ILLINOIS LICENSURE TESTING SYSTEM

FIELD 219: TECHNOLOGY EDUCATION

TEST FRAMEWORK

January 2017

Effective beginning January 22, 2018

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Technology and Society
Technological Design and Problem Solving
The Designed World
Pedagogy and Professional Practices

SUBAREA I—TECHNOLOGY AND SOCIETY

0001 Understand the core concepts of technology.

For example:

- Demonstrate knowledge of the nature of technology (e.g., goal-directed, creative uniquely human endeavor).
- Analyze characteristics of systems (e.g., input, process, output, feedback) and subsystems.
- Analyze the use of controls, sensors, and feedback loops (i.e., open and closed) in engineered systems and products.
- Describe the nature of requirements, constraints, and trade-offs involved in the design of technologies.
- Demonstrate knowledge of methods and processes related to design optimization.
- Demonstrate knowledge of the impact of management and quality control.

0002 Understand the relationship between technology and society, and the history of technology.

For example:

- Demonstrate knowledge of the historical development of technological tools, equipment, and processes.
- Demonstrate knowledge of how social, cultural, economic, political, and environmental issues are influenced by the development and use of technology.
- Analyze the effects of social, cultural, economic, political, and environmental forces on the development of technology.
- Demonstrate knowledge of ethical issues related to the use of technology.
- Analyze historical and current trends and patterns in technology (e.g., the accelerating rate of technological development and diffusion, newer forms of technology replacing older forms of technology).
- Demonstrate understanding of the nature and effects of unintended consequences of technology.

0003 Understand interrelationships between technologies and between technology and other fields of study.

For example:

- Analyze how knowledge from a variety of fields of study has affected the development of technological products and systems.
- Demonstrate knowledge of the interrelationships between technology and the environment (e.g., economic and environmental competition, solving environmental problems).
- Demonstrate knowledge of the process of scientific research and inquiry and the connections between technological innovation and research in science.
- Apply basic scientific principles used in technology and engineering.
- Apply basic mathematical principles (e.g., measurement, geometry, statistics) in modeling and solving technology problems.
- Apply knowledge of the use of computing technology (e.g., programming, spreadsheets, simulations) in the development of technologies.

SUBAREA II—TECHNOLOGICAL DESIGN AND PROBLEM SOLVING

0004 Understand the attributes of design and the design process.

For example:

- Identify characteristics of the design process (e.g., iterative, creative, and guiding steps that can be repeated in different sequences).
- Analyze a design for its ability to use resources appropriately or meet an economic, environmental, aesthetic, or cultural need.
- Apply knowledge of techniques related to brainstorming, researching, and generating ideas.
- Apply knowledge of how to interpret or develop a design proposal.
- Apply knowledge of modeling and prototyping and the role of prototypes (including computer prototypes) in the development process.

0005 Understand how to apply the design process.

For example:

- Demonstrate knowledge of procedures for communicating processes and procedures related to the development process (e.g., hand drawings, CAD files, graphs, charts).
- Apply knowledge of procedures, tools, and techniques for developing prototypes and creating two- or three-dimensional models of a design.
- Evaluate solutions using conceptual, physical, and mathematical models at various intervals of the design process.
- Demonstrate knowledge of how to produce a final product or system using the design process.
- Apply knowledge of how to evaluate final solutions and communicate design processes and final results.

0006 Understand how to use and maintain technological products and systems.

For example:

- Interpret information provided in technical manuals and other documentation related to operating a system or solving a given problem.
- Apply knowledge of tools, materials, and machines used to diagnose, adjust, and repair systems.
- Demonstrate knowledge of methods used to troubleshoot and diagnose systems to ensure safe and proper functioning.
- Demonstrate knowledge of how to operate a variety of technologies and systems.
- Apply knowledge of how to design and use instruments to gather data.
- Demonstrate knowledge of how computers and related technologies are used to access, retrieve, process, store, analyze, and communicate information.
- Demonstrate knowledge of how to use assessment techniques (e.g., trend analysis, experimentation) to make decisions about the development and use of technologies.

SUBAREA III—THE DESIGNED WORLD

0007 Understand medical, agricultural, and bio-related technologies.

For example:

- Demonstrate knowledge of the basic role of medical technologies (e.g., prevention, surgical procedures, vaccines, genetic engineering) in improving health care.
- Demonstrate knowledge of the basic technologies (e.g., pumps, sensors, servomotors) and systems (e.g., closed feedback) underlying medical technologies.
- Demonstrate knowledge of the basic technologies (e.g., plow, GPS) and systems underlying agricultural technologies.
- Demonstrate knowledge of the interdependence of various support technologies in the field of agriculture (e.g., energy, transportation, chemical engineering).
- Demonstrate knowledge of the role of conservation (e.g., soil, water, energy) in agriculture in order to ensure the maintenance of a safe environment.

0008 Understand energy and power technologies.

For example:

- Apply concepts of work, potential energy, kinetic energy, and power.
- Apply knowledge of the conservation of energy and the concept of efficiency to power systems.
- Apply knowledge of the major forms of energy (e.g., thermal, radiant, electrical, mechanical, chemical, nuclear) and conversions among them.
- Demonstrate knowledge of a variety of power systems (e.g., mechanical, fluid, electrical, thermal), their components (e.g., gears, pumps, switches, transistors, heat engine), and operating principles.
- Analyze characteristics of renewable and nonrenewable energy sources and systems.
- Analyze a power system in terms of input, load, process, and output.

