

# Technology Education

## [27.460]

### STANDARD 1

**The competent technology education teacher understands the foundations of work, the career development process, occupational skill standards, and workplace skill requirements.**

**Knowledge Indicators** - *The competent technology education teacher:*

- 1A. understands the history, organization, and future of work and how work relates to needs and functions of the economy and society.
- 1B. understands career development concepts, the relationship between work and learning, and the career planning process.
- 1C. understands the use of the relevant Illinois Occupational Skill Standards in the development of curriculum (see “Architectural Drafting Cluster” (2000), “Automotive Technician” (2000), “Chemical Process Technical Operators” (1998), “Entry-Level Truck Driver” (2001), “Finishing and Distribution Cluster” (2000), “HVAC/R Technician Cluster” (2001), “Imaging/Pre-Press Cluster” (2000), “Machining Skills Cluster” (1997), “Mechanical Drafting Cluster” (2000), “Metal Stamping Skills Cluster” (1998), “Plastics Molding Cluster” (2001), and “Press Operators Cluster” (2000), all published by the Illinois Occupational Skill Standards and Credentialing Council, 2450 Foundation Drive, Springfield, IL 62703-5432; no later editions or revisions are incorporated).

**Performance Indicators** - *The competent technology education teacher:*

- 1D. relates workplace cultural expectations to workplace skills.
- 1E. develops partnerships with members of the business community to provide learning opportunities for students.
- 1F. provides advice in the career planning process.
- 1G. selects appropriate skill standards for the program areas.

### STANDARD 2

**The competent technology education teacher demonstrates the ability to plan, deliver, and evaluate instruction based upon knowledge of subject matter in the field; student organizations; student, community and work needs; curriculum goals; and findings of educational research.**

**Knowledge Indicators** - *The competent technology education teacher:*

- 2A. understands pedagogy unique to the discipline.
- 2B. understands the rationale for integrating student organizations’ activities into the curriculum.
- 2C. understands professional literature relating to the specific content area and to workplace needs.
- 2D. understands economic/socio-economic conditions, patterns of business development, and changing labor and career opportunities and their impact on the relevancy of classroom instruction.

**Performance Indicators** - *The competent technology education teacher:*

- 2E. utilizes appropriate pedagogy unique to the individual discipline within career and technical education.

- 2F. creates learning environments and classroom activities that develop life/workplace skills and knowledge in the discipline.
- 2G. identifies and utilizes educational research findings that justify teaching strategies.
- 2H. applies curricular content and processes in order to achieve the goals of student organizations.
- 2I. applies post-secondary admission standards and occupational skill standards when designing curriculum and assessment.
- 2J. designs appropriate assessment plans for students.
- 2K. develops collaborative partnerships with students, colleagues, community, business/industry, and parents to maximize resources.
- 2L. participates in appropriate professional organizations and develops a plan for continued personal and professional growth.
- 2M. plans, organizes, and manages laboratories/technical facilities for instruction that which meet diverse needs of students (i.e., safety, inventory, filing, requisitioning equipment and materials, maintenance, budgeting).
- 2N. implements laws and policies relating to safe environments and incorporates appropriate safety standards, healthy practices, and ergonomic needs.

### **STANDARD 3**

**The competent technology education teacher understands the process of reading and demonstrates instructional abilities to teach reading in the content area of technology education.**

#### **Knowledge Indicators - *The competent technology education teacher:***

- 3A. understands that the reading process is the construction of meaning through the interactions of the reader's background knowledge and experiences, the information in the text, and the purpose of the reading situation.
- 3B. recognizes the relationships among the four language arts (reading, writing, listening, and speaking), and knows how to provide opportunities to integrate these through instruction.
- 3C. understands how to design, select, modify, and evaluate materials in terms of the reading needs of the learner.
- 3D. understands the importance of and encourages the use of literature for adolescents in the curriculum and for independent reading.
- 3E. understands the relationship between oral and silent reading.
- 3F. understands the role of subject-area vocabulary in developing reading comprehension.
- 3G. understands the importance of the unique study strategies required of the specific content area in developing reading comprehension.
- 3H. understands the importance of the relationship between assessment and instruction in the planning process.

