Engineers Week 2014 (February 16-22) provides an excellent opportunity for ITEEA to assist DiscoverE in its ongoing efforts to:

- Celebrate how engineers make a difference in our world.
- Increase public awareness about the need for engineering.
- Bring engineering to life for kids, educators, and parents.

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 2015, including Training, Resources, Activities, and Videos.

Meet the national winners of the 2014 DiscoverE Educator Recognition Awards: Todd Matia (Left), Lockheed Martin Corporation, Sand Creek High School, Colorado Springs, CO; Stephanie Cross (Center), University of Massachusetts Lowell, Lawrence Family Development Charter School, Lawrence, MA; and Romeo Valdez (Right), Texas A&M University, Foy H. Moody High School, Corpus Christi, TX.

The award honors educators who tirelessly promote the engineering profession in 6th- to 12th-grade classrooms all over the United States. A unique feature of the annual program allows not just engineers, but also engineering students, to be part of the nomination process. This community recognizes that educators deserve support and respect when it comes to advancing student learning, especially in the fields of science, technology, engineering, and mathematics. Every year, up to three winners receive a trip to Washington, DC for a recognition event and a $2,000 cash prize. Their engineer/student nominators will also receive the trip to Washington, DC. Additionally, eight notable runners-up will receive $500 each and gift packs. Visit www.discovere.org for additional information.
Kindergartners are known for their high energy level, curiosity, and imagination. Engineering challenges are a perfect fit for these learners. A Home for All Seasons is an Engineering by Design™ Technology, Elementary, Environment, Mathematics, and Science (EbD-TEEMS™) unit that contains a variety of integrated lessons to capture and hold the attention of this energetic group.

Throughout the unit, the lesson activities develop students’ vocabulary and oral language skills. At the beginning of the unit, literature is used to engage students and encourage thinking about animals and where they live. Lessons contain focus questions to expand their higher-order thinking skills and guide the discussions. This also provides teachers with numerous opportunities to assess student learning and correct misconceptions.

Kindergarten students have a natural curiosity of the world around them and especially for animals. This EbD-TEEMS unit facilitates the exploration of a variety of animals’ homes through construction and discussion of the characteristics of the different environments.

Students learn that some animals use natural resources and human-made objects to create homes. They are given opportunities to use their creativity, the design process, and natural and human-made materials to design and make animal homes. Bird nests are measured using the squares students created with connecting cubes. Counting and arranging cubes into a square reinforce math skills.

STEM notebooks are used to record student learning. Their observations and reflections are kept in their notebooks. The design process steps are documented.

EbD-TEEMS units are a fantastic resource for both novice and experienced STEM teachers. The units are integrated to meet the needs and learning styles of all students.
MIDDLE SCHOOL DESIGN BRIEF

Fix My Classroom!

The 7th grade Engineering byDesign™ Invention and Innovation course allows students to explore the Engineering Design Process through hands-on problem-solving activities. Students are challenged to think critically about our human-made world. Students participate in engineering design activities to understand how criteria, constraints, and processes affect designs. Students are involved in activities and experiences where they learn about brainstorming, visualizing, modeling, constructing, testing, experimenting, and refining designs. Students also develop skills in researching for information, communicating design information, and reporting results.

Lesson One challenges students to identify problems within their classrooms. Fix my Classroom creates a need for students to not only be aware of the problems around them but to create the necessary solutions to fix them. Students create a list of classroom problems; for example, pencils falling off desks, losing papers, etc. Student teams choose a problem from the list and brainstorm ideas about designing an invention that can “fix” the problem.

To document the process, students use an Engineering Design Journal. Each student documents the group’s brainstorming in his or her journal. In order to move forward in the process, the instructor must sign off on each group’s idea. After approval, teams move forward in the building process. Students test and evaluate with the option for redesign before communicating their final solution to the class. As part of the Enrichment portion, students can complete a survey activity. Students create a survey and then ask people in the school to take part to discover what problems exist in the school. Students survey a variety of people (different ages and occupations) to get the most ideas. Students graph and then analyze the results. Students can calculate the mean, median, mode, and range of their data. Students create a plan of action to present to the principal to create a solution to the problem. The survey should ask questions such as:

- What is the most annoying problem you find here at school?
- What problem would you like to see solved?
- What does not work as well as you would like it to work?
- If you could invent something to make your life easier here at school, what would you invent?

Teams choose their best idea, then design and develop it, and finally, present their solution to classmates.

Authors: Curtis Funkhouser, Blaire Booth, and Chandra Porter are classroom teachers and National Teacher Effectiveness Coaches.
Photo Credits: Chandra Porter
The Engineering Design Process would be nothing without the power of perseverance. Students using the Engineering byDesign™ (EbD™) curriculum are equipped with an understanding of the engineering design process as well as a wealth of content based on historical context that helps to build the grit necessary to increase the number of students pursuing careers in engineering. As a second-year Engineering Technology instructor, I am excited to integrate EbD™ into the existing curriculum for first- to third-year students pursuing the Engineering Technology Pathway. The existing curriculum, while rich in projects, lacks a content-rich integration of math, science, and technology, especially from an historical context. The use of the EbD curriculum allows tools for measuring student growth while at the same time giving the flexibility for independent, creative problem solving.

This year I decided to integrate the EbD curriculum at the beginning of the year and was delighted by the student response to the content as well as the approach to solving problems. In the EbD first-year course Foundations of Technology, students develop skills and knowledge necessary to implement the engineering design process in a problem-based learning environment. This year students were introduced to the engineering design process using lessons from the first five days and Unit 1 of Inventions and Innovations. In my classes students are taught to approach lessons as honing skills necessary to do the work of an engineer. From documenting their work in their Engineering Design Journals to creative and cooperative problem solving, students are practicing skills that are necessary to be effective and competent engineers.

First Five Days

- **Design Challenge**: Develop a self-propelled vehicle using a balloon, 2 paper clips, clothespin, popsicle stick, and 12” of tape that will travel an incline created from a 5-foot horizontal and 6-foot vertical distance.
- **Engineering Design Process**: Students assessed their use of a process while completing the challenge by reflecting on steps they used to cooperatively develop and test their solutions. But the true lesson for this activity was a lesson in perseverance. When many groups failed to meet the design challenge within the required time, students implemented a redesign and tested until they achieved success. Many students analyzed the reason for their failure and worked in teams to determine better solutions.
- **Engineering Design Journal**: This lesson helps to legitimize the use of the Design Journal in my classroom. Students understand that the work they do and the ideas they generate, no matter how small, should be documented for future reference.
- **Creativity and Brainstorming**: Lastly, students get to learn that how they approach generating solutions to problems is integral to the development of problem solutions.

In all, students developed skills during the five days that led them successfully through all years in the Engineering Technology Pathway.

From Unit 1 of Invention and Innovation: "...students glean from a historical context how ideas become both inventions and innovations." Using 21st century technological skills, students created presentations documenting the evolutionary history of technological devices ranging from water treatment systems to the Internet. Particularly useful in this unit were students’ surveys of data and graphical analysis. As I prepare my students for new statewide assessments that are based on critical responses, it is refreshing to find within the curriculum tools that provide both practice and snapshots of skills that will be assessed at the end of the year.

This year appears to be very promising; as students end their unit on CAD and continue their journey of perseverance, they are adding to the skills in their engineering toolbox. Together with existing curriculum and EbD, students are being equipped with technical knowledge, skills, and most of all the confidence to solve today’s and tomorrow’s problems.

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