

MSDE Technology Education VSC

Goals. Indicators & Objectives

The Nature of Technology:

Students will develop an understanding of the nature of technology.

Indicator Statement: Develop an understanding of the nature, characteristics and scope of technology. (ITEA, STL 1)

Objective(s):

- Refine and extend a conceptual understanding of new words regarding technology. (VSC Reading Processes/ Vocabulary)
- Analyze various definitions of “technology.”
- Explain that technology creates new economic opportunities and social benefits and, at the same time, produces new social problems.
- Recognize and explain that technological innovation is often driven by the profit motive.
- Explain that technology liberates us from demeaning and demanding labor and, therefore, creates more leisure.
- Explain that technology has increased human life span by conquering many debilitating diseases.
- Describe how technology can be intrusive in our lives and may threaten our right to privacy.

Indicator Statement: Develop an understanding of the core concepts of technology. (ITEA, STL 2)

Objective(s):

- Recognize and explain that **systems-thinking** applies logic and creativity with appropriate compromises in complex real-life problems.
- Explain that stability of a **technological system** is influenced by all of the components of the system, especially those in the feedback loop
- Recognize and explain that selecting resources involves **trade-offs** between competing values, such as availability, cost, desirability, and waste.
- Explain that **requirements** involve the identification of the criteria and constraints of a product or system.
- Define **optimization** as an ongoing process of designing or making a product and is dependent on criteria and constraint

Indicator Statement: Develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (ITEA, STL 3)

Objective(s):

- Explain that technology innovation often results when ideas, knowledge, or skills, are shared within a technology, among technologies, or across other fields.
- Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
- Express that mathematical concepts such as the use of measurement, symbols, estimation, accuracy, and the idea of scaling and proportion are key to the development of technology.
- Provide examples of how technological progress promotes the advancement of science and mathematics.
- Explain how the development of computer databases has revolutionized research in the social sciences.

Engineering Design and Development:

Students will demonstrate knowledge of and apply the **engineering design and development** process.

Indicator Statement: Develop an understanding of the attributes of design. (ITEA, STL 8)

Objective(s):

- Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
- Analyze the phases of the design process.
- Explain why designs need to be continually critiqued and refined.

Indicator Statement: Develop an understanding of engineering design. (ITEA, STL 9)

Objective(s):

- Describe the personal characteristics involved in engineering.

At least - -

- Creativity
- Resourcefulness
- Ability to visualize and think abstractly
- Explain constraints on the engineering design process.

At least –

- Safety
- Reliability
- Economic considerations
- Quality control
- Environmental concerns
- Manufacturability
- Maintenance
- Human factors engineering (ergonomics)

Indicator Statement: Develop abilities to apply and analyze the design process. (ITEA, STL 11)

Objective(s):

- Define the problem.
- Brainstorm.
- Research and generate ideas.
- Identify criteria and specify constraints.
- Explore possibilities.
- Select approach.
- Develop a design proposal.
- Make a model or prototype.
- Test and evaluate the design.
- Redesign.
- Create or make it.
- Communicate processes or results.

Indicator Statement: Select and use tools and equipment correctly and safely.

Objective(s):

- Select and use the appropriate tools and equipment in:
 - making two-dimensional and three-dimensional representations of design solutions.
 - forming and molding processes.
 - machining processes.
 - assembly processes.
- Select and use appropriate tools based on the properties of materials.
- Select and use tools and instruments in the testing and evaluation of design solutions.

Indicator Statement: Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

Objective(s):

- Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.
- Explain why technological problems must be researched before they can be solved.
- Identify and describe problems that cannot be solved through the use of technology.

Indicator Statement: Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

Objective(s):

- Diagnose a system that is malfunctioning and use tools, materials, machines and knowledge to repair it.

- Troubleshoot, analyze and maintain systems to ensure safe and proper function and precision.
- Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to maintain technological products and systems.

Core Technologies:

Students will demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world.

Indicator Statement: Discuss the functioning and applications of core technologies applied in common technology systems.

Objective(s):

- Describe the core technologies (mechanical, structural, electrical, electronic, thermal, fluid, optical, bio, and material) as they are applied in the designed world.
- Analyze the functioning of the core technologies in the designed world.
- In terms of:
 - common components
 - basic system design
 - safety
 - simple controls
 - system performance evaluation

Indicator Statement: Analyze the functioning and applications of mechanical systems.

Objective(s):

- Identify and describe applications of mechanical technology in the designed world.

Such as:

- Levers
- Inclined planes
- Wedges
- Wheels and axles
- Pulleys
- Screws
- Gears
- Cams
- Linkages

- Explain science concepts and mathematic processes applied in mechanical technology.

Such as:

- Force
- Motion
- Energy
- Work
- Power
- Efficiency
- Gravity
- Friction

Indicator Statement: Analyze the functioning and applications of structural systems.

