TECHNOLOGY and ENGINEERING

Bring STEM to LIFE!

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Welcome to ITEEA’s interactive STEM kit.

Click on the small STEMbots throughout the document to learn more.
Students Who Study Technology and Engineering
“Bring STEM to LIFE”!

(Adapted from Standards for Technological Literacy: Content for the Study of Technology – 3rd Edition: ITEEA)

Students who study technology and engineering through an integrative STEM education approach learn about the technological world that inventors, engineers, and other innovators have created. Among other things, they study how energy is generated from coal, natural gas, nuclear power, solar power, as well as when and how it is transmitted and distributed. They examine communication systems: telephone, radio and television, smart devices, satellite communications, fiber optics, and the Internet. They delve into manufacturing and materials—processing industries, from steel and petrochemicals to computer chips and household appliances. They investigate transportation, information processing, and medical technology. They look into new technologies, such as genetic engineering and emerging technologies, such as fusion power and soft robotics.

The goal is to produce students with a more conceptual understanding of technology and engineering and its place in society. These students are able to conceptualize and evaluate new technologies that they may have never before seen. By “doing and making,” children are able to become “makers” for the future.

We support NAE in stating that PreK-12 engineering education must promote engineering “habits of mind” (NAE, 2014). Engineering habits of mind are aligned with what many believe are essential skills for citizens in the 21st century (Partnership for 21st Century Skills, 2011).

In addition to understanding how particular technologies are developed and used, students should be able to evaluate the technologies’ impacts on the environment, on other technologies, and on society itself. Technologies inevitably involve trade-offs between benefits and costs and intelligent decisions made about technology need to be taken into account. Students come to see each technology as neither good nor bad in itself, but one whose costs and benefits should be carefully weighed before deciding if it is worth developing.
Engineers, architects, computer scientists, technicians, and others involved in technology use a variety of approaches to problem solving, including troubleshooting, research and development, invention, innovation, and experimentation.

The **engineering design process** typically begins with defining the human need, want, challenge, or opportunity. After investigating and researching the human need, want, challenge, or opportunity, the designer generates a number of ideas for solutions. Then, considering the original criteria, along with various constraints, one design, or, in some cases more than one, is chosen as the most promising. The selected design is modeled and tested, and then reevaluated. If necessary, the original design is dropped and another tried. Eventually through a series of iterations that repeat the variable steps of the process as necessary, a final design is chosen.

Technological studies are ideal as an interdisciplinary integrator of all subject content. It especially excels in connecting the fields represented by the **STEM acronym**. When taught effectively, technology is not simply one more field of study seeking admission to an already crowded curriculum, pushing others out of the way. Instead, it reinforces and complements the material that students learn in other classes—Technology and Engineering Bring STEM to Life!

Technological and engineering literacy is the ability to use, manage, assess, and understand technology. A technologically and engineering literate person understands, in increasingly sophisticated ways that evolve over time, what technology is, how it is created, and how it shapes society, and in turn is shaped by society. A technologically literate person will be comfortable with learning about technology and engineering, without being afraid or intimidated by it.

Learning to understand and thrive within the framework of technology and engineering, technological and engineering literacy benefits students in a number of ways. For future engineers, aspiring architects, or students who will have jobs in one area of technology or another, it means they will leave high school with a **head start on their careers**. They will already understand the basics of such things as the design process and possess a big picture of the field they are entering. This will allow them to put the specialized knowledge they learn later into a broader context.

STEM is an important force in our economy; anyone and everyone benefits by being familiar with it. On the individual level, technological and engineering literacy allows consumers to better assess products and make more intelligent buying decisions, policy decisions, and those that affect our quality of life.

Technology and Engineering Education through Integrative STEM education effectively delivers technological literacy and engineering and paves the way for making a positive difference in the lives of humankind!
Advancing Technology and Engineering Capabilities for All People

Mission of the International Technology and Engineering Educators Association

ITEEA’s mission is to advance technological and engineering capabilities for all people and to nurture and promote the professionalism of those engaged in these pursuits. ITEEA seeks to meet the professional needs and interests of members as well as to improve public understanding of technology, innovation, design, and engineering and its contributions to human life.

ITEEA is the largest professional educational association, principal voice, and information clearinghouse devoted to enhancing technology, innovation, design and engineering through experiences in our schools (K–12). Its membership encompasses individuals and institutions throughout the world with the primary membership in North America. ITEEA strengthens the profession through leadership, professional development, membership services, networking, publications, and classroom resources. ITEEA seeks to meet the professional needs and interests of members as well as to improve public understanding of technology and engineering through integrative STEM education and its contributions to the world in which we live.