0009 Understand information and communication technologies.

For example:

- Analyze communication systems and their components (i.e., source, encoder, transmitter, receiver, decoder, destination).
- Apply knowledge of various types of communication systems (e.g., print, wireless, digital, machine-to-machine) and technologies (e.g., microphone, analog-to-digital converter).
- Apply knowledge of symbols, measurements, and drawings used to communicate information.
- Demonstrate knowledge of how to use a variety of technologies to produce a communication product for a given purpose (e.g., inform, persuade, entertain, educate).
- Demonstrate knowledge of digital information and communication systems (e.g., binary data, computers, protocols, networks).

0010 Understand transportation technologies.

For example:

- Demonstrate knowledge of the role transportation plays in the global economy and in supporting other technologies (e.g. manufacturing, communications, construction, energy).
- Apply knowledge of different modes of transportation systems (e.g., highways, railways, waterways) and the interconnections between them.
- Analyze transportation vehicles and their subsystems (e.g., structural, propulsion, suspension, control).
- Apply knowledge of transportation processes (e.g., loading, storing, managing), logistics, distribution, and associated systems.
- Apply knowledge of how government regulations influence the design and operation of transportation systems.
- Demonstrate understanding of factors involved in the design of different transportation systems and technologies (e.g., airports, automobiles).

0011 Understand manufacturing technologies.

For example:

- Demonstrate knowledge of the chemical, physical, and mechanical properties (e.g., strength, hardness, elasticity) of materials.
- Select appropriate materials (i.e., metals; ceramics; polymers, including wood; composites) for manufacturing various products based on given requirements.
- Apply knowledge of material processes (i.e., separating, forming, combining, conditioning; additive, subtractive).
- Apply knowledge of tools and machines used in manufacturing.
- Apply knowledge of types of manufacturing systems (e.g., customized, batch and continuous production methods).
- Demonstrate knowledge of the role of other technologies (e.g., servomotor, G-code, probes, sensors) in supporting the manufacturing process.

0012 Understand construction technologies.

For example:

- Apply knowledge of types of building systems and subsystems.
- Demonstrate knowledge of building laws and codes and how they influence the design of a construction project.
- Apply knowledge of properties and uses of construction materials.
- Demonstrate knowledge of the tools and equipment used in construction technology.
- Analyze properties (e.g., compression, tension, dynamic load) of various construction designs and structures.
- Demonstrate knowledge of the practices and procedures used to ensure that structures remain useful through their designed lifetime.
- Demonstrate understanding of design processes used in construction technologies.

SUBAREA IV—PEDAGOGY AND PROFESSIONAL PRACTICE

0013 Understand effective pedagogical practices when planning, delivering, and assessing student learning.

For example:

- Demonstrate knowledge of strategies for teaching students about the foundations of work, the career development process, occupational skill standards, and workplace skill requirements.
- Demonstrate knowledge of strategies for integrating student organizations' activities into the curriculum.
- Apply strategies to create learning environments and classroom activities that develop college and career readiness skills and technological literacy.
- Demonstrate understanding of ways to design and adapt assessment methods and approaches to meet the diverse needs of students.
- Demonstrate knowledge of appropriate professional organizations and recognize the importance of continued personal and professional growth.
- Demonstrate knowledge of how to maintain safe environments and incorporate appropriate safety standards, healthy practices, and ergonomic needs.
- Demonstrate understanding of ways to design and adapt instructional materials and approaches to meet the diverse needs of students.

0014 Understand the process of reading, and apply knowledge of strategies for promoting students' reading development in the technology education classroom.

For example:

- Demonstrate knowledge of the reading process (e.g., the construction of meaning through interactions between a reader's prior knowledge, information in the text, and the purpose of the reading situation), and apply knowledge of strategies for integrating the language arts into technology education instruction to support students' reading and concept development (e.g., providing purposeful opportunities for students to read, write about, and discuss content in order to improve their understanding).
- Apply knowledge of strategies that foster reading in the technology education classroom (e.g., incorporating relevant literature for adolescents in the curriculum; building and maintaining a classroom library; encouraging students' independent reading, research, and inquiry related to technology education).
- Demonstrate knowledge of the role of vocabulary knowledge in supporting students' reading comprehension and concept development, and apply knowledge of strategies for promoting students' discipline-specific vocabulary development (e.g., recognizing structural and/or meaning-based relationships between words, using context clues, distinguishing denotative and connotative meanings of words, interpreting idioms and figurative language, consulting specialized reference materials).
- Apply knowledge of strategies for preparing students to read text effectively and for teaching and modeling the use of comprehension strategies before, during, and after reading, including strategies that promote close reading (e.g., breaking down complex sentences, monitoring for comprehension to correct confusions and misunderstandings that arise during reading).
- Apply knowledge of strategies for developing students' ability to comprehend and critically analyze discipline-specific texts, including recognizing organizational patterns unique to informational texts; using graphic organizers as an aid for analyzing and recalling information from texts; analyzing and summarizing an author's argument, claims, evidence, and point of view; evaluating the credibility of sources; and synthesizing multiple sources of information presented in different media or formats.

- Apply knowledge of strategies for evaluating, selecting, modifying, and designing reading materials appropriate to the academic task and students' reading abilities (e.g., analyzing instructional materials in terms of readability, content, length, format, illustrations, and other pertinent factors).
- Apply knowledge of strategies for providing continuous monitoring of students' reading progress through observations, work samples, and various informal assessments and for differentiating technology education instruction to address students' assessed reading needs.