Pennsylvania Technology Education

Executive Summary

K-12 Program Rationale and Guide

TEAP

www.teap-online.org

Introduction

The Technology Education K-12 Program Rationale and Guide for Pennsylvania was developed to provide a rationale and an educational model for technology education programs in the Commonwealth. It reflects both the *Pennsylvania Academic Standards for Science and Technology* and the national *Standards for Technological Literacy: Content for the Study of Technology*. The guide is intended to assist in the process of developing and improving a technology education curriculum in grades K-12. It emphasizes well-established principles of curriculum development and assessment and applies them specifically to technology as a content area.

What Is the Vision of the TEAP K-12 Guide?

The goal of Technology Education in Pennsylvania is that every student can become technologically literate. The K-12 Guide was developed as a road map to help school districts embrace this vision.

"Integrating Mathematics and Science through Technology Education"

Why Is Technological Literacy Important to Pennsylvania?

Technology is the engine driving economic prosperity in both the Commonwealth and the nation. A technologically literate population is essential to our economic progress.

Effective democracy depends on all citizens participating in the decision-making process. Because so many decisions involve technological issues, all citizens need to be technologically literate.

> *Technology* is the system by which society provides its members with those things needed or desired.
> (*Webster's New World Dictionary*)

Technology affects and is affected by both our society and the individual. Understanding technology is an important characteristic of an educated person. Technological literacy enables people to develop knowledge and abilities about human innovation in action.

Why Are Technology Standards Necessary?

Within the past decade, the educational community has undergone major changes in its view of curriculum, instruction, standards, and assessment. Of significant impact has been the move toward educational standards. The Pennsylvania Department of Education has prepared Academic Standards for Science and Technology that will apply to all students in kindergarten through twelfth grade. Nationally, the International Technology Education Association (ITEA) has also completed voluntary compliance standards specifically for technology education programs nationwide.

Pennsylvania's Academic Standards for Science and Technology
http://www.pde.psu.edu/standard/science.pdf
Following the direction of many national associations and other states, Pennsylvania is developing standards for all academic areas. Although many disciplines appear separately as their own set of standards, the fields of science and technology are combined. The science and technology standards contain eight different areas. These standards "describe what students should know and be able to do at four grade levels (fourth, seventh, tenth, and twelfth)" (Pennsylvania Department of Education, 2000). They reflect the increasing complexity and sophistication that students are expected to achieve as they progress through school.

National Standards for Technological Literacy
The International Technology Education Association (ITEA) released content standards in 2000. They define both the knowledge base and processes for the study of technology. These content standards are organized around five broad areas of study: The Nature of Technology, Technology and Society, Design, Abilities for a Technological World, and The Designed World. The *Standards for Technological Literacy* can be found at: http://www.iteawww.org.

> *Technology education* is a field associated with the study of technology, in essence, a study of the human-made world.

How Will Individual School Districts Address These Technology Standards?

Each district will have to develop their its plan of action for meeting the state-mandated technology component of the PA Science and Technology Standards at grades K -12 . The following sequence of recommended courses is provided by the TEAP curriculum committee as a guide. This sequence of courses is not intended to be viewed as the *only* way to address the technology component of the PA Science and Technology Standards.

Sample Technology Education Program Framework K-12

The primary purpose of technology education is to provide technological literacy. In Pennsylvania, the *Academic Standards for Science and Technology* will define the minimum

Curriculum Content Sequence - PA
(Sample Recommended Model)

Elementary *Gr. K-5*	**Design and Technology Education** **(Integrated into the Elementary Curriculum)**		
Middle Level *Gr. 6-8*	**Exploring Technology Course**	**Applying Technology Course**	**Creating Technology Course**
			Required
High School *Foundations Gr. 9*	**Technological Design and Systems**		
			Required
High School *Electives Gr. 9-12*	**Design and Problem-Solving Electives**		
			Elective
High School *Capstone Gr. 11-12*	**and/or** **Innovation***		
			*Required if no electives taken in grades 9-12

