

CELL-MET5-E-EEK_JT

Engineering Engagement Kits Give Students Hands-on Experience—and Potential Future Careers

Outcome/accomplishment: Building from Engineering Engagement Kits (EEK!) developed for use in museums around the country, educators and researchers have designed curriculum lessons for kindergarten through grade 12 students that increase awareness of engineering as a profession and its role in serving society. The initiative, which was launched by teachers in five classrooms (two elementary and two middle schools) in four states (AZ, FL, NJ, OH), is supported by the NSF-funded Engineering Research Center in Cellular Metamaterials (CELL-MET), headquartered at Boston University (BU). Because heart disease is the leading cause of death in the United States, the heart-focused biomedical engineering kit is extremely relevant and directly relates to cutting-edge research in engineering heart tissue that can be used to repair diseased hearts.

Impact/benefits: CELL-MET is a collaboration of university engineering departments whose top-tier goal is to develop techniques to cure heart attacks. To that end, the Center's research is aimed at building engineered heart tissues of increasing complexity through advances at the convergence of engineering and biological disciplines. Educating people at all levels increases understanding of the world of research and technology and provides “people power” for future advances. K-12 is a pivotal time to develop student understanding of and enthusiasm for science and engineering. EEK! exposes students and their families to the field of engineering, supports heart-healthy behavior, and engages them in the problems researchers must consider when building heart tissue patches.

Explanation/ background: The idea for adapting the EEK! curriculum is part of CELL-MET's effort to increase outreach to underserved communities while overcoming the challenges of COVID-19 restrictions. EEK! consists of seven activities that are geared toward reaching people with different learning preferences. Each activity addresses one or more of five learning objectives (LO):

- To get children excited about engineering by minimizing cognitive barriers between self-identity and engineering—LO1: You can do things that engineers do – You're an engineer!
- To highlight the soft skills that are so important to engineering—LO2: Creativity is an important engineering tool. And LO3: Engineers use teamwork to find solutions to problems.
- Demonstrate how engineering can be used to help people—LO4: Engineers help keep people healthy. And LO5: Engineers are working to solve problems like heart disease.

Supporting materials were developed for this program, including EEK! Engineering Lab Notebook, classroom posters and worksheets, a digital game pilot, and pre- and post-tests for engineering identity. The curriculum aligns with Next Generation Science Standards (NGSS) for K12 students. This is a multi-state effort in the United States to create new education standards that are "rich in content and practice, arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education."



Figure 1. An EEK! Activity: "Real or Imagined" is a card-based guessing game intended to demonstrate the importance of imagination and creativity in engineering. (Credit: CELL-MET)



Figure 2. A student assembles a pulse oximeter as part of the EEK! curriculum. (Credit: CELL-MET)