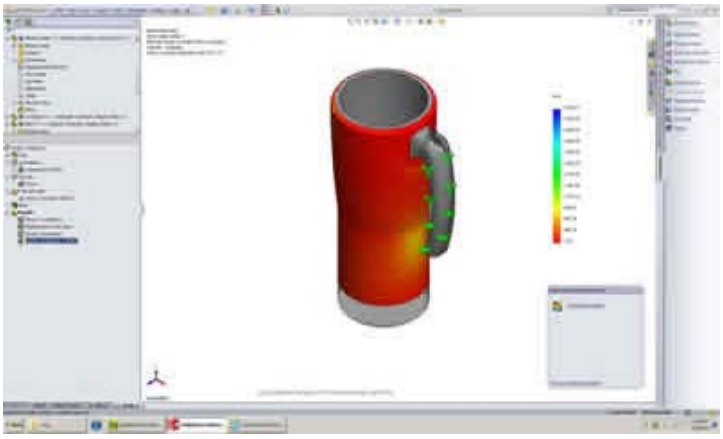
Boulder Valley School District
Excellence and Equity

High School Industrial Design Curriculum Essentials Document



Boulder Valley School District
Department of CTEC
October 2011

Introduction

Everything around us, outside of nature, had to be designed by someone. The chairs we sit on, the clothes we wear, the products we use in our day to day lives, each of these require some though and intent went into their production and implementation. This class takes the technical skills learned in CAD and adds in the creative component of problem solving and product design.

Industrial Design Overview

Course Description

Industrial Design takes the student with drafting core knowledge, and puts focus on the design phase. This is a process which takes an idea from the mind and puts a product in the hand. This class will also place a secondary focus on the expansion of their CAD knowledge and the use of the program to design machines to solve problems. There is a fee for materials used and there is some work expected out of class as well.

Assessments

- Projects
- Physical manufactured products

Topics at a Glance

- 3D Solid Modeling Review
- Assemblies
- 2D Drawing Files
- Design Process
- Static Design Analysis
- Thermal Analysis
- Animation and photorealistic rendering of designs
- Materials
- Manufacturing process

Prepared Graduates

The preschool through twelfth-grade concepts and skills that all students who complete the Colorado education system must master to ensure their success in a postsecondary and workforce setting.

1. CTE Essential Skills: Academic Foundations

ESSK.01: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Complete required training, education, and certification to prepare for employment in a particular career field
- Demonstrate language arts, mathematics, and scientific knowledge and skills required to pursue the full range of post-secondary and career opportunities

2. CTE Essential Skills: Communications Standards

ESSK.02: Use oral and written communication skills in creating, expressing, and interrupting information and ideas, including technical terminology and information

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice
- Demonstrate use of concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication in the workplace

3. CTE Essential Skills: Problem Solving and Critical Thinking

ESSK.03: Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams using creativity and innovation.

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Employ critical thinking skills independently and in teams to solve problems and make decisions
- Employ critical thinking and interpersonal skills to resolve conflicts with staff and/or customers
- Conduct technical research to gather information necessary for decision-making

4. CTE Essential Skills: Safety, Health, and Environmental

ESSK.06: Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Implement personal and jobsite safety rules and regulations to maintain safe and helpful working conditions and environment
- Complete work tasks in accordance with employee rights and responsibilities and employers obligations to maintain workplace safety and health

5. CTE Essential Skills: Leadership and Teamwork

ESSK.07: Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Employ leadership skills to accomplish organizational skills and objectives

6. CTE Essential Skills: Employability and Career Development

ESSK.09: Know and understand the importance of employability skills; explore, plan, and effectively manage careers; know and understand the importance of entrepreneurship skills

Prepared Graduate Competencies in the CTE Essential Skills standard:

- Indentify and demonstrate positive work behaviors and personal qualities needed to be employable
- Develop skills related to seeking and applying for employment to find and obtain a desired job

COLORADO COMMUNITY COLLEGE SYSTEM CAREER & TECHNICAL EDUCATION TECHNICAL STANDARDS REVISION & ACADEMIC ALIGNMENT PROCESS

Colorado's 21st Century Career & Technical Education Programs have evolved beyond the historic perception of vocational education. They are Colorado's best kept secret for:

- Relevant & rigorous learning
- Raising achievement among all students
- Strengthening Colorado's workforce & economy

Colorado Career & Technical Education serves more than 116,000 Colorado secondary students annually through 1,200 programs in 160 school districts, 270 High Schools, 8 Technical Centers, 16 Community Colleges & 3 Technical Colleges. One of every three Colorado high school students gains valuable experiences by their enrollment in these programs.

