



FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

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Ideas with **IMPACT**



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**Engineering
for All**



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Sample Florida Common Core and ISTE Standards

ISTE Standards

5.4.a

Design CT activities where data can be obtained, analyzed and represented to support problem-solving and learning in other content areas.

5.4.b

Design authentic learning activities that ask students to leverage a design process to solve problems with awareness of technical and human constraints and defend their design choices.

SC.912.N.4.2

Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.

SC.912.P.12.3

Interpret and apply Newton's three laws of motion.

Equitable Access

Ensure robust and reliable access to digital devices, internet connectivity, capable teachers and technology platforms required to support the learning vision for all students (including language learners, students with physical or learning disabilities)

Goals & Objectives

I wanted to have a project that introduced engineering concepts to my IT classes. I wanted to expose my students to projects that were hands on and used the Engineering Design Process. Through Engineering Tomorrow, students and teachers are given the opportunity to expose students to Engineering activities and Engineering Professionals.

Objectives

- Students will gain an understanding of engineering concepts
- Students will learn how to build a bridge using the Engineering Design Process
- Students will learn to understand the relationship between Math and Engineering (Science, **Technology**, Engineering, **Art**, and Math)
- Students will learn create a prototype based on their design and test it
- Students will be able to design a bridge at home using materials provided

Project Overview

This project contains several engineering projects. This project focuses on the bridge project.

In this project students discover and learn about the scientific and real-world aspects of bridges. After working through an interactive student workbook, students will design and build their own bridge. During the lesson students learn about the Engineering Design Process, Physics: Newton's law, Environmental Science: Human Population; Biodiversity, Geometry: Property of shapes, and Introduction to Engineering: Structural Analysis, and Open-ended design problems. The project is done in a week. The sections are split into three days. The first day, the students review the student interactive notebook and are guided by college students taking an Engineering via zoom. The homework for the students is to design a bridge on paper and come back the second day, with designs ready to build with materials that are provided. The second day, students are introduced to an Industry Professional via zoom and given guidance on structure design. On the third day, the bridges are built, and feedback is given by an Industry Professional. I use Monday, Wednesday, and Friday for the three days for this project to give students time to design and build.

To test the bridge, students attached a hook to bridge and test how many cans their bridge can hold. Students enjoy designing, building, testing, and learning how the Engineering design process works in the real world.

Example: The bridge example project introduces students to the importance of bridges and how they connect communities. Students learn the significance of bridges and how they contribute to society. The goal of the project is to build a bridge model that is strong enough to hold the maximum hold.

Step-By-Step Lesson Plan/Guide (For Teachers)

Teacher:

- Students will work through the [Bridges Interactive Student Workbook](#) presentation.
- When assigning this lesson, first make a copy of the slides to save within your personal Google Drive, then make a copy for each student.
- The slideshow is designed to be interactive, this way students can type directly on the slides.
- Each slide of the presentation provides an activity for students to complete (reading, watching a video, inserting images, answering questions, etc.)
- Students may work individually or within groups.
- This task has students discover and learn about the scientific and real-world aspects of bridges. Students will explore and design their own bridge.

Assessment:

- Informal assessments can be completed by looking at the interactive slides within the slideshow, especially within the final reflection slide.
- Assessments outside the interactive slides are suggested below as Pre and Post Work Ideas.

Pre Work Ideas:

- [Student Choice Pre Work Assignment](#): Introduction to bridge design by structural engineer (and author of [Built](#)) Roma Agrawal or exploration of a website about current Wash DC bridge revitalization project similar to NYC Highline. Students are introduced to bridge engineering design considerations in advance of the bridge build challenge.
- Discuss slide 3 in Student Slides Presentation
<https://docs.google.com/presentation/d/1jQk5WW4psBBUf09j-Uss-pu6qqIMD-KW3dk21-ux31k/edit#slide=id.p>

Pre Work- Introduction to the Engineering Design Process:

- Students should complete the [Engineering Design Process Introduction Activity](#) before beginning the lab

After reviewing slides with the students, have students brainstorm and start the Design Process on paper. Students will use ideas from presentation and draw out their prototype, Students will take materials home and work on their design as homework.

In-Process and Post Work Ideas:

- Assign slides 15-23 of the interactive student workbook presentation as a design evaluation and reflection on the engineering design process.

Extension Activity: TED ED Lessons:

Epic Engineering: Building the Brooklyn Bridge

Building the impossible: Golden Gate Bridge

Discuss original designs and why they were rejected, and why design was chosen.

Websites/Learning Ideas/Resources

Engineering Tomorrow

<https://engineeringtomorrow.org/>

Ted Ed

<https://ed.ted.com/>

Engineering Design Process

<https://www.teachengineering.org/populartopics/designprocess>

<https://www.nasa.gov/audience/foreducators/best/edp.html>

Amazing Bridges

<https://www.cnn.com/travel/article/most-amazing-bridges/index.html>

Scariest Bridges in the world

https://www.youtube.com/watch?v=vIZvqGL_wEQ&t=198s

Pictures