Objective(s): Identify and describe applications of structural technology in the designed world.

- Such as:

- Post and beam structures
- Frame structures
- Suspension structures
- Cantilever structures
- Mass structures
- Pressurized structures

➤ Explain science concepts and mathematical concepts applied in mechanical technology.

Such as:

- Compression
- Tension
- Efficiency
- Center of gravity

Indicator Statement: Analyze the functioning and applications of materials technology.

Objective(s):

➤ Identify and describe applications of materials technology in the designed world.

Such as:

- Metals
- Alloys
- Nonmetals
- Composites
- Biomaterials

➤ Explain science concepts and mathematical concepts applied in materials technology.

Such as:

- Strength of shapes
- Forces
- Center of gravity
- Moments of inertia
- Stress
- Strain
- Deflection
- Efficiency

Indicator Statement: Analyze the functioning and applications of electrical systems.

Objective(s):

➤ Identify and describe applications of electrical technology in the designed world.

Such as:

- Generators
- Electric motors
- Alarm systems
- Automobile electrical systems

➤ Explain science concepts and mathematical concepts applied in electrical technology.

Such as:

- Measure resistance
- Conduction
- Semi-conduction
- Current (alternating and direct)
- Voltage
- Power
- Circuits
- Magnetism
- Ohm's law
- Ratio

➤ Identify and describe how various types of electric circuits (i.e., series and parallel) provide a means of transferring and using electrical energy to produce heat, light, sound, as well as chemical changes.

➤ Analyze the magnetic effects of current (i.e., electromagnet) and the electric effects of magnets (i.e., motors).

➤ Solve for the unknown in a linear equation related to electrical technology.

Indicator Statement: Analyze the functioning and application of electronic technology systems.

Objective(s):

- Identify and describe applications of electronic technology in the designed world.

Such as:

- Computers
- Telephones
- Radio and television

- Explain science concepts and mathematical concepts applied in electronic technology.

Such as:

- Electromagnetic waves
- Digital logic
- Binary numbers
- Frequency
- Amplification

Indicator Statement: Analyze the functioning and application of thermal technology systems.

Objective(s):

- Identify and describe applications of thermal technology in the designed world.

Such as:

- Thermometer
- Refrigerator
- Furnace
- Air conditioner
- Heat engines

- Explain science concepts and mathematical concepts applied in thermal technology.

Such as:

- Convection
- Conduction
- Radiation
- Insulation
- Efficiency

Indicator Statement: Analyze the functioning and applications of fluid technology systems.

Objective(s):

- Identify and describe applications of fluid technology in the designed world.

Such as:

- Air pumps
- Water pumps
- Automobile brakes
- Airfoils

- Explain science concepts and mathematical concepts applied in fluid technology.

Such as:

- Pressure
- Vacuum
- Volume
- Area
- Ratio

Indicator Statement: Analyze the functioning and application of optical systems.

Objective(s):

- Identify and describe applications of optical technology in the designed world.

Such as:

- Microscope and magnifier
- Laser
- Fiber optics

- Optical telescope
 - Bar code reader
 - Scanner
 - Explain science concepts and mathematical concepts applied in optical technology.
- Such as:

- Light waves
- Frequency
- Period
- Reflection
- Refraction
- Diffraction
- Proportion (direct and indirect)
- Superposition
- Interference

Indicator Statement: Analyze the functioning and application of biotechnology systems.

Objective(s):

- Identify and describe applications of biotechnology in the designed world.
- Such as:

- Genetically modified food
- DNA fingerprinting
- Oil biodegradation
- Insulin production
- Bioethics

- Explain science concepts and mathematical concepts applied in biotechnology.
- Such as:

- Genes
- Genetic code
- DNA structure
- Enzymes
- Proteins
- Cloning
- Mutations
- Chromosome number
- Genetic recombination
- Anaerobic conversion
- Fermentation

The Designed World:

Students will demonstrate knowledge of the major enterprises that produce the goods and services of **the designed world**.

Indicator Statement: Discuss the major enterprises of the designed world.

Objective(s):

- Analyze the major enterprises of the designed world (medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction)

At least - -

- Occupations
- Processes
- Products
- Problems

Indicator Statement: Develop an understanding of medical technologies. (ITEA, STL 14)

Objective(s):

- Explain the functioning and application of medical processes and products.