ALIGNMENT REQUIRED BY SB 08-212

22-7-1005. Preschool through elementary and secondary education - aligned standards - adoption - revisions.

2(b): In developing the preschool through elementary and secondary education standards, the State Board shall also **take into account any Career & Technical Education standards** adopted by the State Board for Community Colleges and Occupational Education, created in Section 23-60-104, C.R.S., and, **to the extent practicable**, shall **align the appropriate portions of the preschool through elementary and secondary education standards with the Career and Technical standards.**

STANDARDS REVIEW AND ALIGNMENT PROCESS

Beginning in the fall of 2008, the Colorado Community College System conducted an intensive standards review and alignment process that involved:

NATIONAL BENCHMARK REVIEW

Colorado Career & Technical Education recently adopted the Career Cluster and Pathway Model endorsed by the United State Department of Education, Division of Adult and Technical Education. This model provided access to a national set of business and industry validated knowledge and skill statements for 16 of the 17 cluster areas. California and Ohio provided the comparative standards for the Energy cluster

- Based on this review Colorado CTE has moved from program-specific to Cluster & Pathway based standards and outcomes
- In addition, we arrived at fewer, higher, clearer and more transferrable standards, expectations and outcomes.

COLORADO CONTENT TEAMS REVIEW

The review, benchmarking and adjusting of the Colorado Cluster and Pathway standards, expectations and outcomes was through the dedicated work of Content Teams comprised of secondary and postsecondary faculty from across the state. Participation by instructors from each level ensured competency alignment between secondary and postsecondary programs. These individuals also proposed the draft academic

alignments for math, science reading, writing and communication, social studies (including Personal Financial Literacy) and post secondary and workforce readiness (PWR.)

ACADEMIC ALIGNMENT REVIEW

In order to validate the alignment of the academic standards to the Career & Technical Education standards, subject matter experts in math, science, reading, writing and communication, and social studies were partnered with career & technical educators to determine if and when a true alignment existed.

CURRENT STATUS

• One set of aligned Essential skills to drive Postsecondary and Workforce Readiness inclusion in all Career & Technical Education programs.

• 52 pathways with validated academic alignments

• 12 pathways with revised standards ready for alignment (currently there are no approved programs in these pathways)

• 21 pathways where no secondary programming currently exists. Standards and alignments will be developed as programs emerge.

• Available for review at: www.coloradostateplan.com/content_standards.htm

Colorado Career & Technical Education Standards Academic Alignment Reference System

The Career & Technical Education standards have been organized by Career Cluster (17) and Pathway (81). In addition, a set of "Essential Skills" was developed to ensure the Postsecondary and Workforce Readiness within any cluster or pathway. These workforce readiness skills are applicable to all career clusters and should form the basis of each CTE program.

Organization

Essential Skills
There exists a common set of knowledge and skills that are applicable to all students regardless of which cluster or pathway they choose. This set of standards, is meant for inclusion in each program to enhance the development of postsecondary and workforce readiness skills.

Career Cluster
A Career Cluster is a grouping of occupations and broad industries based on commonalities. The 17 Career Clusters organize academic and occupational knowledge and skills into a coherent course sequence and identify pathways from secondary schools to two- and four-year colleges, graduate schools, and the workplace. Students learn in school about what they can do in the future. This connection to future goals motivates students to work harder and enroll in more rigorous courses.

