Colorado CTE

STEM (2015): Grades 9, 10, 11, 12, Higher Education

Adopted 2015

Understand and demonstrate the characteristics, scope and core concepts of technology. STCO.01

01. Understand and apply tools, materials and processes. STCO.01.01

a. Apply and create an appropriate process for an assigned situation to solve a real world problem, using tools and materials. STCO.01.01.A

b. Interpret of results of a study, including inferences and predictions. Define and explain the meaning of significance (both practical and statistical). STCO.01.01.B

02. Apply characteristics of technology. STCO.01.02

a. Analyze rate, goal and commercialization of technology through a production process. STCO.01.02.A

03. Use the appropriate technology to determine scope. STCO.01.03

a. Demonstrate the ability to formulate results by the collection and interpretation of data. STCO.01.03.A

04. Identify and apply the core concepts of technology. STCO.01.04

a. Demonstrate the ability to characterize a plan and identify the necessary tools that will produce a technical solution when given a problem statement. STCO.01.04.A

b. Describe the elements of good engineering practice (e.g. understanding customer needs, planning requirements, analysis, using appropriate tools and materials, prototyping, test, evaluation and verification. STCO.01.04.B

c. Effectively use project management techniques (including, but not limited to, time management practices, effective organizational skills, conduct analysis of cost, resources, and production capability and quality practices with continuous improvement. STCO.01.04.C

d. Apply knowledge of scientific development to solve real world technical applications. STCO.01.04.D

Understand and demonstrate the relationships among technologies and the connections between

01. Understand and apply tools, materials and processes. STCO.02.01

a. Apply invention as a process of connecting science, technology and math, along with materials, tools and innovation to create breakthrough devices, tools and systems. STCO.02.01.A

technology and other fields of study. STCO.02

02. Synthesize and apply technological knowledge and advances of science and mathematics. STCO.02.02

a. Develop, communicate, and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects. STCO.02.02.A

b. Use mathematical principals to analyze the application of an existing material or system with the goal of improving and modifying it. STCO.02.02.B

c. Gather, analyze and interpret data on chemical and physical properties of elements (e.g., density, melting point, boiling point, pH, conductivity). STCO.02.02.C

d. Develop, communicate and justify an evidence based scientific explanation regarding the potential or kinetic nature of a type of energy. STCO.02.02.D

e. Use appropriate computation methods that encompasses estimation, calculation, and degree of precision. STCO.02.02.E

f. Find solutions to equations involving power and exponential functions; solve these equations graphically or numerically or algebraically using calculators, graphing utilities or other. STCO.02.02.F

Understand and demonstrate the cultural, social, economic, political and environmental effects of technology. STCO.03

01. Understand and apply tools, materials and processes of technology. STCO.03.01

a. Understand why the management of waste produced from technological systems is an important societal issue. STCO.03.01.A

b. Explain how humans devise technologies to reduce the negative consequence of other technologies. (e.g. expanded use of recycling and new processes such as deconstruction vs. demolition). STCO.03.01.B

02. Demonstrate an understanding of the environmental consequences of technology. STCO.03.02

a. Explain how making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects. STCO.03.02.A

b. Develop an appreciation for the vast relationships in technology and how future developments and society's well being is dependent on how well technology is understood, developed, used and restricted. STCO.03.02.B

03. Understand the impact of technology on cultural, social, economic, and political changes. STCO.03.03

a. Apply the knowledge of natural science and mathematics gained by study, experience and practice applied with creativity and judgment. STCO.03.03.A

b. Think critically, analyze evidence, read graphs, understand logical arguments, detect logical fallacies, test conjectures, evaluate risks, and appreciate the role mathematics plays in the modern world, i.e., be quantitatively literate. STCO.03.03.B

Understand and demonstrate the influence of technology on history and the societal role in the development and use of technology. STCO.04

01. Understand and apply tools, materials and processes of technology. STCO.04.01

a. Develop an understanding of the factors that drive technological development (e.g. social and cultural priorities as well as the acceptance and use of products and systems). STCO.04.01.A

b. Trace the development and use of tools and materials through the evolution of civilization. STCO.04.01.B