Such as:

- Prevention and rehabilitation
 - Vaccines and pharmaceuticals
 - Surgical procedures
 - Explain that telemedicine reflects the convergence of technological advances and advances in other fields.
- At least - -

- Medicine
- Telecommunications
- Virtual presence
- Computer engineering

Indicator Statement: Develop an understanding of agricultural and related biotechnologies. (ITEA, STL 15)

Objective(s):

- Explain the production and application of agricultural processes and products.
- Such as:

- Food
 - Fiber
 - Fuel
 - Chemical
 - Explain the- Text application of biotechnology processes and products.
- At least - -

- Agricultural
- Pharmaceuticals
- Food and beverages
- Medicine
- Energy
- Explain that agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
- Research and report on applications of biotechnology such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.

Indicator Statement: Develop an understanding of energy and power technologies. (ITEA, STL 16)

Objective(s):

- Explain the production, conversion, transmission, and application of different forms of energy.
- Such as:

- Mechanical
- Radiant
- Chemical
- Thermal
- Electrical
- Nuclear
- Explain that energy cannot be created nor destroyed; however, it can be converted from one form to another.
- Analyze power systems identifying the source of energy, the process, and loads.

Indicator Statement: Develop an understanding of information and communication technologies. (ITEA, STL 17)

Objective(s):

- Analyze the functioning and applications of information processing machines.
- Such as:
 - Printing
 - Telephone
 - Radio and television
 - Computer
- Explain that information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.

- Identify and describe the parts of a communication system.

At least - -

- Source
- Encoder
- Transmitter
- Receiver
- Decoder
- Destination

Indicator Statement: Develop an understanding of transportation technologies. (ITEA, STL 18)

Objective(s):

- Analyze transportation systems.

Such as:

- Land
- Water
- Air
- Space
- Analyze the role transportation plays in the operation of other enterprises, such as manufacturing, construction, communication, health and safety, and agriculture.
- Explain that intermodalism is the use of different modes of transportation in an interconnected system that moves people and goods.
- Research and report on “smart technologies.”

Indicator Statement: Develop an understanding of manufacturing technologies. (ITEA, STL 19)

Objective(s):

- Analyze manufacturing processes.

At least - -

- Designing
- Development
- Producing
- Servicing
- Describe mechanical processes that change the form of materials.

At least - -

- Separating
- Forming
- Combining
- Conditioning
- Classify manufacturing systems as being customized production, batch production, or continuous production.
- Describe how the interchangeability of parts increases the effectiveness of a manufacturing process.
- Research chemical technologies used to modify or alter chemical substances in the manufacturing process.

At least –

- Synthetic fibers
- Pharmaceuticals
- Plastics
- Fuels

Indicator Statement: Develop an understanding of construction technologies. (ITEA, STL 20)

Objective(s):

- Analyze heavy engineering structures.

Such as:

- Highways
- Rail lines
- Bridges
- Airports

- Canals
- Pipelines
- Power transmission and communication towers
- Hydroelectric and flood control dams
- Analyze types of buildings.

Such as:

- Residential
- Commercial
- Industrial

- Analyze the steps in the construction process.

At least - -

- Preparing the site
- Setting foundations
- Building the framework
- Enclosing the structure
- Installing utilities
- Finishing the interior and exterior
- Completing the site

The Impacts of Technology:

Students will develop abilities to assess the **impacts of technology**.

Indicator Statement: Develop abilities to assess the impacts of products and systems. (ITEA, STL 13)

Objective(s):

- Refine and extend comprehension skills by selecting, reading, analyzing and evaluating a variety of print and electronic texts about products and systems. (VSC Reading Comprehension /Informational Texts)
- Defend and rationalize the development and use of a proposed technology.

At least - -

- Who will have access to the technology?
- Who will control it?
- What are the costs of not developing or using the technology?
- Who will benefit and who will lose by the technology?
- What will the impact of the technology be on my family, my community, and me?

Indicator Statement: Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)

Objective(s):

- Explain that changes in society caused by the use of technology can range from gradual to rapid and from subtle to obvious.
- Explain that decisions about the use of technology involve trade-offs between positive and negative effects.
- Cite instances where ethical considerations have impacted the development, selection, and use of technologies.
- Explain how the transfer of technology from one society to another affects culture, society, economics, and politics.
- Explain situations where technological development has magnified the inequities among peoples and societies.
- Justify the contention that individual citizens have to make informed decisions about the development and use of technology

Indicator Statement: Develop an understanding of the effects of technology on the environment. (ITEA, STL 5)

Objective(s):

- Analyze the relationship between technological processes and natural processes.
- Investigate technologies designed to reduce the negative consequences of other technologies.
- Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.
- Assess the effectiveness of the use of technology to monitor environmental conditions.

Indicator Statement: Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)

Objective(s):

- Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
- Defends the proposition that the evolution of civilization has been directly affected by, and has been in turn affected, the development and use of tools and materials.
- Explain that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
- Analyze the development and use of technology in the pre-agricultural, agricultural, industrial, and information ages.
- Identify and describe instances where societal opinions and demands or corporate interests have influenced the decision to develop a technology.