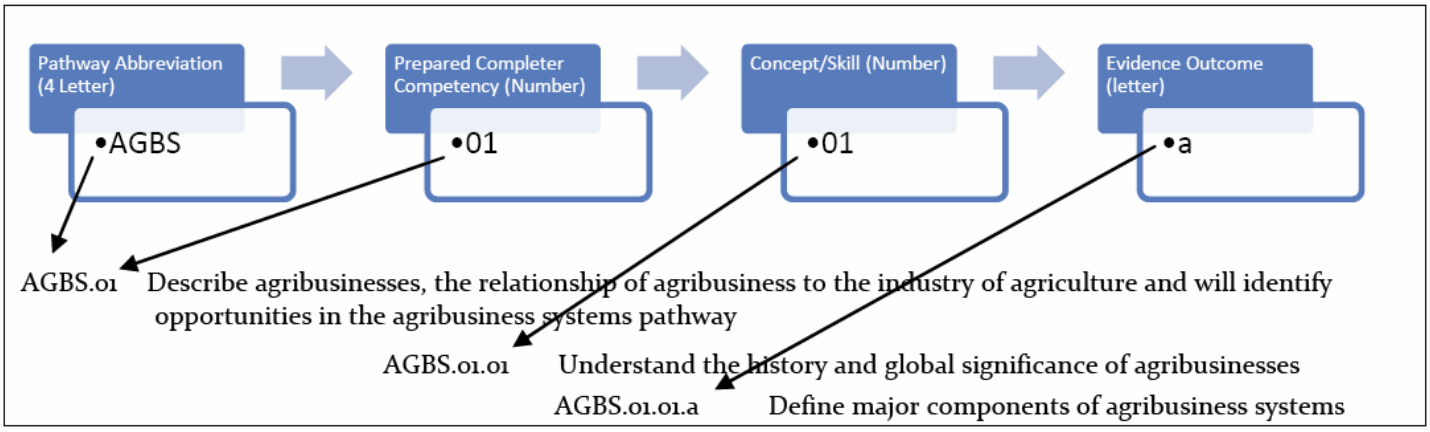
Career Pathway
Pathways are sub-groupings of occupations/career specialties used as an organizing tool for curriculum design and instruction. Occupations/career specialties are grouped into Pathways based on the fact that they require a set of common knowledge and skills for career success.

Prepared Completer Competency
This level targets the "big ideas" in each pathway. These are the competencies that all students who complete a CTE pathway must master to ensure their success in a postsecondary and workforce setting. Prepared Completer Competencies will not usually be "course" specific but grow with the student's progression through the sequence of courses.

Concept/ Skill
The articulation of the concepts and skills that indicates a student is making progress toward being a prepared completer. They answer the question: *What do students need to know and be able to do?*

Evidence Outcome
The indication that a student is meeting an expectation at the mastery level. *How do we know that a student can do it?*

CTE Standards Numbering System



Academic Alignments

Academic alignments, where appropriate in Math, Reading, Writing and Communication, Science and Social Studies (including Personal Financial Literacy) were defined by CTE and academic subject matter experts using the following criteria:

• It was a point where technical and academic content naturally collided;

• The student must demonstrate adequate proficiency with the academic standard to perform the technical skill; and

• It could be assessed for both academic and technical understanding.

Colorado's CTE programs have had academic alignments dating back to the early 1990's. While these alignments resulted in an increase in academic focus in CTE programs, the reality is that a true transformation in intentional teaching toward the academic standard was limited.

With these alignments comes a new expectation: If a CTE instructor is teaching a CTE concept that has an identified alignment, they must also be intentional about their instruction of the academic standard. CCCS will be providing professional development and instructional resources to assist with the successful implementation of this new expectation. In addition, this expanded expectation will require increased collaboration between CTE and academic instructors to transform teaching and learning throughout each school.

For each set of Cluster and Pathway standards, the academic alignments have been included and are separated by academic area. CCCS chose to align at the "Evidence Outcome" level. The aligned academic evidence outcome follows the CTE evidence outcome to which it has been aligned. For a sample, see Illustration A.

