



## School of Engineering Center for Engineering Education and Outreach

### About the CEEO

The Tufts University Center for Engineering Education and Outreach (CEEEO) is a leader in supporting efforts to integrate engineering into K-12 education. The three divisions of **Outreach**, **Research**, and **Educational Tools** all contribute toward the goals of:

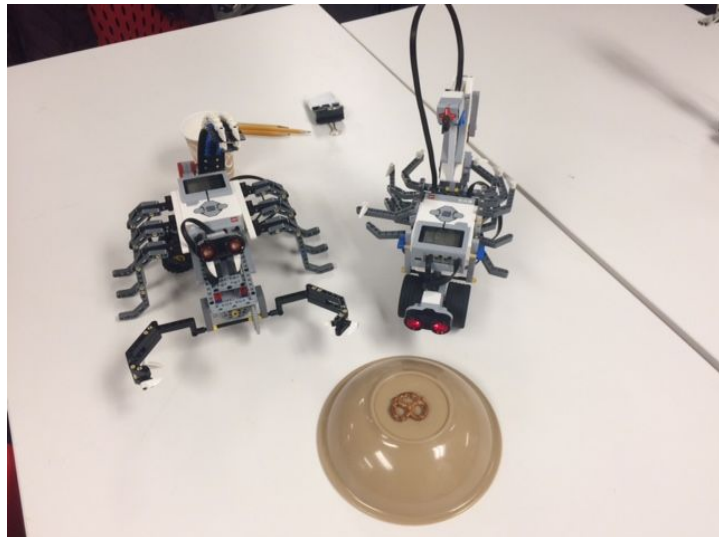
- 1) increasing student and teacher excitement for learning STEM;
- 2) improving student and teacher skills so learning is more enjoyable in all subjects;
- 3) increasing the general public's technological literacy; and
- 4) increasing the awareness of the importance of STEM for society.

Our motivation stems from our fundamental belief that the skills we help students develop are closely connected to the transformation of our physical world into a world with improved excitement for learning, higher quality of life, better health, and greater environmental responsibility. Over the past 20 years, we have put these beliefs into practice through workshops, professional developments, and outreach at both a local and international level.

### Objectives

Participants in our workshops can expect to gain:

- Comfort with the engineering design process
- Familiarity with LEGO Robotics and/or Makerspace tools
- An idea of what engineering can look like in a K-8 classroom
- A broader understanding of how engineering can be integrated into their class curriculum
- A close look at what real engineers are working on in their labs
- Teachers will act as both learners and educators as they explore hands-on projects, and think about how they could integrate them into their own classrooms.



## Workshop Staff

Lead workshop staff possess a masters degree or Ph.D. in engineering and/or education. Workshop support staff may include other senior staff members or undergraduates with experience implementing STEM solutions.

## Workshop Offerings for International Groups

Our workshop offerings are tailored to the group's interests and expose participants to hands-on engineering projects using LEGO Robotics, makerspace tools, and craft materials. The CEEO is also able to partner with other Tufts community members to provide opportunities for groups to tour engineering labs and makerspaces on the Tufts University campus, and hear from university faculty and staff about their work.

We offer workshops for both students and educators/administrators. Workshops for students and workshops for educators will both explore hands-on engineering design challenges. However, workshops for educators are tailored to provide more information about pedagogy, engineering education, and various projects underway at the CEEO.

## Sample Workshop Schedules

### Workshop 1: Half Day Workshop for Students and Educators

Time	Activity
9:00-9:30	Introduction to the CEEO <ul style="list-style-type: none"><li>• Who we are and what we do</li><li>• Pedagogy</li></ul>
9:30-12:00	Hands-on Engineering Design Challenge

### Workshop 2: Full Day Workshop for Educators

Day 1	
9:00-10:15	Introduction to the CEEO <ul style="list-style-type: none"><li>• Who we are and what we do</li><li>• Pedagogy</li></ul>
10:15-10:45	Makerspace Tour
10:45-12:00	Introductory Hands-on Engineering Design Challenge
12:00-1:00	Lunch
1:00-4:00	Hands-on Engineering Design Challenge



