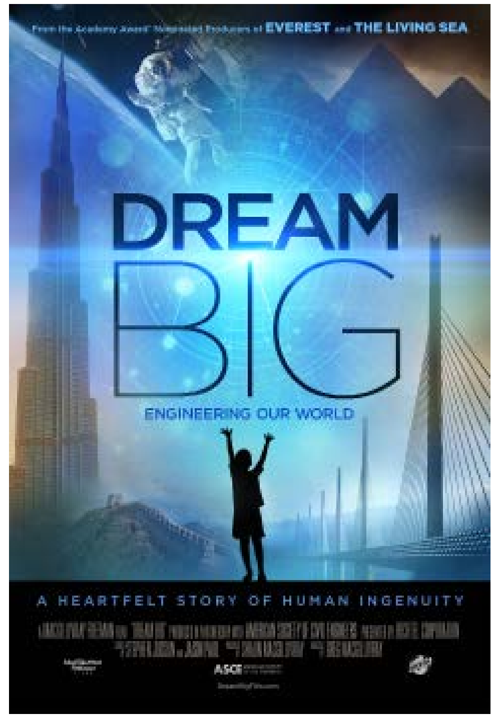
special insert

ENGINEERS WEEK 2017

dream big!

DISCOVER ENGINEERS WEEK
FEBRUARY 19-25, 2017

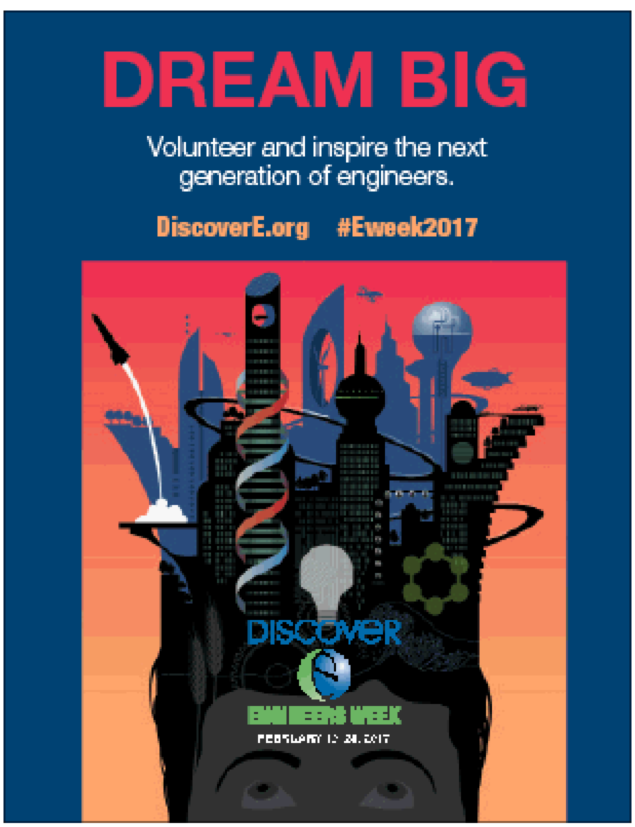


Every engineering project, large or small, starts with a dream.

Engineers engage their creativity and technical know-how to transform dreams into reality. Their dreams have resulted in giant structures, improved agriculture, and made it possible to explore the heavens and oceans.

During Engineers Week 2017 (February 19-25) we celebrate the imaginative and innovative ways engineers tackle world problems. We also want to inspire future generations of innovators, and this year we hope ITEEA members will help your students Dream Big with us!

Dream Big is a HUGE film. Literally. It is a first of its kind movie produced for 3D IMAX® and giant screen theaters, and release begins in February. *Dream Big* takes viewers on a journey of discovery from the world's tallest building to a bridge higher than the clouds and to a solar car race across Australia. The film shows more than the ingenuity behind these marvels—it reveals the heart that drives engineers to create better lives for people. More than a movie, *Dream Big* includes a suite of educational resources and programs giving engineers, educators, and museums opportunities to engage in local communities. Learn more at DiscoverE.org/DreamBig.



To strengthen the connection between ITEEA and Engineers Week, ITEEA is pleased to include the official Engineers Week poster as an insert in this journal. Additionally, ITEEA's STEM⌖Center for Teaching and Learning has created a series of design briefs for use by technology and engineering educators at the elementary, middle, and high school levels that appear on the following pages.

STEM⌖CTL is ITEEA's curriculum and professional development arm, established to advance technological literacy and to demonstrate how technology and engineering bring STEM to life!

Be sure to visit www.discovere.org for all the ways you and your students can make the most of Engineers Week 2017, including Training, Resources, Activities, and Videos.

This insert is made possible by the American Society of Civil Engineers; Bechtel; Bentley Systems, Inc.; ExxonMobil Corporation; Lockheed Martin Corporation; NCEES; Northrop Grumman Foundation; Shell Oil Company; TE Connectivity; and United Engineering Foundation.

ELEMENTARY SCHOOL DESIGN BRIEF
A Home for All Seasons

by Kirsten Perry

BUILDING THE BIRDHOUSES


Measuring the parts is important.