level of technological literacy. The variety and level of these standards require a series of activities articulated throughout the K-12 schooling experience. To properly develop into technologically literate individuals, students must experience a wide variety of technological activities with real-world contexts and become exposed to the widest possible range of technological careers. The course sequence listed above is designed specifically to assist technology teachers to address the *PA Academic Standards for Science and Technology* and align with the national *Content Standards for Technological Literacy*. In kindergarten through fifth grade an introduction to technological literacy can be accomplished through activities integrated into the regular curriculum. The certified technology education teacher can meet with students or may serve as a "consultant/facilitator" and/or guide for the regular elementary teachers as they make technology education a part of the curriculum. TEAP recommends a design and technology approach to technology

education at the elementary level. Three courses at the middle school level (*Exploring Technology, Creating Technology,* and *Applying Technology*) follow this elementary experience. At a minimum, the profession recommends that two high school technology courses are necessary to meet the requirements of the proposed Pennsylvania Academic Standards for Science and Technology. *A Technological Design and Systems* course should occur at ninth or tenth grade. Following this course, students in grades nine through twelve can elect to take technology education courses that will further develop their technological literacy and help them make decisions about potential careers or future schooling. Each of these elective courses must use a design and problem-solving methodology and be designed to address state and national standards. An alternative to offering a series of required electives is to require that all students take a capstone course called *Innovation,* at the eleventh or twelfth grade level.

Elementary School (Grades K to 5)

The TEAP Elementary Design and Technology Guide is available at http://www.teap-online.org/guide.html. Elementary Design and Technology is the application of knowledge, creativity, and resources to solve real-world problems and extend human potential. An important foundation of technological content is delivered at this level. Design and technology at the K-3 level provides students the opportunity to become technologically aware of the society around them. The delivery of design and technology in grades 4-5 provides the basis for integrating learning across all disciplines while applying technological concepts. Design and technology education offers elementary educators a project-centered, student-centered, inquiry-driven pathway to deliver and reinforce other content areas (e.g., science, math, history, and language).

Middle School (Grades 6 to 8)

The TEAP Middle Level Guide is available at http://www.teap-online.org/guide.html. At the middle level, three technology courses are required to meet the proposed Pennsylvania standards. Each of these locally planned comprehensive courses (as recommended below) should be a minimum of approximately 90 contact hours in length. Additional time may be necessary to adequately provide the opportunity for all children to learn and do technology and meet the *PA Science and Technology Standards*.
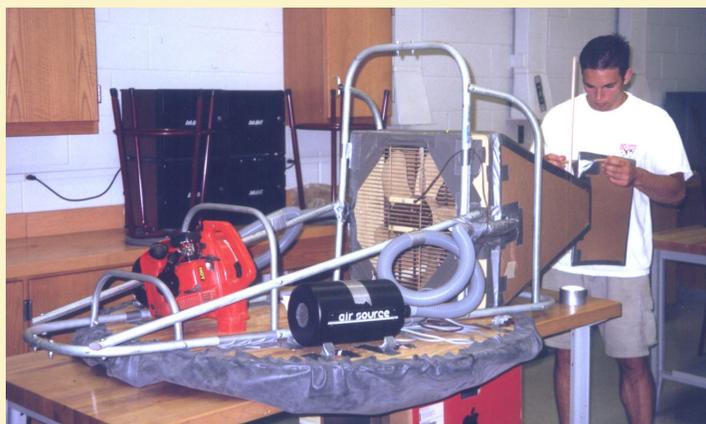
Student working on fabrication of Hovercraft directional unit (Warwick School District)

Exploring Technology (Grade 6)

Exploring Technology is an activity-based course that introduces students to technology by examining the basic systems of communication, manufacturing, construction, transportation, and bio-related technologies. Students will study the evolution of technology, invention and innovation, impacts of technology, the systems approach, and various problem-solving methods.

Applying Technology (Grade 7)

Applying Technology is an activity-based course that focuses on the application of the tools, materials, and processes of physical, information, and biotechnology systems. Students will study the ways materials, energy, and information are processed to transmit information, build structures, make products, move passengers and freight, and alter and affect living organisms.

Creating Technology (Grade 8)

Exploring Technology and *Applying Technology* courses provide the foundation for *Creating Technology*. This component comprises designing and developing real-word solutions to technological problems and challenges.

