CTE CONTENT AREA: Technology Education
CONTENT MODULE TITLE: The Nature of Technology

MODULE DESCRIPTION

The Nature of Technology introduces students to understanding technology and how to adapt to an ever-changing world. Humans utilize technologies to modify the world around them to meet their needs and wants. Technology extends human potential by allowing people to do things they could not otherwise do. Technological activity is purposeful and directed towards desired and predictable goals, but sometimes the results are unintended or undesired.

The development of a particular technology is influenced by a variety of factors, including the needs of individuals, groups, and society as a whole, as well as by the existing level of development of related technological components, devices, and systems.

In this module, students will learn about the nature of technology in order to become technologically literate and adaptable. Students will define technology, explore its core concepts, describe the relationships between technologies, and identify how technology impacts human endeavor.

This module is intended as the first of five modules that can be completed in sequence or integrated with content with the other technology modules through laboratory activities and problem-based assignments.

GUIDING QUESTION

What do students need to understand about the nature of technology to prepare them to become technologically literate and adaptable members of society?

MODULE CONTENT

The Nature of Technology
1. The Characteristics and Scope of Technology
   Students will
   a) Identify how a product or system solved human problems or expanded human capabilities through technology
   b) Describe how humans have developed technologies to support individual or collective needs
   c) Evaluate factors that drive human creativity and motivation
   d) Describe and define product demand and how innovators or producers meet that demand
   e) Connect and differentiate between the natural and the human-made world

2. The Core Concepts of Technology

Students will
a) Identify and describe technological system components that include input, process, output, and feedback elements
b) Describe how system components relate to each other in open- and closed-loop systems
c) Analyze how system components can interconnect to one another to create larger and more complex systems
d) Assess how missing components or malfunctions impact the operation of a system
e) Evaluate the tradeoffs of different technologies and compare the compromises between competing factors
f) Describe system maintenance that is required to keep a system operating properly, to keep it operating longer, or to improve its performance

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields
   Students will
   a) Analyze the interaction of systems and the interrelationship of technological environments
   b) Apply knowledge from other fields of study, including science and mathematics, to solve technological problems

4. Career Pathways
   Students will
   a) Explain roles and functions of individuals engaged in technology and STEM careers
   b) Investigate education, training requirements, and opportunities for career paths in technical and STEM fields
   c) Assess personal employability skills for technical careers and evaluate personal suitability for such careers

ILLUSTRATIVE ACTIVITIES by Theme Module

Career and Community Connections
Technology and Engineering Career Exploration
> Students research an occupation in STEM- or STEAM-related fields. Students identify and report on the training, education, skills, and aptitudes necessary to enter a chosen occupation along with the benefits of that occupation to self and society. Products include a poster, a presentation, slides, or a web page.

Communication and Interpersonal Relationships
Communication Collaboration
> Students between different classes or schools engage in a collaborative group project using communication technology. Students evaluate how the communications technology enables them to overcome barriers of differing times and locations. Students identify if there are negative impacts of relying on the communications technologies and if there are problems with which the communications technologies could not assist or could not overcome.

Financial and Consumer Literacy
Product Life Cycle Analysis

Students evaluate a consumer product for its full lifecycle by identifying the cost of the materials and the cost of production, use, and disposal of the product. Students compare those costs to the value of the product to humans and the benefit that the product brings. Students evaluate how the evolution of the product changes how human needs and wants are defined and how the economics of the technology change over time. Examples include costs associated with Internet access, cell phones, and PCs that have seen increased use and capabilities while becoming less expensive over time.

Health, Safety, and Wellness
Invention and Innovation Research

Students identify, research, and report on a technological invention or innovation that has improved human health, safety, or wellness. Students evaluate the benefits that the invention or innovation provides to individuals or societies. Examples of innovations or inventions include vaccines, adaptive technologies, prosthetics, or genetic engineering for plants. Products include a poster, a presentation, slides, or a web page.

Problem Solving and Innovation
Rube Goldberg Machine

Students develop a Rube Goldberg machine that includes the different simple machines to complete a given task by connecting separate components that have been built by different teams. Students analyze the machine as a complex system with subsystems that work together. Groups identify the system components, the connections, interactions, and variations. As a class, students identify where system failures can occur and how they can be prevented.