In order to achieve these goals, ITEEA:

- Represents more than 35,000 K-12 technology and engineering educators throughout the U.S. and internationally. This includes classroom teachers, developers, administrators, and university personnel in the field representing all levels of education. ITEEA corporate members are comprised of leading technology and engineering companies.

- Conducts a wide variety of professional development programs and holds an Annual Conference—the largest technology and engineering education showcase of exhibits and educational sessions in the world. ITEEA collaborates with like-minded organizations to further strengthen the voice of technology and engineering educators.

- Publishes Technology and Engineering Teacher, Children’s Technology and Engineering, the Journal of Technology Education, STEM Connections, and a variety of other publications that lead the profession by providing teaching directions, instructional ideas, and networking opportunities.

- Takes part in numerous committees, task forces, and boards that coordinate all aspects of technology and engineering education and sponsor dozens of meetings, conferences, and exhibits each year.

- Sponsors an active honors and awards program that recognizes outstanding teachers and programs (K-12) from states, provinces, and countries affiliated with the Association. ITEEA also presents award certificates and supports other programs that recognize outstanding efforts in the technology and engineering teaching profession.
ITEEA Councils

ITEEA’s Councils, including the Council on Technology and Engineering Teacher Education (CTETE), the Council for Supervision and Leadership (ITEEA-CSL), the Children’s Council, and the Technology and Engineering Education Collegiate Association (TEECA) recruit the best and brightest in our field in order to lead the movement towards an integrative STEM education for all students and building a better future for our nation.

ITEEA’s Foundation for Technology and Engineering Educators

ITEEA and its foundation, the Foundation for Technology and Engineering Educators (FTEE), provide awards, grants, and scholarships to support the advancement of technology and engineering education. FTEE awards support programs that will: make our children technologically and engineering literate; transfer industrial and corporate research into our schools; produce models of excellence in technology and engineering teaching; create public awareness regarding the nature of technology and engineering education; and help technology and engineering teachers maintain a competitive edge in technology.

ITEEA’s Honorary Society for Technology and Engineering Education

Epsilon Pi Tau recognizes academic excellence of students in fields devoted to the study of technology and the preparation of practitioners for the technology professions. Epsilon Pi Tau also extends the honor of membership and advancement activities to outstanding practitioners in the technology professions, scholars with exemplary research interests in technology in society and/or persons who have significantly supported or advanced technology professions. In addition to a recognition program that extends through members’ careers and beyond, Epsilon Pi Tau continually seeks to serve, support, and strengthen the technology professions through publications, conferences, thought leadership, and alliances with corporations, professional associations, government agencies, and nongovernmental organizations.

Conducts a vigorous public policy program frequently providing information to government, agencies, associations, and other special interest groups concerning technology and engineering education. The Association strives to provide concerned publics with an understanding of the importance of technological literacy through technology, innovation, design, and engineering education to the future growth and well-being of all nations.
ITEEA offers individual, PreK-12 schoolwide STEM Memberships, university, and corporate memberships. Our members are classroom teachers, state and local supervisors, college students, college and university faculty, science, math, and art teachers who are interested in STEM education.

Who Are ITEEA’s Members?

ITEEA Member Profile

Maurice Frazier, Ph.D.
ITEEA Member since: 2004
High School Technology Teacher,
Oscar Smith High School, VA
Adjunct Professor, Old Dominion Univ.

Maurice’s ITEEA Membership Goal: To make valuable contributions to my profession and promote public awareness about the importance of STEM education.

“I have been a high school technology education teacher at Oscar Smith High School in Chesapeake, VA for 15 years. I also teach at Old Dominion University as an adjunct professor in the STEMPS Department (Science Technology Engineering Mathematics for Professional Studies). The majority of my teaching experience has been in the areas of graphic design and communications.

It has been my experience that membership in ITEEA is extremely beneficial in several different ways. I have been able to establish a professional network of colleagues from across the country. I have had the opportunity to make multiple presentations at the annual conference where I was exposed to latest trends, ideas, and innovations in our field. I also have the ability to tap into numerous instructional resources that have assisted me in the delivery of content to my students. Membership in ITEEA has been a tremendous professional asset for me that I plan to maintain for years to come.”

ITEEA Member Profile

Lauren Lapinski
ITEEA Member since: 1999
Bala Cynwyd Middle School
Lower Merion School District, PA

Lauren’s ITEEA Membership Goal: I depend on ITEEA to keep me current in trends/developments in the field and to provide me with a way to stay connected to other technology and engineering professionals.