Measuring to make sure the back fits.

A child's innate curiosity and creativity can be enhanced with the integration of STEM (Science, Technology, Engineering, and Math) into his or her everyday experiences as a natural part of the learning process. As children learn, they are inclined to touch, manipulate, and experience the world around them in ways that we, as adults, have somehow forgotten.

One of the unique aspects of the TEEMS building blocks are that they are built around the National Academy of Engineering challenges for the 21st century. Engineers feel these fourteen challenges are the most pressing for our future. How fitting that the creative minds of our children could someday meet these challenges and possibly solve them!

While "A Home for all Seasons" doesn't specifically tackle one of the NAE challenges, it does introduce students to the challenges they will face in future building blocks.

The TEEMS (Technology, Engineering, Environment, Math, and Science) building block, "A Home for all Seasons," teaches kindergarten students about the different homes that exist for animals and how each home meets the needs of the inhabitants that reside there. Through the use of technology, students conduct a study of butterflies that includes researching butterflies and creating a book highlighting the research findings. The Technology and Engineering construction component is met as students design and build birdhouses. The second "E" in TEEMS is Environment, which takes place as students learn about shelters and habits. Students use Math (measurement, quantities, and shapes) to discover the different sizes of animals as well as measuring the dimensions of a birdhouse. Following guided inquiry activities, the design challenge will have students designing and building a birdhouse. During this building block students also integrate Scientific concepts as they create homes for animals that live underwater and underground; they will paper mache' beehives and learn how spiders spin webs. The read aloud "A House is a House for Me," engages students with its whimsical pictures and characters.

This Building Block is a creative and fun way for kindergarten students to get their start in STEM and prepares them for future challenges in the world around them.


Helping one another to attach parts.

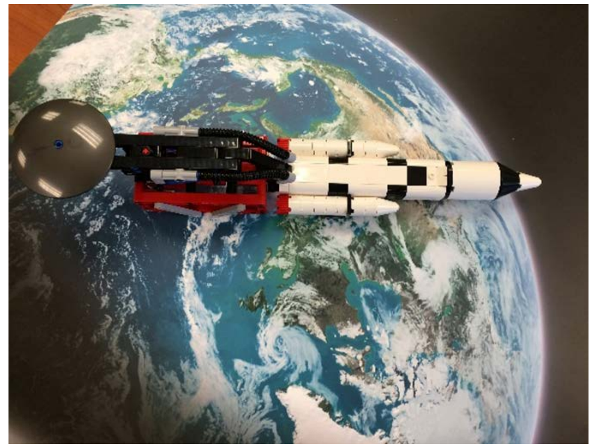

The door actually opens!

Checking to make sure the nest fits inside.

MIDDLE SCHOOL DESIGN BRIEF
Vision of a Launch System

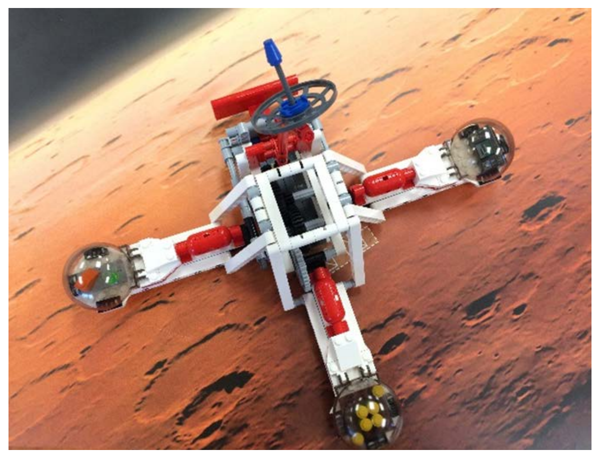
by Joanna Papadopoulos

Technological Systems is a course through ITEEA's Engineering byDesign™ (EbD) curriculum that investigates various technological systems through their function, development, interaction, and maintenance. The course explores various technological systems such as manufacturing, construction, communications, biomedical, and power/energy. Students learn about the impact technology has on humans, the environment, and global relations. Students explore macrosystems as well as microsystems and identify how they are interdependent with each other. As technology advances, systems become more sophisticated and the subsystems become major components to the success of the entire system.



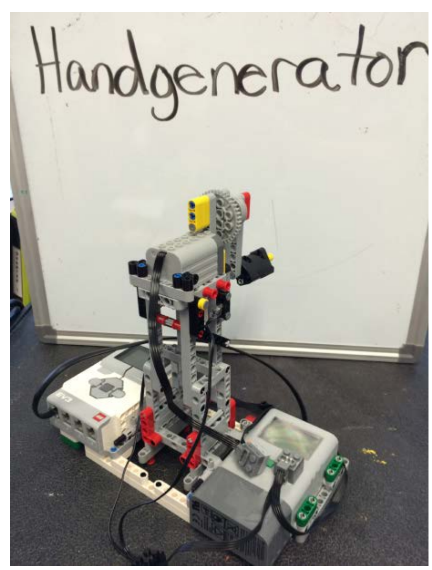
Prototype of Thrust Structure.