#### **Performance indicators: *The competent technology education teacher:***

- 3I. plans and teaches lessons for students that develop comprehension of content-area materials through instructional practices that include analyzing critically, evaluating sources, synthesizing, and summarizing material.
- 3J. plans and teaches lessons on how to monitor comprehension and correct confusions and misunderstandings that arise during reading.
- 3K. plans and models use of comprehension strategies before, during, and after reading of text.
- 3L. provides opportunities for students to develop content-area vocabulary through instructional practices that develop connections and relationships among words, use of context clues, and understanding of connotative and denotative meaning of words.
- 3M. plans and teaches lessons that encourage students to write about the content read in order to improve understanding.

- 3N. plans and teaches lessons for students to develop study strategies that include previewing and preparing to read text effectively, recognizing organizational patterns unique to informational text, and using graphic organizers as an aid for recalling information.
- 3O. plans and teaches units that require students to carry out research or inquiry using multiple texts, including electronic resources.
- 3P. provides continuous monitoring of student progress through observations, work samples, and various informal reading assessments.
- 3Q. analyzes and evaluates the quality and appropriateness of instructional materials in terms of readability, content, length, format, illustrations, and other pertinent factors.
- 3R. promotes the development of an environment that includes classroom libraries.

## **STANDARD 4**

**The competent technology education teacher demonstrates fundamental knowledge of the history and nature of technology in connection with other fields of study.**

**Knowledge Indicators - *The competent technology education teacher:***

- 4A. understands that technology involves the generation of knowledge and processes to develop products and systems that solve problems and extend human capabilities.
- 4B. understands that throughout history technology has been one of the most powerful social, cultural, and economic forces; in turn, these same forces have influenced the development of technology.
- 4C. understands that historical data help the technologist and the social scientist determine possible scenarios for the future.
- 4D. understands that the rate of technological development and diffusion is accelerating.
- 4E. understands that technology includes a combination of “knowing” and “doing.” The “knowing” component includes technological knowledge as well as the ability to apply knowledge from other fields of study to technological activity; the “doing” component includes the ability to apply this diverse knowledge to technological processes.
- 4F. understands that outcomes of technological research are sometimes the result of specific, goal-directed activity (e.g., putting a human on the moon), while some outcomes are not intended or planned (e.g., Post-it notes and spin-offs).
- 4G. understands that technological endeavors often replace older forms of technology, resulting in social and environmental consequences.
- 4H. understands that technology has economic, political, and environmental connections with culture and society.
- 4I. understands that designing, developing, producing, inventing, innovating, and problem solving are fundamental concepts in technological activity. (These concepts are human activities that are purposely directed toward meeting needs and wants.)
- 4J. understands that systems-oriented thinking is important because systems are the building blocks in technology. These systems vary in complexity of working knowledge from very little to substantial technological knowledge to use or operate.
- 4K. understands that the stability of a system is influenced by all of the components in the system, especially those in the feedback loop.
- 4L. understands that the nature of technological knowledge and activity are related to information, energy, or physical technologies.
- 4M. understands that a variety of symbols and languages are used to communicate information and that some are universally applied across technologies (e.g., standardized measurement systems and the metric system), while others are unique to various contexts and technologies (e.g., electrical symbols and computer nomenclature).
- 4N. understands that technology influences careers by changing the way work is performed, thus creating new types of jobs, modifying current jobs, and reducing the numbers of others.

- 4O. understands that technology has its own body of knowledge and processes that are connected within that field, as well as to other fields of study.
- 4P. understands that connections among technological topics are valuable and useful in relating procedures to one another and building new knowledge bases.
- 4Q. understands that technological knowledge and activity promote advances in science and mathematics; in other cases, advances in science and mathematics have led to advances in technology.
- 4R. understands that science and technology utilize similar techniques to investigate and obtain information. These techniques include inquiry, modeling, and forecasting.
- 4S. understands that mathematical models, scientific principles, and computer-generated models are used to develop and produce products and systems.
- 4T. understands that engineering concepts and principles are used in the development and use of products and systems.
- 4U. understands that technological transfer occurs within a technology, between technologies, across other fields, and between countries.