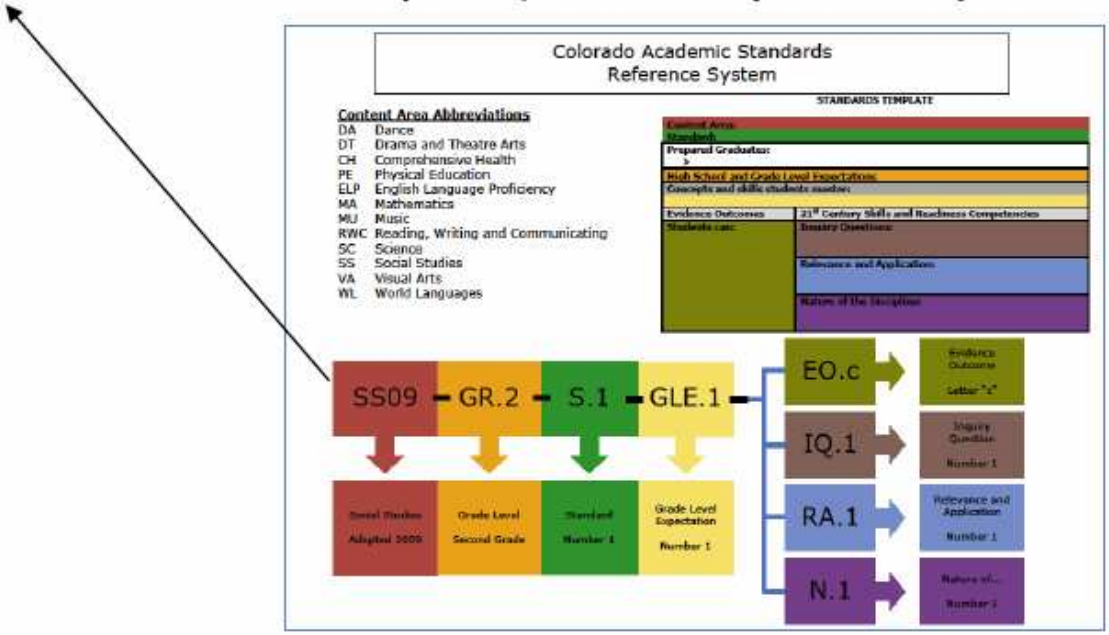
Illustration A

AGBS.01 The student will describe agribusinesses, the relationship of agribusiness to the industry of agriculture and will identify opportunities in the agribusiness systems pathway

AGBS.01.01 The student will understand the history and global significance of agribusinesses

AGBS.01.01.b Define the major trends and relationship of agribusiness to global agriculture production

MA10-GR.HS-S.1-GLE.2-EO.a Reason quantitatively and use units to solve problems (CCSS: N-Q)



The academic standard number used in the alignments matches the Colorado Department of Education standards numbering convention.