02. Explain the evolution of techniques, measurement, and resources. STCO.04.02

a. Understand that the design and construction of structures have evolved from the development of techniques for measurement, controlling systems, and the understanding of special relationships. STCO.04.02.A

b. Understand that just as the Iron Age was defined by the use of iron, the information age is evolving the use of information as a resource. STCO.04.02.B

03. Understand how development is driven by demands, values, and interests. STCO.04.03

a. Chronicle technology development throughout history and the forces that were apparent during the historical timeline from the Iron Age to the Information Age. STCO.04.03.A

b. Identify factors that contribute to the design and demand for various technologies (e.g. economy, fads, and advertising). STCO.04.03.B

04. Explain the acceptance and use of products and systems. STCO.04.04

a. Learn that most technological development has been evolutionary, the result a series of refinements to a basic invention. STCO.04.04.A

05. Apply the process of inventions and innovations. STCO.04.05

a. Identify changes in society and the creation of new needs and wants to the process of invention and innovation. STCO.04.05.A

Develop and demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. STCO.05

01. Understand and apply tools, materials and processes of technology. STCO.05.01

a. Recognize the multidisciplinary approach in solving technological problems. STCO.05.01.A

b. Gather, analyze and interpret data on the quantity of energy in a system or object using appropriate measurements, equations and graphs. STCO.05.01.B

c. Develop an understanding of counting techniques to solve problems in real world contexts. STCO.05.01.C

02. **Implement trouble shooting techniques in problem solving.** STCO.05.02

- a. Gather knowledge to correct issues relevant to use and preventative maintenance. (the noisy belt, leaking window, screws to repair human joints, Hubble telescope). STCO.05.02.A
- b. Analyze and interpret prior knowledge of tools, materials and processes to create a plan of action. STCO.05.02.B
- c. Gather, analyze and interpret data and graphs regarding position, velocity and acceleration of moving objects. STCO.05.02.C
- d. Develop new ideas to solve and eliminate recurring issues. STCO.05.02.D

03. **Apply research and development in problem solving.** STCO.05.03

- a. Apply a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace. STCO.05.03.A
- b. Utilize research in solving technological problems. STCO.05.03.B
- c. Evaluate the efficiency of a variety of energy transformations. STCO.05.03.C
- d. Demonstrate the relationship between all representations of linear functions using point-slope, slope-intercept, and standard form of a line through tables, graphs, symbols, text, and geometric models. STCO.05.03.D
- e. Categorize sequences as arithmetic, geometric, or neither and develop formulas for the general terms related to arithmetic and geometric sequences using tables, graphs, symbols, text, and geometric models. STCO.05.03.E

04. **Clarify the meanings of invention and innovation.** STCO.05.04

- a. Understand community and environmental needs and their long-term impact. (i.e., not in my back yard vs. imminent domain). STCO.05.04.A
- b. Understand the definitions of invention and innovation. (i.e., Invention is a process of turning ideas and imagination into devices and systems and Innovation is the process of modifying an existing product or system to improve it). STCO.05.04.B

Understand and demonstrate the attributes of design by applying the design process and assessing the impact of bringing a product to market. STCO.06

01. **Understand and apply tools, materials and processes of technology.** STCO.06.01

- a. Use tools to manipulate materials through the design cycle. STCO.06.01.A
- b. Apply criteria and constraints of materials, processes and tools to a design. STCO.06.01.B

02. **Use the attributes of design.** STCO.06.02

- a. Understand that design is a creative planning process that leads to useful products and systems. STCO.06.02.A
- b. Explain how the requirements of a design, such as criteria, constraints, and efficiencies sometimes compete with each other. STCO.06.02.B

03. Utilize the design process. STCO.06.03

a. Demonstrate the design process by defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, and exploring possibilities. STCO.06.03.A

b. Select an approach, develop a design proposal, make a model or prototype, test and evaluate the design using specifications, refine the design, create or make it, and communicate processes and results. STCO.06.03.B

c. Understand that the design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. STCO.06.03.C

04. Understand the impact of products. STCO.06.04

a. Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment. STCO.06.04.A

b. Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology. STCO.06.04.B

Understand and demonstrate engineering design by applying the design process and assessing the impact of systems. STCO.07