**Performance Indicators - *The competent technology education teacher:***

- 4V. communicates the relationship of the systems in technological development via timelines, paradigms, and taxonomies.
- 4W. identifies measurement techniques utilizing appropriate representatives of technology, math, science, and engineering.
- 4X. communicates career information related to a changing workforce and instills the importance of portfolio development and lifelong learning.
- 4Y. determines the significance of a variety of symbols and languages, both universal and unique, that are used to communicate information from technology to technology, technology to human, or human to technology.
- 4Z. develops curricula integrating technology education with other fields of study.
- 4AA. develops scenarios depicting how technological change affects human endeavors in the social, cultural, and economic arenas.
- 4BB. analyzes and describes technological transfer that occurs within a technology, between technologies, across other fields, and between other countries.

## **STANDARD 5**

### **The competent technology education teacher understands and is able to design technology.**

**Knowledge Indicators - *The competent technology education teacher:***

- 5A. understands that the quality and value of a design depends on how clearly it meets a need, fits its purpose, uses resources appropriately, and addresses constraints, (e.g. economic, environmental, aesthetic, and political).
- 5B. understands that designing a product, device, process, or system requires considering how it will be developed, managed, used, and assessed for its impact and consequences.
- 5C. understands how to balance design tradeoffs, since there is no perfect design that meets all criteria, such as the safest, most reliable, least expensive, and most efficient.
- 5D. understands the general developmental process of design and that the design process is iterative and not linear and includes generating ideas; considering constraints such as cost and criteria; and communicating processes and results.
- 5E. understands the value and importance of testing in the evaluation of good design.
- 5F. understands the roles of documentation and communication and their impact on quality design.
- 5G. understands design decision criteria and their use in determining whether a design solution should be developed. These criteria may include personal, social, cultural, economic, political, and environmental issues.

**Performance Indicators - *The competent technology education teacher:***

- 5H. demonstrates the ability to identify practical problems deriving from human needs or wants.
- 5I. demonstrates the ability to develop and use design briefs with proper specifications.
- 5J. demonstrates the ability to investigate, generate, and select ideas to plan an optimum design that takes into account knowledge of constraints and criteria obtained from research.
- 5K. demonstrates the ability to select, plan, and implement the best possible solution that takes into consideration the many tradeoffs and reaches the best compromise.
- 5L. demonstrates the ability to design ways to produce products by mass production.
- 5M. demonstrates the ability to evaluate a selected design solution and make modifications based on that evaluation.
- 5N. demonstrates the ability to use verbal and graphic means to communicate processes, observations, and the results of the entire design process.
- 5O. demonstrates the ability to use feedback to consider design steps and to redesign in light of public concern or comment.
- 5P. demonstrates the ability to use standards of quality in the design and production of consumer goods.
- 5Q. demonstrates the ability to use marketing criteria in creating a design (e.g., value and function).

**STANDARD 6**

**The competent technology education teacher understands and is able to develop technology.**

**Knowledge Indicators - *The competent technology education teacher:***

- 6A. understands that developing and producing a product or system involves learning the safe and proper use of resources following instructions and troubleshooting to determine if a design works or if there is a need for redesign.
- 6B. understands that resource management involves procurement, inventory, warehousing, waste disposal, energy use, and time and people management, which affect the development of products and systems.
- 6C. understands that a prototype is a working model used to test design concepts by making actual observations and necessary adjustments.
- 6D. understands that problem-solving strategies, such as working backward or asking probing questions, provide a systematic means for exploring a variety of development and production methods that help enable successful solutions.
- 6E. understands that optimization is a procedure used to make a system or design as effective or functional as possible and typically involves a process of experimentation, trial and error, testing, and development.
- 6F. understands that quality, safety, and ergonomic design principles (e.g., enhancement of quality of life, productivity, safety, and convenience) influence the development of products and systems.
- 6G. understands that teamwork, responsibility, and interpersonal dynamics play a significant role in the success of production and development activities.

**Performance Indicators - *The competent technology education teacher:***

- 6H. develops a systematic set of procedures and uses them to produce a prototype or model.
- 6I. refines a design by using prototypes and testing to ensure quality, efficiency, and productivity of the final production process.
- 6J. selects and uses a variety of resources to optimize the development of a production process or system.
- 6K. develops and produces a product or system using the criteria and constraints noted in previous trials and tests.
- 6L. modifies or develops tools, materials, machines, flow controls, or system operations to meet production constraints.

- 6M. implements the appropriate safety precautions for his or her personal safety and the safety of others.
- 6N. recognizes that humans are a valuable resource in managing information, energy, and physical technologies.
- 6O. documents and communicates processes and procedures using appropriate techniques (e.g., flow charts, drawings, graphics, symbols, spread sheets, graphs, and time charts) in oral and written presentations for different audiences.