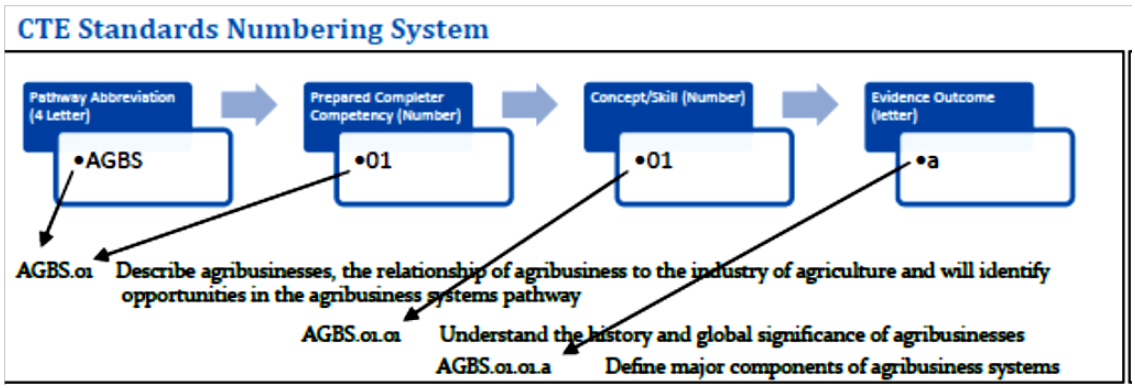
Career Pathway Abbreviations

Sector	Career Cluster	Career Pathway	Abbreviation
Agriculture, Natural Resources and Energy	Agriculture and Natural Resources Cluster	Agriculture and Natural Resources Cluster	AGCL
	Agriculture and Natural Resources Cluster	Agribusiness Systems Pathway	AGBS
	Agriculture and Natural Resources Cluster	Animal Science Pathway	ANSC
	Agriculture and Natural Resources Cluster	Food Products and Processing Systems Pathway	FPPS
	Agriculture and Natural Resources Cluster	Natural Resources and Environmental Systems Pathway	NRES
	Agriculture and Natural Resources Cluster	Plant Science Pathway	PLSC
	Agriculture and Natural Resources Cluster	Power Structural and Technical Systems Pathway	PSTS
	Energy Cluster	Energy Efficiency & Environmental Technology	EEET
	Energy Cluster	Renewable Energy Production	RNEP

	Energy Cluster	Electrical Energy Transmission & Distribution	ELTD
	Energy Cluster	Electromechanical Generation & Maintenance	EMGN
	Energy Cluster	Fossil Energy Extraction, Processing & Distribution	FSEP
Business, Marketing, Government and Public Administration	Finance Cluster	Accounting Pathway	FIAC
	Finance Cluster	Banking Services Pathway	FIBS
	Finance Cluster	Corporate Finance Pathway	FICF
	Finance Cluster	Insurance Pathway	FIIN
	Finance Cluster	Securities and Investments Pathway	FISI
	Government and Public Administration Cluster	Foreign Service Pathway	GPFS
	Government and Public Administration Cluster	Governance Pathway	GPAG
	Government and Public Administration Cluster	Planning Pathway	GPAP
	Government and Public Administration Cluster	Public Management and Administration Pathway	GPMA
	Government and Public Administration Cluster	Regulation Pathway	GPAR
	Government and Public Administration Cluster	Revenue and Taxation Pathway	GPRT
	Management and Administration Cluster	Administrative Services Pathway	MAAS
	Management and Administration Cluster	Business Information Technology Pathway	MAIT
	Management and Administration Cluster	Corporate/General Management Pathway	MAGM
	Management and Administration Cluster	Human Resource Management Pathway	MAHR
	Management and Administration Cluster	Operations Management Pathway	MAOM
	Marketing Cluster	Marketing Communications Pathway	MKTC
	Marketing Cluster	Marketing Management Pathway	MKMN
	Marketing Cluster	Marketing Research Pathway	MKMR
	Marketing Cluster	Merchandising Pathway	MKME
	Marketing Cluster	Professional Sales/Sales Management Pathway	MKPS
Postsecondary and Workforce Readiness	Academic & Career Success	ACE	ESSK
	Academic & Career Success	World of Work	WOWR
Health Science, Criminal Justice and Public Safety	Health Science Cluster	Therapeutic Services Pathway	THSR
	Law, Public Safety, Corrections, & Security	Emergency and Fire Management Services Pathway	EMFM
	Law, Public Safety, Corrections, & Security	Law Enforcement Services Pathway	LEAS