“I believe that students enrolled in technology and engineering education courses emerge from school more prepared for the world, armed with skills and abilities that will prove invaluable both in and beyond the walls of the classroom. This organization works to ensure that these types of courses continue to exist and students can continue to reap the benefits.

In addition to my work in the classroom for the last 11 years, I’ve also been deeply involved in the Technology Student Association since I was a middle school student myself. Outside of the classroom, I enjoy traveling, spending time with my family, reading, and running with my dog.”
Standards-Based Curriculum

STEM CTL has developed the Premier Standards-based Integrative STEM Curriculum Model designed to be flexible, affordable, and accountable. The Engineering byDesign™ (EbD) curriculum was initially developed to address the need for a standards-based curriculum using Standards for Technological Literacy, and through a dynamic process, now addresses the needs for a standards-based Integrative STEM curricula. Key attributes are:

- Develops broad Technological and Engineering Literacy for every student using the 6E Learning byDESIGN™ Instructional Model;
- Based on Standards for Technological Literacy, Next Generation Science Standards (NGSS), Common Core State Standards (CCSS-Mathematics/English-Language Arts) and the National Academy of Engineering’s (NAE) Engineering Habits of Mind.
Based on Constructivist theory, EbD™ is problem/project-based within the context of the Grand Challenges for Engineering (NAE).

**Professional Learning Communities (Professional Development):**
The STEM±Center for Teaching and Learning is building a community of STEM Education Leaders through face-to-face professional development, webinars, and an online learning community that prepare educators to be Integrative STEM professionals. Professional Development Opportunities includes:

- Collaborative Learning Community: for teachers-by teachers;
- **Summer Institutes on Engineering byDesign Curriculum:**
- On-site workshops (school/district/state) that develop STEM pedagogy and practice through a facilitated learning opportunity;
- A broad range of options for developing the Integrative STEM professional.

**Assessment**
The STEM±CTL is concerned with developing high quality assessments to inform curriculum quality and fidelity, teacher effectiveness, and student growth achievement. To this end, services provide online “Dashboards” for class, school, and state assessment reports that reflect the growth of student knowledge, capabilities, and ways of thinking and acting. Highlights include:

- Innovative performance assessments that focus on what students know and are able to do;
- Flexible **Teacher Assessment Dashboard** provides real-time data on student learning;
- Links STEM subjects through **Integrative STEM Focal Points**;
- Summative Assessment reports that focus on student growth and contribute towards identifying teacher effectiveness.

**Research**
The STEM±CTL is engaged in validating the “T & E” of STEM through research that focuses on storytelling and data-driven discovery. We highlight great technology and engineering teachers doing great things. We aim to provide data-driven evidence of STEM learning for all students. Initiatives consist of:

- Institutional Research Agreement and Student Research Agreement to engage the research community;
- Future Leaders Scholarship to build a community of STEM±CTL future collaborators;
- Assessment Development Institute for the analysis, revision, and updating of EbD assessment items;
- Identify and publish Publications in research-oriented educational journals.

**Consortium**
The STEM±CTL uses a Consortium model approach to develop the Integrative STEM resources described above. Started in 1999, states join annually to leverage valuable, but declining local resources. Consortium benefits include:

- A group of **National Teacher Effectiveness Coaches (TECs)** provide high quality, consistent professional development opportunities for states on a cost-recovery model;
- Consortium members are provided unlimited* distribution of EbD/STEM materials within their state or district; (*as defined by the Consortium State/District)
- Professional Development opportunities at the ITEEA Annual Conference including travel funds for the Consortium Director and a lead trainer;
- Strategic Initiatives Meeting twice per year, including the Fall Leadership Forum (September) and Annual ITEEA Conference (March);
- Limited Network Schools are included with the annual membership. The Network Schools include pre-post tests and the EbD online professional learning community (Collaborate byDesign™).
Building a Network of Partners to Help Create a Technologically Literate Society
ITEEA Corporate Partners

Autodesk
Bentley Systems Inc.
BirdBrain Technologies, LLC
CNC Software/Mastercam
DS Solidworks Corporation
Fablificador 3D Printers by K&L Services Group, Inc.

Goodheart-Willcox Publisher
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Pitsco
PTC
Stratasys Inc.
TeacherGeek, Inc.
Tormach, Inc.
Vex Robotics, Inc.
Whitebox Learning

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Valley City State University
Virginia Tech Integrative STEM Education Grad Program