	<ul style="list-style-type: none"> <li>• Chain reaction</li> </ul>
10:00-11:00	Tufts University Engineering Lab Tour
11:00-12:00	Maze Challenges
12:00-1:00	Lunch
1:00-4:00	Maze Challenges
Day 3	
9:00-10:00	Client-Centered Robotics Design Challenge <ul style="list-style-type: none"> <li>• Build something to help Abby the Dog</li> <li>• Build something to help one of the CEEO staff members</li> <li>• Build something to help clean up the workshop room</li> </ul>
10:00-11:00	Tufts University Engineering Lab Tour
11:00-12:00	Client-Centered Robotics Design Challenge
12:00-12:45	Lunch
12:45-4:00	Client-Centered Robotics Design Challenge
Day 4	
9:00-12:00	Research Toys, Interview Students, Design a Toy
12:00-1:00	Lunch
1:00-4:00	Continue working on the toy and engineering design journal
Day 5	
9:00-12:00	Design a Toy
12:00-1:00	Lunch
1:00-3:00	Design a Toy
3:00-3:30	Toy Testing - after have a debrief about toy
3:30-4:00	Wrap Up & Clean Up



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### Multi-Day Workshop for Educators

Day 1	
9:00-9:15	Arrival
9:15-10:30	Tufts University Campus Tour
10:30-12:00	Introduction to the CEEO <ul style="list-style-type: none"> <li>• Who we are</li> <li>• What we do</li> <li>• Pedagogy</li> </ul>
12:00-1:00	Lunch
1:00-4:00	Hands-on Engineering Design Challenge <ul style="list-style-type: none"> <li>• Novel Engineering</li> </ul>
Day 2	
9:00-10:00	Hands-on Engineering Design Challenge
10:00-11:00	Tufts University Engineering Lab Tour
11:00-12:00	Engineering Education Discussion <ul style="list-style-type: none"> <li>• STOMP Panel</li> <li>• Adaptive Teaching</li> </ul>

	<ul style="list-style-type: none"> <li>• Student Thinking</li> </ul>
12:00-1:00	Lunch
1:00-4:00	Hands-on Engineering Design Challenge <ul style="list-style-type: none"> <li>• Client-focused design-- Abby the Dog</li> </ul>
Day 3	
9:00-10:00	Robotics in the Classroom Discussion
10:00-11:00	Tufts University Engineering Lab Tour
11:00-12:00	Introduction to Robotics <ul style="list-style-type: none"> <li>• WeDo</li> <li>• EV3</li> </ul>
12:00-1:00	Lunch
1:00-4:00	Hands-on Robotics Engineering Design Challenge
Day 4	
9:00-12:00	School Observations* (if during the school year)
12:00-1:00	Lunch
1:00-4:00	How can you implement engineering in your own classroom? What does engineering look like for younger students? Curriculum workshopping/brainstorming.
Day 5	
9:00-10:00	Makerspace Design
10:00-12:00	Exploring Makerspace Tools
12:00-1:00	Lunch
1:00-2:00	Tufts University Makerspace Tour
2:00-4:00	Makerspace Design Challenge

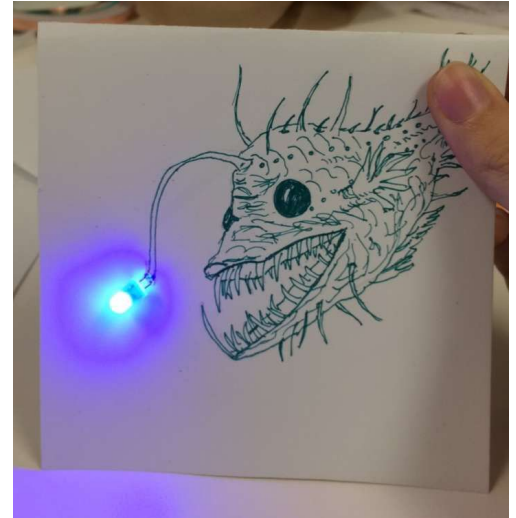
\*If your group is interested in shadowing K-12 classrooms in the local community, we can arrange for school tours and observations. This requires significant organization, and these requests must be made months in advance in order to coordinate visits.