## **STANDARD 7**

### **The competent technology education teacher understands and is able to manage technology.**

#### **Knowledge Indicators - *The competent technology education teacher:***

- 7A. understands that operations manuals, owner's manuals, documented protocols, and general directions are essential to ensure the proper use and management of a product or system.
- 7B. understands that instrumentation and control of systems and products rely on proper functioning of open- or closed-loop systems, calibration of human or machine-controlled products and systems, and proper interpretation of their use.
- 7C. understands that systems analysis requires an understanding of the overall operation of a system, as well as the subsystems and components.
- 7D. understands that connecting micro-systems to macro-systems can potentially be used as a means to solve more complex problems.
- 7E. understands that problem solving is often required in order to use and operate technology systems because systems do not always work as designed.
- 7F. understands that facilitating human efforts can result in appropriate management of capital, time, information, knowledge, energy, materials, and tools necessary to properly use or apply technology.
- 7G. understands that computers and electronic media are primary means of communication.
- 7H. understands basic internal configuration and component identification of computer stations and their network abilities.
- 7I. understands proper methods of computer software installation and computer set-up.

#### **Performance Indicators - *The competent technology education teacher:***

- 7J. interprets the documentation contained in operations and owner's manuals in order to follow protocols and specific directions.
- 7K. safely operates and manages systems according to the function for which they have been designed.
- 7L. analyzes systems to determine how the various components work together to function as a whole system in order to understand how to change the system.
- 7M. monitors, adjusts, and maintains system processes in order to ensure the system's proper function and precision.
- 7N. troubleshoots, diagnoses problems, and maintains technological systems to ensure proper operation.
- 7O. applies knowledge and experiences gained from using systems as input for design improvements and to solve different problems.
- 7P. develops plans for implementing educational technology in classrooms and labs.
- 7Q. creates a vision for technological growth in regards to professional development and instructional technology in his or her school district.
- 7R. safely and effectively upgrades and maintains both an independent and networked computer workstation.
- 7S. loads and maintains computer software.
- 7T. locates, analyzes, retrieves, and distributes electronic data (i.e., uses the Internet and/or other electrical forms of media distribution).

- 7U. develops and demonstrates scale models of technological informational systems.
- 7V. develops a means of mass communication.

## **STANDARD 8**

**The competent technology education teacher understands and is able to assess the effects of the use of technology.**

**Knowledge Indicators** - *The competent technology education teacher:*

- 8A. understands when the development and application of technology have a role in shaping personal, social, and environmental perspectives and values.
- 8B. understands that assessment is an evaluation technique, involving steps and procedures that are iterative and require making trade-offs, analyzing risks, and choosing a best course of action.
- 8C. understands acceptance or rejection of the development of technology that correlates directly with the personal, social, political, and economic assessment of the value of technology.
- 8D. understands that human factors, including the principles of safety, health, and comfort, are important in evaluating the impact and consequences of technology.
- 8E. understands that trend analysis and patterns of development provide a means for understanding technological and environmental changes, including the resulting impacts and consequences.
- 8F. understands that the impact and consequences of technology influence local, national, and global issues.

**Performance Indicators** - *The competent technology education teacher:*

- 8G. determines the significance of technological trends for individuals, families, communities, and the world.
- 8H. uses historical case studies, when appropriate, to develop a perspective on the impact and consequences of technology.
- 8I. investigates technology's impact and consequences on social, cultural, and environmental issues using historical and current events and forecasting techniques.
- 8J. uses technology assessment procedures to alter and refine products and systems.
- 8K. communicates results of technological assessment to a wide variety of audiences (e.g., peers, family, and community) in order to explain a viewpoint on technology.

## **STANDARD 9**

**The competent technology education teacher understands and is able to demonstrate the application of technological context related to information, energy, and physical technologies.**

**Knowledge Indicators** - *The competent technology education teacher:*

- 9A. understands the relationship between facts, data, information, knowledge, logic, and wisdom within the structure of information.
- 9B. understands ways in which data and information can be stored and retrieved.
- 9C. understands that there are many ways of presenting and transmitting information, such as using graphic and electronic processes and tools.
- 9D. understands that data and information are communicated using symbols, icons, graphic images, and languages through a variety of visual, auditory, and tactile stimuli.
- 9E. understands that informational technology communication systems utilize a closed loop system.