The *Technological Systems* course includes six units of study that focus on technological systems design. Students learn what a system is, how it is created, and how "systems thinking" can be used to understand how the various components interact as part of an entire system. Students participate in activities that develop their understanding of how systems are designed and produced by following specific criteria and constraints. They investigate both the positives and negatives of using technological systems and identify that the systems are designed to address a human want or need. Students learn how to use technical information to problem-solve and evaluate various systems. As the unit continues, students investigate how materials and tools are used to create systems. The final engineering design challenge focuses on space transportation systems, where students need to apply their knowledge of conventional transportation systems and modify them to be able to thrive in outer space (ITEEA: MRE, 2016).



Biosphere Vegetable Garden.

In the Future of the Space Program lesson, students are challenged to explore NASA's space program by analyzing and evaluating a future spacecraft using their acquired knowledge of systems and subsystems. Students will use data from Space Shuttle Missions to investigate what is required for humans, goods, and vehicles to be transported through outer space. Students are given an engineering design challenge scenario that requires the student to construct a thrust structure attached to a rocket while adhering to specific criteria and constraints. The engineering design team documents its design process using engineering notebooks and creates a presentation to NASA of its best thrust design. This lesson builds on the students' background knowledge of technological systems and allows them to participate in engineering-design activities that provide the students the opportunity to design, create, evaluate, and optimize their designs. Students are challenged to solve real-world problems that today's engineers work to solve as well as explore various career paths in engineering.



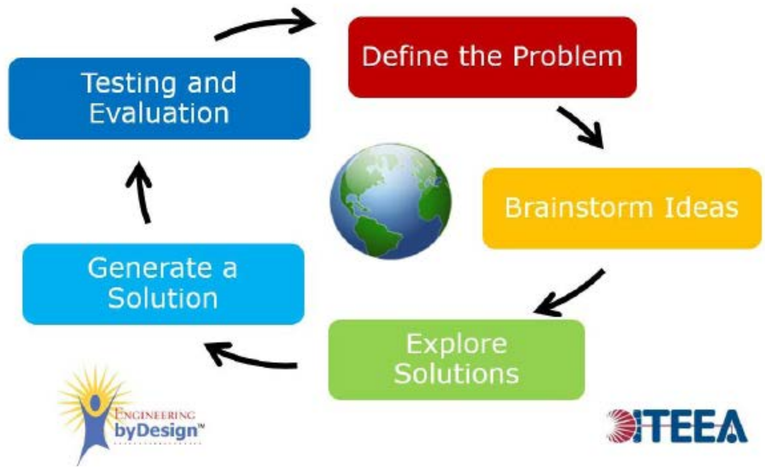
Hand Generator.

ITEEA EbD™ *Technological Systems*
www.iteea.org/STEMCenter/EbD/47499/54682.aspx

HIGH SCHOOL DESIGN BRIEF

Build a Strong Foundation for Your Students

by Daniel Kelly



If you want to build a house that will last, you must start with a strong and solid foundation. Education is no different. Any quality curriculum or course of study requires a solid foundation upon which the lessons and instruction are built. This fact is not overlooked within the Engineering byDesign™ (EbD™) curriculum. The aptly named *Foundations of Technology* course lays the groundwork for the EbD™ high school course of study by providing students a clear conceptual understanding of the designed world and preparing students for more specialized technology and engineering courses. While *Foundations of Technology* provides a base for the high school course of study, the cornerstone of EbD™ and engineering education is the engineering design process. First introduced during the First Five Days activities, the engineering design process is reinforced and built upon in the first lesson of Unit Two in the *Foundations of Technology* course.

As with all EbD™ lessons, the teacher begins by explicitly presenting the lesson's Big Idea. The Big Idea for this lesson is: "The engineering design process is a systematic, iterative, problem-solving method that produces solutions to meet human wants and desires." This provides students with a definition of the engineering design process they can refer to throughout the EbD™ curriculum and beyond.

After the introduction to the concept, the students are shown a video to reinforce the stages of the engineering design process and shown a real-world example of how significant innovation and invention can be accomplished through engineering. A TED talk, "How I Harnessed the Wind," tells the story of a young African boy who designed and built a windmill to power his family home and ended up providing power to his community to charge phones for communication and other necessities. This example of the engineering design process provides a tangible example of how identified problems can be solved through an iterative method.

Building on the foundation laid with the engineering design process, the lesson progresses to a problem-solving activity: The Crane Strain. In this activity, students are challenged to design and build a wooden crane with the goal of lifting the greatest amount of weight. This project reinforces the need to use the engineering design process to design, build, test, and improve their design. The Crain Strain is a fun and practical way to get students to purposefully apply the engineering design process to develop a solution to a problem.

Photo credit: Michael Grubbs

No matter how small the problem or how great the challenge, the engineering design process provides the solid foundation needed for students to build problem-solving and design skills necessary for success in engineering and nonengineering courses and challenges alike. The engineering design process may be the foundation of the EbD™ curriculum, but it doesn't stop there. Continual reinforcement of these foundational skills will help ensure that we are building strong programs, with students ready to tackle those challenges still unknown to us.