01. Understand and apply tools, materials and processes of technology. STCO.07.01

a. Use tools to evaluate and select materials and processes for the design cycle. STCO.07.01.A

02. Use engineering principles. STCO.07.02

a. Understand that modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. STCO.07.02.A

b. Explain that it involves the knowledge of the mathematical and natural sciences that are gained by study, experience and practice. STCO.07.02.B

03. Understand the engineer's role in the design process. STCO.07.03

a. Understand the engineering profession has developed well tested sets of rules and design principles that provide a systematic approach as well as an ability to quantify the design process in order to improve efficiency. STCO.07.03.A

b. Demonstrate the ability to collaborate and work effectively with others. STCO.07.03.B

c. Use teamwork and leadership skills effectively. STCO.07.03.C

04. Understand the impact of systems. STCO.07.04

a. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. STCO.07.04.A

b. Use verbal and non verbal techniques to communicate information. STCO.07.04.B

Apply tools, materials and processes to manipulate and connect our designed world through the technology areas. STCO.08

01. **Understand and demonstrate the knowledge and skills required in Biotechnology.** STCO.08.01
    a. Identify and distinguish among medical technologies used in prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained. STCO.08.01.A

02. **Understand and demonstrate the knowledge and skills required in Agriculture.** STCO.08.02
    a. Demonstrate an understanding that agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food and beverages, medicine, energy, the environment and genetic engineering. STCO.08.02.A

03. **Understand and demonstrate the knowledge and skills required in Power and Energy.** STCO.08.03
    a. Differentiate among the major forms of power to determine the optimal source for solving a real world application (thermal, radiant, electrical, mechanical, chemical, nuclear, renewable and non renewable). STCO.08.03.A
    b. Understand that power systems must have a source of energy, a process and loads. STCO.08.03.B

04. **Understand and demonstrate the knowledge and skills required in Communication.** STCO.08.04
    a. Demonstrate how information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine. STCO.08.04.A
    b. Use technological knowledge and processes to communicate using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. STCO.08.04.B

05. **Understand and demonstrate the knowledge and skills required in Transportation.** STCO.08.05
    a. Understand the role that transportation plays in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture. STCO.08.05.A
    b. Explain how the design of intelligent and non-intelligent transportation systems depend on many processes and innovative techniques. STCO.08.05.B
    c. Demonstrate how transportation vehicles utilize subsystems that function together for the system to work effectively (e.g., structural propulsion, suspension, guidance, control, and support). STCO.08.05.C

06. **Understand and demonstrate the knowledge and skills required in Manufacturing.** STCO.08.06

- a. Identify types of manufacturing systems, (i.e. customized production, batch production, and continuous production). STCO.08.06.A
- b. Categorize durable goods and non-durable goods. STCO.08.06.B
- c. Differentiate among the individual qualities of materials (i.e., natural, synthetic, or mixed). STCO.08.06.C
- d. Demonstrate how a mass production system and/or an assembly line incorporate interchangeable parts that increase the efficiency of the outcome. STCO.08.06.D

07. **Understand and demonstrate the knowledge and skills required in Construction.** STCO.08.07

- a. Distinguish and explain how buildings and structures generally contain a variety of subsystems as well as a subsystem of large infrastructures STCO.08.07.A
- b. Explain the interchangeable systems of structural innovations. STCO.08.07.B
- c. Demonstrate sustainable practices used in modern construction. STCO.08.07.C

Understand and demonstrate the importance of health, safety and environmental management systems in organizations and the importance of professional ethics and legal responsibilities. STCO.09

01. **Develop an awareness of and apply safety, health and environmental practices using ethical and legal standards.** STCO.09.01

- a. Apply appropriate safety and health practices when developing plans, projects, processes, or solving complex problems (e.g., OSHA, Fire Codes, Hazmat, etc). STCO.09.01.A
- b. Identify existing or potential hazards to existing or assigned plans, projects or processes STCO.09.01.B
- c. Apply ethical and legal standards as they pertain to projects. STCO.09.01.C