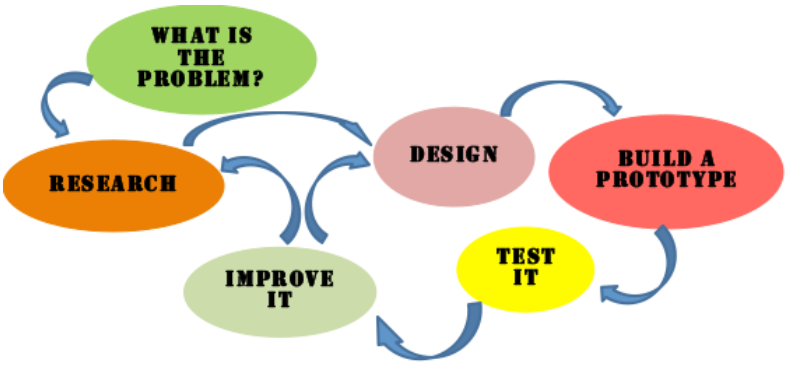
Vocabulary	**Design**: to create or plan for a work to be executed, often takes the form of scale drawings or models. **Engineer:** (n) a person trained and skilled in the design, construction, and use of engines or machines, or in any of various branches of engineering; (v) to design or create using the techniques or methods of engineering. **Innovate:** To introduce something new; make changes in anything established. **Prototype:** A basic working model used by engineers to test design concepts.
Anticipated Student Preconceptions/ Misconceptions	Students should understand that engineering is often not building things "from scratch". Improving existing items and meeting needs of the people that will use an item are key components in engineering design.
Frameworks	**Massachusetts Science Frameworks** **Grade 3-5** **Technology/Engineering** **3-5-ETS1-1.** Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet. **3-5-ETS1-2**. Generate several possible solutions to a design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem. **3-5-ETS1-3**. Plan and carry out tests of one or more elements of a model or prototype in which variables are controlled and failure points are considered to identify which elements need to be improved. Apply the results of tests to redesign a model or prototype **3-5-ETS1-4(MA).** Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution. **3-5-ETS1-5(MA).** Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.

Guiding Question	How does the engineering design process facilitate the research and design of an innovative product?
Objectives	Students will be able to: • List the Engineering Design Process steps • Explain the design choices they made for their desk
Activity	Student groups work together to innovate a new design for their school desk. As they work through the steps of the engineering design process, part of the "Test It" phase will be to present the design to their classmates and make changes to their

	initial design based on the feedback. **What's the Problem?** Today's school desks were designed for students in the19th century. Your challenge is to design a desk for the 21st century student. **Research** • What do your classmates want to be able to do at their desk? • What types of accommodations will make the desk better for them to work at? • What materials will your desk be made out of? **Design** Sketch out your design. Be sure to label the design's unique features. **Build a Prototype** Using cardboard, tape, and other found items, construct a prototype of your design. **Test It** Present your design to the class. Have your classmates give you feedback about the various features of your prototype.
Assessment	**Improve It** Based on the feedback from your classmates, write up a description of how you would change your desk's features. See rubric.
Differentiated Suggestions	This can be modified in several ways. Students can work in groups or individually, Students can have written or verbal presentations or use digital media.
Adapting the Activity for Other Grades	For older grades, students could be asked to include additional features determined by the teacher or could consider other factors such as cost or sustainable materials. Older students may also want to try Google SketchUp or creating a 3D digital design.
Bibliography	Hunt, Emily M., Michelle Pantoya, and Irma Sizer. *Designing Dandelions*. Lubbock, Texas: Texas Tech University Press, 2013. (Grades 2-5) *What is the Engineering Design Process:* http://www.pbslearningmedia.org/resource/phy03.sci.engin.design.desprocess/what-is-the-engineering-design-process/

Innovate It!

Design a better desk.



What's the Problem?
Today's school desks were designed for students in the19th century. Your challenge is to design a desk for the 21st century student.

Research
- What do your classmates want to be able to do at their desk?
- What types of accommodations will make the desk better for them to work at?
- What materials will your desk be made out of?

Design
Sketch out your design. Be sure to label the design's unique features.

Build a Prototype
Using cardboard, tape, and other found items, construct a prototype (model) of your design.

Test It
Present your design to the class. Have your classmates give you feedback about the various features of your prototype.

Improve It
Based on the feedback from your classmates, write up a description on how you would change your desk's features.

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	Below Expectations	Meets Expectations	Above Expectations
Research Students collected information in order to design their prototype to the needs of the "client."	Students gathered an insufficient amount of research to inform their prototype design.	Students gathered a sufficient amount of research to inform their prototype design.	Students gathered additional research to inform their prototype design.
Process Students followed the EDP – designing and building a prototype.	Students neglected to follow all steps of the EDP and did not record their design choices.	Students followed most steps of the EDP and recorded their design choices.	Students followed all steps of the EDP and recorded their design choices.
Test It Students presented their design and received feedback from classmates.	Students' presentation covered few details of their research and design choices.	Students' presentation covered their research and design choices.	Students' presentation covered their research, design choices, and additional information about their process.
Improve It Students noted how they would improve their prototype based on class feedback.	Students' write-up included insufficient information as to what they would do to improve their prototype based on class feedback.	Students' write- up included what they would do to improve their prototype based on class feedback.	Students' write- up included additional information about what they would do to improve their prototype based on class feedback.