

Technological and Engineering Literacy: An Educational Imperative



Technology and Engineering bring STEM to Life!
International Technology and Engineering Educators Association
iteea.org

Why is technological and engineering literacy important?

Technology and engineering are pervasive in all aspects of our lives. Every human activity is dependent upon the products, systems, and processes created to help grow food, provide shelter, communicate, work, and recreate. As the world grows more complex, it is increasingly important for everyone to understand more about technology and engineering. People need to understand technology's impacts on their lives, society, and the environment, as well as how to use and develop technological products, systems, and processes to extend human capabilities. These understandings are all important elements of technological and engineering literacy. The goal is not to make everyone technologists or engineers but to broaden technological and engineering literacy so that people can make informed decisions about technology and better contribute to its design, development, and use.



The increased call for people to enter science, technology, engineering, and mathematics (STEM) occupations is an important reason for more people to study technology and engineering. STEM jobs create new goods and services through research and development and contribute to our overall quality of life. Technology and engineering, however, have not traditionally been considered core subjects in PreK-12 education and thus have not received the same educational focus as science and mathematics. All occupations require the use of technological products, systems, and processes, and therefore people with higher levels of technological and engineering literacy are better prepared for the workforce. Occupations required in a modern society demand people who are critical, transdisciplinary thinkers with the ability to adapt to new technologies. This need can be addressed by expanding technology and engineering education.

What should students know and be able to do to be technologically and engineering literate?

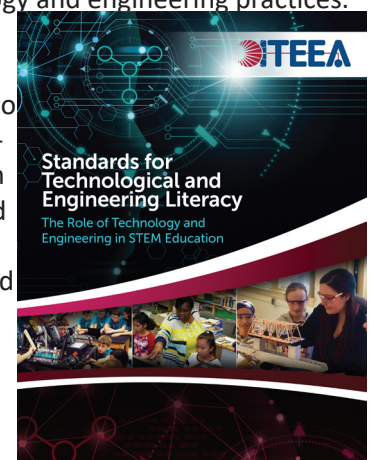
A challenge in communicating a clear picture of technological and engineering literacy is that it encompasses a broad area of human activity, one that is constantly evolving. The recently released *Standards for Technological and Engineering Literacy* distills this broad field into a set of eight core disciplinary standards and eight practices that are widely applicable across a range of technology and engineering contexts and that incorporate acknowledged technology and engineering practices.

By focusing on essential knowledge, skills, and dispositions, *STEL* defines a level of literacy that is expected of all learners across the PreK-12 spectrum, much as we expect all students to achieve a certain level of language literacy, scientific literacy, and mathematical literacy. Technological and engineering literacy is as fundamental to successful participation in the modern world as are these other forms of literacy. *STEL* presents the information that students should know and be able to do in order to achieve a high level of technological and engineering literacy. In other words, the standards prescribe the outcomes for the study of technology and engineering in Grades PreK-12.

How is technology and engineering being taught in our schools?

Elementary teachers teach about technology and engineering through integrated activities that are a part of their daily curriculum. One example would be a design activity to plan and build a community. Such an activity would integrate the subjects of technology, social studies, mathematics, science, and language arts with the opportunity to create a hands-on community-planning experience. The culminating experience is the building of a student-planned city with consideration for transportation, communication, environmental, and construction systems.

There are an estimated **60,000** U.S. public school secondary technology/engineering teachers, with each state having its own customized technology program. Technology and engineering are electives in most locations, while other states have requirements for high school graduation. Technology and engineering does not yet enjoy the same educational funding, support, or time in the school schedule as the other core subjects. However, the current science, technology, engineering, mathematics (STEM) funding holds much promise for supporting technology and engineering programs.



What are the origins of teaching technology and engineering?

Technology and engineering teaching has evolved as technology has advanced. During the industrial era of the 20th century, it was taught in the schools as industrial arts, reflecting the industrial society. As society advanced technologically, the field changed to reflect the breadth of technological and engineering, not just industrial practice. Generally, the public is unaware of these changes in curriculum and content and, therefore, the field continues to strive for support in order to advance the subject matter.

Redefining Technology and Engineering

Technology and engineering education programs provide a unique mechanism for achieving these and other goals by delivering an integrated, design-based approach to teaching and learning. However, for more students to be able to take advantage of technology and engineering programs currently provided in many elementary, middle, and high schools, something must change. A greater understanding about the role of technology and engineering courses must be promoted. Historically, technically oriented courses have not been as valued as other school course content. The value and importance of technological and engineering literacy is accepted by a wide group of experts. Despite this consensus, formal technology and engineering courses are not available in all schools. Some countries, states/provinces, and localities have put compulsory technology and engineering education programs in place, but many students receive little or no exposure to the study of technology and engineering, particularly those in Grades PreK-5. Students are graduating with a minimal understanding of one of the most powerful forces shaping society today.

Technology and engineering are complex and constantly evolving, so teachers should spend less time on discrete facts and more time on the broad dimensions of knowing, thinking, and doing in the context of technology and engineering. The knowing dimension involves taking in information, organizing it, and understanding factual and conceptual relationships. The thinking dimension entails making sense of information through questioning, analysis, and decision making. The doing dimension involves using technology and engineering in applied ways such as designing, making/building, producing, and evaluating. All three of these dimensions—knowing, thinking, and doing—are symbiotic and equally important in the development of technological and engineering literacy.

Technology and engineering education is a broad field that encompasses dozens of subdisciplines. These range from a variety of technological focus areas (e.g., energy technology, transportation technology, biotechnology) to information technology/computer science to the many engineering sub-specialties, among others. Technology and engineering education, as envisioned in *Standards for Technological and Engineering Literacy*, provides an effective launching point for continuing study to prepare individuals to work in these more specialized fields. Technology and engineering education in the PreK-12 environment also provides essential foundational understandings and abilities for all individuals, regardless of their career pathway.

How are technology and engineering teachers prepared and licensed?

Technology and engineering teachers receive the same university education and teacher licensure as teachers of other core subjects. They often have a specialized background in design, engineering, and technical areas as well.

A call to action

We urge the inclusion of technology and engineering in STEM education legislation as a subject area with a knowledge base as used by engineers, technology workers, designers, and architects, among others, rather than just a delivery system for other subjects. Further, we recommend that technology and engineering teachers be given the same opportunities as their peers in concept-based instruction and assistance with investigating the ideal scope, sequence, and curricula content in our country. This means requiring meaningful professional development for technology and engineering teachers through rigorous teacher preparation programs and ongoing professional development that will further their teaching skills. Also, instituting tax credits, scholarships, or other incentives for beginning technology and engineering teachers with strong content preparation and tax incentives to businesses that provide assistance to local schools to help with science, technology, engineering, and mathematics (STEM) teacher enhancement.

The full *STEL* Document is available for download at www.iteea.org/stel.aspx. Print, printable PDF, and EPub versions are also available.