- 9F. understands that the knowledge and information provided through informational technology systems can shape personal views and concepts of reality.
- 9G. understands that cross-cultural values are transmitted at the local, regional, national, and global levels, using various systems of informational technology.
- 9H. understands that information has become a commodity for exchange valued by society.
- 9I. understands that informational technology systems are used in commercial enterprises (e.g., broadcasting companies and the Internet).

**Performance Indicators - *The competent technology education teacher:***

- 9J. develops a means to communicate information through the use of graphics, (e.g., printing, film, and drafting).
- 9K. accesses, retrieves, organizes, processes, maintains, interprets, and evaluates information from a variety of sources in order to solve a practical problem.
- 9L. stores information for retrieval at a later time using various formats such as digital, analog, and graphics.
- 9M. in order to understand the communication process, uses computers to communicate information from human to human, machine to human, human to machine, and machine to machine.
- 9N. creates a message that includes symbols in order to communicate to a person.
- 9O. utilizes informational technology systems in order to communicate over distance and to large, diverse populations.
- 9P. researches and develops a means to overcome interference in order to improve the communication process.
- 9Q. uses mathematical knowledge to encode data into a binary form.
- 9R. evaluates the quality of information received in the communications process through such methods as comparing and contrasting sources, examining relevancy, and investigating the background of experts.
- 9S. researches ways that the mass media (e.g., newspaper, broadcast and cable channels, and the Internet) transmit messages to the public.

## STANDARD 10

**The competent technology education teacher understands and is able to demonstrate knowledge and the application of technological context related to information, energy, and physical technologies.**

**Knowledge Indicators - *The competent technology education teacher:***

- 10A. understands how materials, resources, and energy are used as inputs in physical technology systems in order to produce materials and products, transport products and humans, and transform energy into power.
- 10B. understands that manufacturing and construction planning and design techniques can reduce costs and produce better products.
- 10C. understands that tools, machines, and instrumentation are used to change materials into new forms through the processes of separating, forming, and combining.
- 10D. understands the nature of materials and their uses as a prerequisite for efficient and sustainable use of resources.
- 10E. understands that trade-offs must be made in selecting the best materials and resources for the production process.
- 10F. understands that the language of industry involves the use of symbols and signs to identify potential hazards, specific technological data, and environmental conditions.
- 10G. understands that the management of physical resources is a determining factor in the success of commercial applications of products and systems.

- 10H. understands that the optimization of production systems helps to conserve resources, manage waste, and reduce the negative effects that technology has on the natural world.
- 10I. understands that the processes associated with transportation systems include receiving, holding/storing, loading, transporting/moving, unloading, and delivering.
- 10J. understands that solutions to complex transportation problems must be developed in order to diminish pollution, congestion, accidents, deaths, and over-consumption of fuel.
- 10K. understands how power systems transform energy from one form to another.
- 10L. understands that the efficiency of power systems is important for conserving energy and producing maximum effectiveness with minimal environmental harm.
- 10M. understands that transforming materials from one form to another requires knowledge of materials and processes.

**Performance Indicators - *The competent technology education teacher:***

- 10N. designs, develops, operates, and assesses a production system that produces products in quantity.
- 10O. selects and safely uses appropriate tools, machines, and equipment to process materials and to produce useful products.
- 10P. assesses transportation systems for moving people and products, taking into account such factors as speed, cost, safety, and environmental impacts.
- 10Q. designs, develops, and tests an energy system for the future that is efficient and does not pollute the environment.
- 10R. tests and experiments with a variety of materials to conform to criteria and constraints of a physical technology system.
- 10S. applies physical science concepts (e.g., force, motion, mechanical advantage, efficiency and friction) when working with physical technology systems.
- 10T. uses a computer to maintain and control a physical technology system.
- 10U. evaluates and optimizes an existing transportation, power, or production system.
- 10V. predicts the life expectancy of selected components, using the knowledge of materials and testing the function of the components over time.
- 10W. identifies emerging physical technologies using trends and research techniques.
- 10X. communicates the results of his or her knowledge and activities in physical technology to others in an effective manner.
- 10Y. researches, prototypes, and tests new energy and power systems that can be used in the future.
- 10Z. incorporates maintenance considerations when designing, using, and monitoring systems.