[Insero Workshop Schedule](#)

## Sample Workshop Themes

### Art and Engineering

This workshop will blend all forms of art and engineering as students design art-bots, learn to design in 3D, laser cut and etch, sew their own circuits, and even construct their own musical instruments. Students will have the opportunity to explore technologies and tools like EV3 Lego Robotics, BlocksCAD, Adobe Illustrator, and laser cutters.



### Toy Design

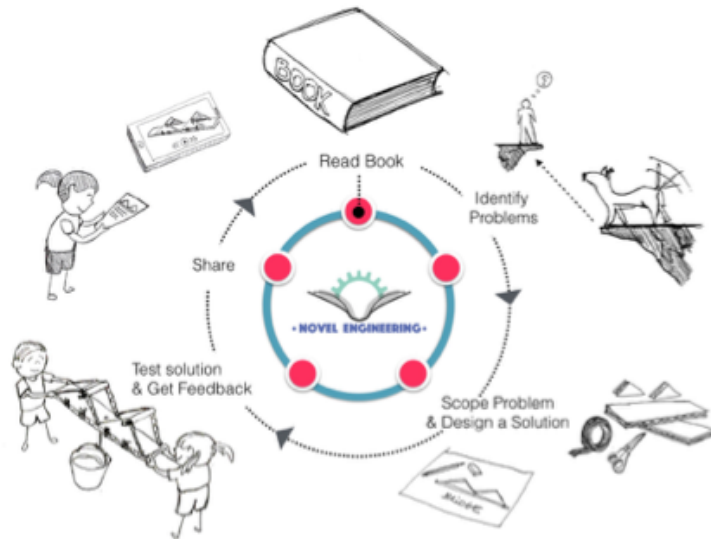
This session will help students design, build, and program LEGO Robots using the engineering design process. Throughout the week, students will be challenged with several open-ended design activities, scaffolding from learning to build with the EV3 kits to complex programming with the MINDSTORMS software. Their final design challenge will be to design a toy, which will be tested by pre-K students in the nearby area.

### Intro to EV3

This session will help students design, build, and program LEGO Robots using the engineering design process. Throughout the week, students will be challenged with several open-ended design activities. The week will start with activities focusing on stability in design and move to other topics, such as gearing, weight distribution, and momentum, as the students incorporate programming and motors into their designs.



This workshop will explore engineering and literacy as students read fairy tales, folktales, and their favorite books to engineer solutions to problems the characters are facing. Challenges will focus on client-centered design. For teachers, this workshop will also focus on implementation.



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The Novel Engineering Approach

Other themes include:

- Space Exploration
- Survival Engineering
- Civil Engineering Through Time
- Game Design
- Rube Goldberg Machines
- Musical Instrument Design

## Educator Online Courses and In-Person Workshops



The CEEO also offers the **Teacher Engineering Education Program (TEEP)**, and online graduate opportunity that takes a K-12 teacher, regardless of background, on an 18 month journey that leads to a certificate in engineering education.

<http://teep.tufts.edu/>

### **CEEO Educator Institute**



The CEEO also offers in-person workshops for educators. All of our workshops are designed to give teachers time to act as students, getting experience with hands-on, engineering design experiences, and to discuss pedagogy related to including engineering in the classroom. Our belief is that teachers are an integral part of curriculum implementation and should be given the tools help them tailor curricula to their classroom and their



students. Our workshops offer educators the chance to delve into a variety of tools and approaches including EV3 Robotics, Novel Engineering (the integration of engineering and literacy), and makerspaces. Each workshop will engage educators in hands-on engineering tasks, and discussions about best practices for teaching engineering. The workshops are held in the summer or can be arranged for private groups.

