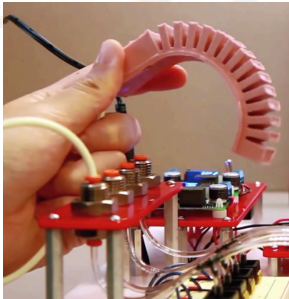


Technology and Engineering Laboratory Context

Robotics and automation technologies are growing fields with the potential to significantly impact our daily lives. Within the Robotics unit of this course, students learn about home automation, self-driving cars, prosthetics, and agricultural crop harvest. Students learn how to write code for controlling various sensors and how to design and fabricate soft robots. Students use silicone as a robotic material type that can be pneumatically inflated using actuators that have been created using various 3D-printed molds. This unit acts as a culminating application of the students' knowledge by providing them the opportunity to engage in hands-on and minds-on learning experiences while intentionally integrating STEM concepts within the lessons. Students learn that complex automated systems contain subsystems with inputs, processes, outputs, and feedback models to explain system behavior in robots. The lesson ties in ethical considerations for using robotics and how they can potentially change the way we go about our daily lives.



The Robotics Primary Challenge

The Soft Robotic Gripper lesson tasks students with learning about soft actuators and how they can be used to assist people with hand disabilities. The design challenge is to develop a soft robotic gripper that can pick up an object with a specific weight. Students use Computer Aided Design (CAD) software to design their gripper and then 3D print their cast.



Mathematics and Science Concepts in a Hands-On, Constructivist Setting

Students expand upon their basic understanding of algebra, physics, and chemistry to include electromagnets, biotechnology, application of algebraic equations, and basic science vocabulary (volume, weight, pH, voltage). Activities are used to help students develop the knowledge and skills required to succeed in college, careers, and civil life. Students apply business planning concepts such as supply and demand as well as life cycles of products. In working in collaborative projects, the students learn valuable work skills such as working with diverse people, achieving deadlines, following instructions, and investigating the process used by companies to design a product. Students learn proper safety procedures and how to maintain a healthy and safe working environment.

The International Technology and Engineering Educators Association's STEM Center for Teaching and Learning™ has developed Engineering byDesign™, the only standards-based national model for Grades PK-12 delivering technological and engineering literacy through an Integrative STEM Education approach. The Engineering byDesign™ model was built using the following student learning standards and STEM initiatives:

- Next Generation Science Standards (K-12)
- Common Core State Standards (High School / Middle School)
- Standards for Technological Literacy (ITEEA)
- Principles and Standards for School Mathematics (NCTM)
- Project 2061
- Benchmarks for Science Literacy (AAAS)
- National Academy of Engineering's Grand Challenges for Engineer-