Understanding STEM Education

What is STEM Education?

At the STEM Education Center at WPI, we believe that teaching STEM is more than simply emphasizing Science, Technology, Engineering and Mathematics. It is an educational philosophy and different way of teaching that incorporates sustainable ways of learning. It better prepares students for the world of the future by creating interconnected, meaningful and relevant learning experiences. Here is the definition that we have adopted…

> STEM Education is… "an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering and mathematics in contexts that make connections between school, community, work, and the global enterprise, enabling the development of STEM literacy and creative thinking and with it, the ability to compete in the new economy" *(Tsupros, Kohler & Hallinen, 2009)*

What are the components of High Quality STEM Experiences?

Adapted from the Dayton Regional STEM Center Quality STEM Framework, available at:
http://daytonregionalstemcenter.org/wp-content/uploads/2012/07/Final-Framework-copyrighted.pdf
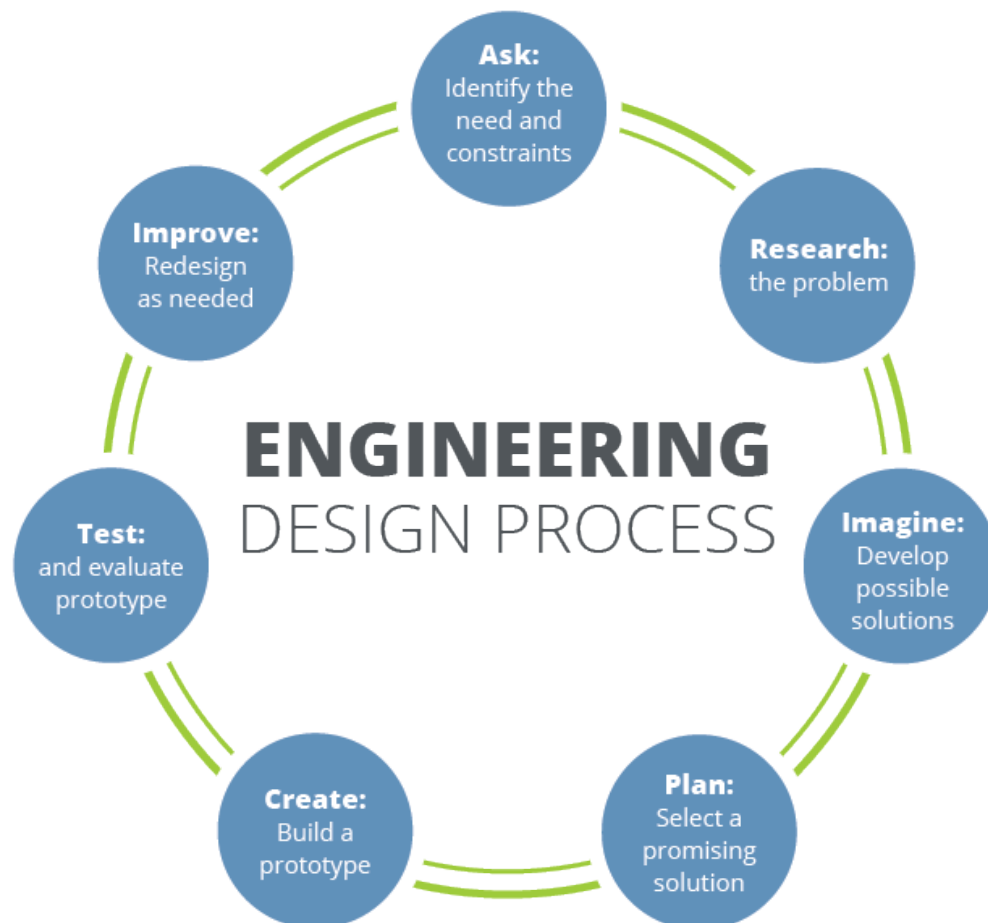
High Quality STEM Education is…
- …designed to engage ALL students regardless of ethnicity, academic achievement, native language, socio-economic status, abilities or prior knowledge
- …intentional and aligned with academic standards and practices
- …designed to engage students in following the engineering design process to solve a problem
- …connected to non-STEM disciplines incorporating reading, writing and communication
- …collaborative and student driven, yet requires individual accountability within a group setting
- …designed to include a performance assessment component, allowing students to demonstrate the skills and content they have learned
- …designed to require students to select and effectively use multiple technology tools (rulers, sensors, simulations, etc…) to solve the problem
- …designed to simulate a real world environment and make connections to STEM careers

What is the Engineering Design Process?

Source: Teach Engineering, https://www.teachengineering.org/k12engineering/designprocess

"The engineering design process is a series of steps that guides engineering teams as we solve problems. The design process is **iterative**, meaning that we repeat the steps as many times as needed, making improvements along the way as we **learn from failure** and uncover new design possibilities to arrive at [successful] solutions."

Ask: Identify the need and constraints

Research: the problem

Imagine: Develop possible solutions

Plan: Select a promising solution

Create: Build a prototype

Test: and evaluate prototype

Improve: Redesign as needed

ENGINEERING DESIGN PROCESS

Engineering Vocabulary:

Criteria – the requirements that must be met by the project

Constraint – a limitation or condition that must be satisfied by a design. *(common constraints include time, cost, and materials)*

Prototype – an early model of the solution that later gets refined to the implemented solution