

Kentucky's K-12 Science, Technology, Engineering and Math (STEM) Program

Engineering Technology Education

Elementary School STEM Program

School districts are encouraged to explore the concept of a K-12 STEM pipeline. This career pathway would facilitate exploration, the attainment of knowledge and skills necessary for informed participation and gainful employment in a technologically dependent society. This pipeline may include a recommended sequence of courses that would allow integration and interdisciplinary instruction of important concepts. Beginning this pipeline at the elementary level could help the students focus their learning.

Middle School STEM Program

Programs in the middle school provide an exploration into STEM and how it connects skills from other academic disciplines. Students experience the design process as they invent devices to solve various problems. Students learn of system requirements, processes and controls as they wrestle with trade-offs due to design constraints. Students apply scientific and mathematical knowledge as they analyze data to predict performance. Students learn the proper and safe operation of some basic tools as their ideas begin to take shape. Through these experiences, students begin to understand the forces that drive our technological society and how these forces can be controlled and directed. Instructional approaches include problem solving/design briefs where students build projects, small/large group instruction, discussion, research, student presentations, and other successful pedagogy. **STEM at the middle school level should include a local chapter of the Technology Student Association (TSA) and can incorporate many of the TSA activities within the curriculum.**

A middle school STEM course is generally offered for six to eighteen weeks for a single class period each day. Alternative schedules that provide for equivalent contact hours may also be implemented. A total program of STEM consists of a minimum of three course offerings, one for each grade level 6-8.

High School Engineering Program

The U.S. has approximately 1.6 million engineering jobs that pay \$42 per hour in median wages. Civil engineers account for the most jobs of any engineering field (274,000 in 2014), followed closely by mechanical engineers (264,000) and industrial engineers (229,000).

Those three engineering jobs, plus electrical engineers and electronics engineers, make up two-thirds of the American engineering workforce.

<http://www.forbes.com/sites/emsi/2014/09/12/the-most-in-demand-and-oldest-engineering-jobs/#6f57082c4b4a>

The Commonwealth of Kentucky has created high school engineering pathways to excite and drive interest in these top Engineering fields. Special attention is also paid to Aerospace Engineering as this is Kentucky's top export and only second to Washington State in export dollars.

High School Engineering Technology Education Program

This program of studies includes the practical application of science and engineering to expose students to a wide range of real world problems. The Commonwealth of Kentucky offers a wide array of Engineering Technology Education and Science, Technology, Engineering and Math (STEM) related High School Career Pathways to create a future workforce ready for industry needs.

Career and Technical Education/Engineering Hybrid Pathways

Project Lead The Way (PLTW) and the Office of Career and Technical Education (CTE) worked together to create further opportunities for students that are enrolled in secondary CTE specific programs. These are referred to as Hybrid pathways that consist of courses within the specific program area with the addition of selected Engineering courses relative to that career area. Since their inception, the hybrid pathways now include nonPLTW engineering courses to allow expanded access across the Commonwealth. These pathways blend CTE courses with engineering courses to help students apply technical skills along with STEM skills to solve real-world problems and to meet the demands of industry for individuals with both technical and engineering knowledge and skills.

Student Organizations

Participation in Technology Student Association (TSA) provides a vehicle for students to employ higher order thinking skills, to interact with industry individuals to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities.

Imagine an activity so captivating that your students spend hours working on it after school for weeks at a time. That's what happens when TSA members engage in TSA's competitions. Only TSA members have the opportunity to compete at exciting regional, state and national conferences. Expert judging by technology educators and industry representatives inspires the best from participants. Members are rewarded not only with medals or trophies, but also with memories of the camaraderie and the challenge brought on by TSA.

STEM at the middle school level as well as Engineering and Engineering Technology at the high school level should include a local chapter of Technology Student Association (TSA) and can incorporate many of the TSA activities within the curriculum.

Engineering Vs. Engineering Technology

According to the Accreditation Board for Engineering and Technology Inc. (ABET); engineering and engineering technology are separate but closely related professional areas that differ in:

- **Curricular Focus** – Engineering programs often focus on theory and conceptual design, while engineering technology programs usually focus on application and implementation. Engineering programs typically require additional, higher-level mathematics, including multiple semesters of calculus and calculus-based theoretical science courses, while engineering technology programs typically focus on algebra, trigonometry, applied calculus, and other courses that are more practical than theoretical in nature.
- **Career Paths** – Graduates from engineering programs are called engineers and often pursue entry-level work involving conceptual design or research and development. Many continue on to graduate-level work in engineering. Graduates of four-year engineering technology programs are called technologists, while graduates of two-year engineering technology programs are called technicians. These professionals are most likely to enter positions in sectors such as construction, manufacturing, product design, testing, or technical services and sales.

[Accreditation Board for Engineering and Technology \(ABET_ Engineering Versus Engineering Technology Webpage](#)

Engineering and Engineering Technology – What is the difference?

This question is asked repeatedly by graduating high school seniors who are considering the field of engineering as a career. They are told that engineering is science-oriented, stressing mathematics, natural and engineering science, engineering design, and the development of engineering research competencies. On the other hand, engineering technology is practice-oriented, stressing applications of engineering science, engineering design, and laboratory experience competencies. The potential student in engineering education is still confused because of the apparent overlap in the definitions. The student must understand that the field of engineering comprises a broad spectrum of occupations requiring different abilities, interest and skills. Both engineering and engineering technology are viable professional paths that lead to rewarding and successful careers. It is important for students to carefully assess their abilities, interests and personal career objectives before deciding between engineering and engineering technology. The student should study the following comparisons in order to decide which career path best fits his or her abilities and interests. All too often, graduating high school seniors enroll in engineering curriculums without realizing there is another alternative in which they could be more successful, during both academic preparation and the career that follows.