Sustainability
Hydroponic Plant Growth

Students develop a hydroponic system to grow food plants. Students conduct class experiments to determine how factors such as nutrient content, light levels, time, growing media, and plant spacing affect plant growth. Students identify and document ideal or optimal growing practices. Students compare or integrate alternative growing methods beyond hydroponics, including aeroculture, aquaponics, farm automation, organic farming, or micro-farming.

STANDARDS ADDRESSED

New York State Career Development and Occupational Studies (CDOS) Standards
Intermediate Level
http://www.p12.nysed.gov/cte/
Standard 1: Career Development
Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions.
Standard 2: Integrated Learning
Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings.
Standard 3a: Universal Foundation Skills

Students will demonstrate mastery of the foundation skills and competencies essential for success in the workplace.

Common Career Technical Core Standards
Career Ready Practices https://www.careertech.org/career-ready-practices
1. Act as a responsible and contributing citizen and employee
2. Apply appropriate and academic and technical skills
3. Attend to personal health and financial well-being
4. Communicate clearly and effectively and with reason
5. Consider environmental, social, and economic impacts of decisions
6. Demonstrate creativity and innovation
7. Employ valid and reliable research strategies
8. Utilize critical thinking to make sense of problems and persevere in solving them
10. Plan education and career paths aligned to personal goals
11. Use technology to enhance productivity
12. Work productively in teams while using cultural global competence

International Technology and Engineering Education Association
Standards for Technological Literacy – https://www.iteea.org/39197.aspx
Standard 1: Students will develop an understanding of the characteristics and scope of technology.
Standard 2: Students will develop an understanding of the core concepts of technology.
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields.

RESOURCES

International Technology and Engineering Educators' Association
www.iteea.org

ITEEA is the international organization that represents technology and engineering educators. The organization supports an annual conference and publishes two journals, *Technology and Engineering Educator* and *Journal of Technology Education*. Many resources are available for classroom teachers including Engineering by Design. ITEEA developed and maintains the Standards for Technological Literacy.

New York State Technology and Engineering Educators' Association (NYSTEEA)
www.nysteea.org

NYSTEEA represents Technology and Engineering Educators across New York State. The website includes information on technology content, current developments in Technology and Engineering Education, professional development opportunities, and other resources for technology educators.

eGFI – Engineering Go For It!
http://egfi-k12.org/

Sponsored by the American Society for Engineering Education (ASEE), this site has information for children on engineering careers and a free newsletter for teachers

and students. The full ASEE website is available at ASEE.org

Engineering is Elementary
https://www.eie.org/
This site is sponsored by the Museum of Science in Boston. It includes information on the Engineering Design Process and classroom materials for teachers.

Teach Engineering
https://www.teachengineering.org
This site is sponsored by the University of Colorado and has engineering design curriculum materials.

New York State Department of Labor
New York State Career Zone
https://www.careerzone.ny.gov
Career Zone is a no-cost online career exploration and planning tool developed by the New York State Department of Labor. It offers career and education information on thousands of careers, as well as, self-assessment and career planning tools. Career Zone is appropriate for users from middle school through adult.

United States Department of Labor
CareerOneStop
https://www.careeronestop.org
CareerOneStop is the career, training, and job search website for the U.S. Department of Labor. The website serves job seekers, businesses, students, and career advisors with a variety of free online tools, information, and resources.

Association of Career and Technical Education
Career Planning Guide
https://www.acteonline.org/wp-content/uploads/2018/02/ACTE_CC_Paper_FINAL.pdf
Research has identified middle school as a time when students can benefit the most from career exploration, a process of building self-awareness, learning about potential careers, and developing a plan for reaching future goals.

AdvanceCTE
Middle Level Career Interest Inventory
https://cte.careertech.org/sites/default/files/StudentInterestSurvey-English.pdf
AdvanceCTE provides a Career Interest Inventory worksheet to use with students in helping them identify the potential matches to the 16career clusters available to them.

Career and Technical Education Technical Assistance Center of New York (CTE TAC)
http://nyctecenter.org/
The Career and Technical Education Technical Assistance Center (CTE TAC) operates under a state contract to assist the New York State Education Department (NYSED) in carrying out its mission of improving the quality, access, and delivery of career and technical education through research-based methods and strategies resulting in broader CTE opportunities for all students.