High School (Grades 9 to 12)

Technology Education at the high school level provides a foundation for understanding, using, assessing, and managing technology through a broad variety of real-world contexts designed to integrate academic learning in grades 9-12. In addition, there are various opportunities designed within the high school technology education offerings to fit the unique needs of a diverse student population. For students to achieve technological literacy as they complete their secondary education, it is essential that they successfully complete a minimum of two courses: 1) *Technological Design and Systems* and 2) one of the *elective technological studies courses* or a single *Innovation Technology* course. Each of these locally planned comprehensive courses (as recommended below) should be a minimum of approximately 90 contact hours in length. Additional time may be necessary to adequately provide the opportunity for all children to learn and do technology and meet the *Pennsylvania Science and Technology Standards.*

Technological Design and Systems
(Grade 9/10 – Foundation for Early High School)

The *Technological Design and Systems* course is the initial high school level course offering recommended for all students to address the Grade 10 benchmarks of the *Pennsylvania Science and Technology Standards*. This course provides a sound base in technological understanding that

allows students to successfully progress and become technologically literate. The areas of information technology, physical technology, and biotechnology are integrated into a hands-on and minds-on problem-solving design course.

Design and Problem-Solving Elective Courses (Grades 9-12)

After students complete the *Technological Design and Systems* course, the high school technology education sequence offers unique elective courses to meet individual needs within a diverse student population. It is recommended that all students with an interest in technology take one or more courses from these areas. This will allow all students to learn about careers in technology, develop more advanced problem-solving skills, and increase their level of technological literacy.

Innovation (Grade 11 or 12 – Capstone/Advanced Placement High School Course)

Innovation is a capstone course that all students should take during eleventh or twelfth grade in order to address the final level of the PA Science and Technology Standards. Innovation can be taught as a one-semester technology course. Whenever possible it is recommended that this course be taught as a one-year course which integrates technology and science. This course allows students to use their technological and scientific expertise to seek out and solve technological, societal, or environmental challenges in the school or community around them. It will be necessary for students in this course to work cooperatively since members of the class may have expertise in only one of the technological competence courses.

What Can You Do to Help Ensure a Technologically Literate Citizenry for Pennsylvania?

⌨ Support contemporary technology education courses, content, and activities at all levels in Pennsylvania's public schools in order to help Pennsylvania youth achieve technological literacy. Technological literacy has been identified as a major component within the Pennsylvania Science and Technology Standards.

Students present their solution to a design challenge.

⌨ Support the maintenance of an existing requirement for all students to complete at least one course in technology education at the middle school level. This requirement should help students to achieve technological literacy at a level commensurate with the 7th grade benchmark level for assessment that has been established in the Pennsylvania Science and Technology Standards.

⌨ Support a new requirement for a Technological Design and Systems course at the ninth or tenth grade level. This course will address technology standards prior to the 10th grade benchmark level for assessment that has been established in the Pennsylvania Science and Technology Standards.

⌨ Support initiatives to provide training for all teachers to become more technologically literate.

⌨ Support Design and Problem Solving course offerings at the high school level, including a healthy selection of elective technology education courses that allow students to experience various aspects of technology in greater depth than would be possible or appropriate in earlier grades.

Preparing for Our Future

ITEA's *Standards for Technological Literacy* provide an essential national perspective. Combined with Pennsylvania's own standards, they provide important milestones in the continuing effort to establish technological literacy. Change is an important result of technology. This guarantees that the study of technology will require an ongoing process of improvement. Rather than view the need for constant updating as a hurdle, it should be addressed as an opportunity to model the essence of technology (innovation). Assuming that students are regularly exposed to technological content and activities throughout their K-12 schooling, they should be able to meet the technology-related academic standards set forth in the Pennsylvania Standards for Science and Technology. It is a challenge that all technology educators are ready to meet!