According to Payscale.com which gathers salary and employment data for the federal government, the average starting salaries for both Engineering graduates as well as Engineering Technology graduates are almost identical, hovering around \$47k* annually as of December 2016. *updated to reflect current pay

Post-Secondary Comparison of Engineering and Engineering Technology

This comparison list is modeled from a brochure, “Mechanical Engineering and Mechanical Engineering Technology, Which Path Will You Take”, published by the American Society of Mechanical Engineers.

ENGINEERING

ENGINEERING TECHNOLOGY

Program Guide Characteristics	Program Guide Characteristics
An innovator—one who is able to interweave a knowledge of advanced mathematics, the natural and engineering sciences, and engineering principles and practices with considerations of economic, social, environmental, and ethical issues to create new systems and products.	A doer or implementer—one who is able to apply a basic knowledge of mathematics, the natural and engineering sciences, current engineering practices, and an understanding of economic principles of the solution of design problems and to the operation or testing of engineering and manufacturing systems.
Program Objectives	Program Objectives
To provide the knowledge necessary to design and manufacture state-of-the-art products and systems needed to meet the current and future needs of society. To provide the knowledge required to apply state-of-the-art techniques and designs to meet the current needs of society.	To provide the knowledge required to apply state-of-the-art techniques and designs to meet the current needs of society.
Program Emphasis	Program Emphasis
Emphasis is on developing methods of analysis and solutions for open-ended design problems.	Emphasis is on applying current knowledge and practices to the solution of specific technical problems.
Expertise Objectives	Expertise Objectives
To develop conceptual abilities.	To develop application abilities.
Program Length	Program Length
Four years.	Four years. Transfer students from community colleges may take longer if they do not have basic math and science courses in freshman and sophomore years.
Courses in Major Field	Courses in Major Field
Engineering students usually do not begin major field of study until the latter part of sophomore year or junior year.	Engineering technology students begin major field of study in the freshman year.
Degrees Awarded	Degrees Awarded
B.S. in Engineering	B.S. in Engineering Technology
Academic Terminology	Academic Terminology
Graduates are referred to as engineers.	Graduates are referred to as engineering technologists. Job titles after entering industry will be “engineers” more often than not.

ENGINEERING**ENGINEERING TECHNOLOGY**

Program Basis	Program Basis
The equivalent of one full year of mathematics and basic science courses provides the foundation for the program that is calculus based.	The equivalent of three-quarters of a year of mathematics and basic science. Engineering Technology programs are algebra-based, but calculus usage is required as a subject.
Emphasis of Technical Courses	Emphasis of Technical Courses
Engineering courses stress the underlying theory of the subject matter.	Technology courses stress the application of technical knowledge and methods in the solution of current industrial type problems.
Emphasis of Laboratory Courses	Emphasis of Laboratory Courses
Laboratory courses provide an intensive overview of experimental methods and of the related underlying theories.	Laboratory courses, an integral component, stress practical design solutions as well as manufacturing and evaluation techniques appropriate for industrial type problems.
Technical Design Emphasis	Technical Design Emphasis
General design principles, applicable to a wide variety of problem situations, are developed.	Current design procedures of a complex, but well-established nature are developed and applied to problems in a specialized technical area.
Transfer Potential	Transfer Potential
Transfer to a technology program from an engineering curriculum is possible with a minimum loss of credits and time.	It is generally not possible to transfer to an engineering curriculum from a technology program without a significant loss of credits and time.
Typical Aspirations of the New Graduate	Typical Aspirations of the New Graduate
The engineering graduate entering industry would most likely aspire to an entry-level position in conceptual design, systems engineering, manufacturing, or product research and development.	A graduate entering industry would most likely aspire to an entry-level position in product design, development, testing, technical operations, or technical services and sales.
Technical Interest	Technical Interest
The engineering graduate is relatively broad and has an analytical, creative mind challenged by open-ended technical problems.	A graduate is relatively specialized and has an applications orientation, challenged by specific technical problems.
Adaptability to Current Industrial Practices	Adaptability to Current Industrial Practices
An engineering graduate typically requires a period of "internship" since engineering programs stress fundamentals.	A graduate is prepared to immediately begin technical assignments since technology programs stress current industrial practices and design procedures.

ENGINEERING**ENGINEERING TECHNOLOGY**

Mobility	Mobility
Many engineers move into management positions.	The majority of engineering technologists move into industrial supervisory positions. Many move into management positions.
Professional Registration	Professional Registration
Graduates of engineering schools are eligible to become registered professional engineers in all states by a process of examination and documentation of experiences.	Graduates of engineering technology schools may become professionally certified in their specific areas of expertise. Technologists may become registered professional engineers in many states; however, the requirements are usually different than those for engineers.
National Accreditation	National Accreditation
Accredited by the Accreditation Board for Engineering and Technology—Engineering Accreditation Commission (EAC of ABET.)	Accredited by the Accreditation Board for Engineering and Technology—Technology Accreditation Commission (TAC of ABET.)
Graduate Education Opportunities	Graduate Education Opportunities
Graduate study in engineering as well as other areas is available for qualified students having a B.S. in engineering.	Graduate study in technology is limited to a few universities and entrance to graduate engineering programs is most often difficult. Advanced degrees in technical education and business are possible.

[Southern Utah University Engineering and Engineering Technology: A Comparison Document](#)