Pennsylvania's technology standards are divided into three key areas: *Physical Systems, Informational Systems,* and *Biotechnological Systems.* The diagram below shows how these areas relate to the national standards that have been developed for technological literacy.
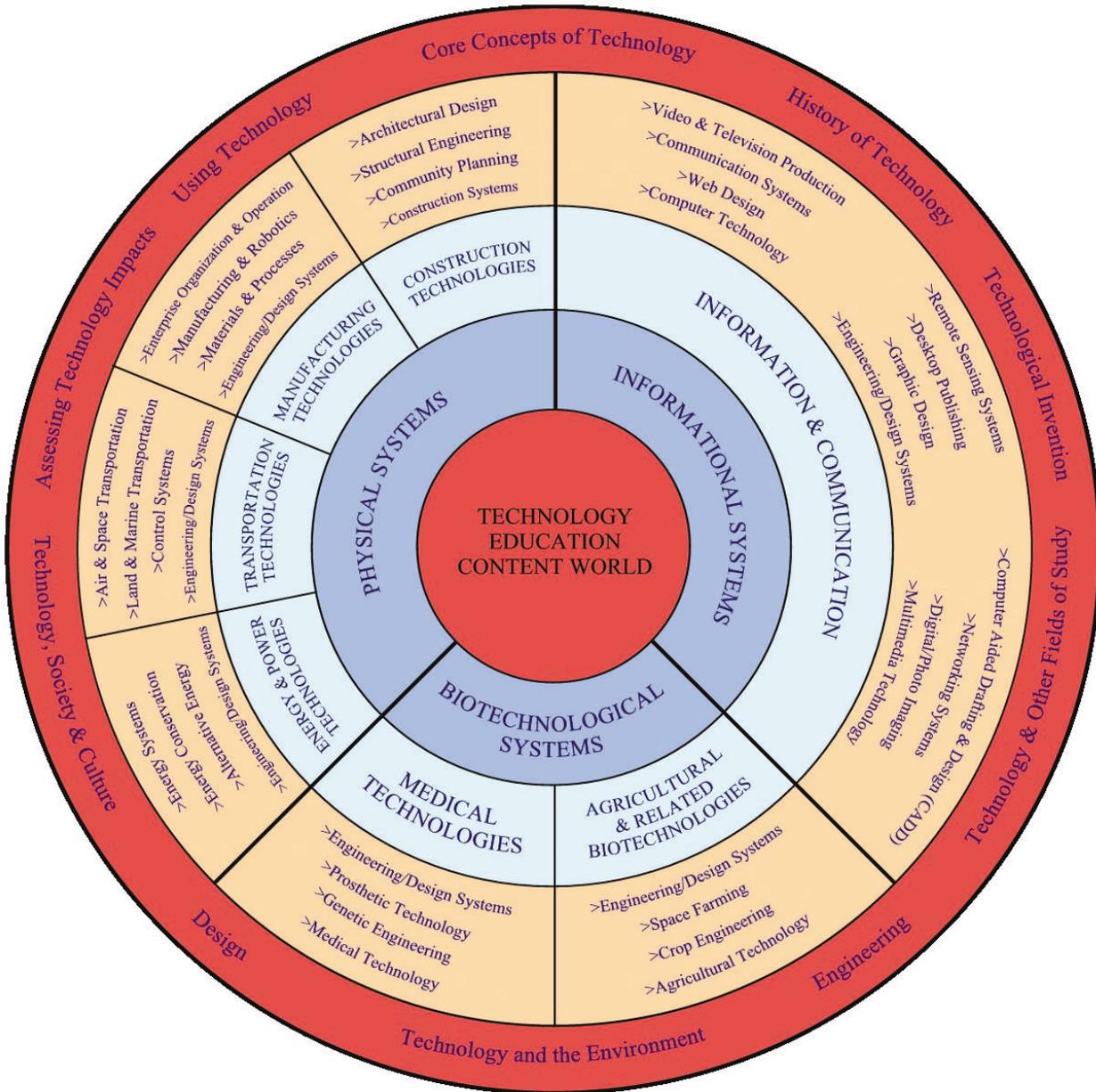

Figure 1. Relationship of Pennsylvania and National Technology Education Standards with Possible Courses.

Technology content organizers as defined by the Pennsylvania Science & Technology Standards.

Technology content organizers as defined by the national Standards for Technological Literacy produced by the International Technology Education Association.

A sampling of elective courses in technology education at the high school level. This list is not intended to be interpreted as a comprehensive listing of all technology education courses offered at the high school level.

Technological Topic Areas.

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