Hospitality, Human Services and Education (Family and Consumer Sciences)	Education & Training Cluster	Teaching and Training Pathway	TCTR
	Hospitality and Tourism Cluster	Restaurants and Food and Beverage Services Pathway (Culinary Arts)	CULA
	Hospitality and Tourism Cluster	Restaurants and Food and Beverage Services Pathway (Catering)	CATR
	Human Service Cluster	Early Childhood Development Pathway (Child & Adolescent Development)	CADV
	Human Service Cluster	Family and Community Services Pathway (Nutrition and Wellness)	NUWL
	Human Service Cluster	Family and Community Services Pathway (Food Science, Dietetics and Nutrition)	FSDN
	Human Service Cluster	Family and Community Services Pathway (Life Management)	LMGT
	Human Service Cluster	Family and Community Services Pathway (Relationships)	RELA
	Human Service Cluster	Personal Care Services Pathway (Cosmetology)	PCSP
Skilled Trades and Technical Sciences	Architecture and Construction Cluster	Construction Pathway	CONP
	Architecture and Construction Cluster	Design and Pre-Construction Pathway	DPCP
	Architecture and Construction Cluster	Maintenance and Operations Pathway	MOPP
	Manufacturing Cluster	Maintenance, Installation and Repair Pathway	MIRP
	Manufacturing Cluster	Manufacturing Production Pathway	MPRP
	Transportation, Distribution, and Logistics Cluster	Facility and Mobile Equipment Maintenance Pathway	FEMP
	Transportation, Distribution, and Logistics Cluster	Logistics, Planning and Management Services Pathway	LPMP
	Transportation, Distribution, and Logistics Cluster	Sales and Service Pathway	TSSP
	Transportation, Distribution, and Logistics Cluster	Transportation/Systems Infrastructure Pathway	TROP
	Transportation, Distribution, and Logistics Cluster	Warehousing and Distribution Center Operations Pathway	WDOP
STEM, Arts, Design and IT	Arts, A/V Technology and Communication Cluster	ARTS CORE CLUSTER	ARCO
	Arts, A/V Technology and Communication Cluster	Audio/Video Technology and Film Pathway	AVTF
	Arts, A/V Technology and Communication Cluster	Journalism and Broadcasting Pathway	COJB
	Arts, A/V Technology and Communication Cluster	Performing Arts Pathway-Dance, Music, Theatre & Playwriting	ARPA
	Arts, A/V Technology and Communication Cluster	Performing Arts Pathway-Technical Theatre Design & Production	ARTT

	Arts, A/V Technology and Communication Cluster	Printing/Publishing Pathway	COPP
	Arts, A/V Technology and Communication Cluster	Visual and Design Arts Pathway	ARVD
	Arts, A/V Technology and Communication Cluster	Visual and Design Arts Pathway (Interior Design)	INTD
	Arts, A/V Technology and Communication Cluster	Visual and Design Arts Pathway (Fashion Design and Merchandising)	FDAM
	Information Technology Cluster	IT CORE CLUSTER	ITCO
	Information Technology Cluster	Interactive Media Pathway	ITIM
	Information Technology Cluster	Network Systems Pathway & Telecommunications	ITNT
	Information Technology Cluster	Programming and Software Engineering Pathway	ITPR
	STEM Cluster	STEM Cluster Standards	STCO



Industrial Design

STCO.**04** 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.b** Trace the development and use of tools and materials through the evolution of civilization.

STCO.**04.02** 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.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.**04.03** 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.b** Identify factors that contribute to the design and demand for various technologies (e.g. economy, fads, and advertising).

STCO.**04.04** 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.**04.05** 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.**05** 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.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.c** Develop an understanding of counting techniques to solve problems in real world contexts.

STCO.**05.02** 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.b** Analyze and interpret prior knowledge of tools, materials and processes to create a plan of action.

STCO.**05.02.c** Gather, analyze and interpret data and graphs regarding position, velocity and acceleration of moving objects.

STCO.**05.02.d** Develop new ideas to solve and eliminate recurring issues.

STCO.**05.03** 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.b** Utilize research in solving technological problems.

STCO.**05.03.c** Evaluate the efficiency of a variety of energy transformations.

STCO.**05.03.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.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.**05.04** 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.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.**06** 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.b** Apply criteria and constraints of materials, processes and tools to a design.

STCO.**06.02** 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.b** Explain how the requirements of a design, such as criteria, constraints, and efficiencies sometimes compete with each other.

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

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

STCO.**07** 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.**07.02** 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.b** Explain that it involves the knowledge of the mathematical and natural sciences that are gained by study, experience and practice.

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

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

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

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

STCO**.08.06** 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.b** Categorize durable goods and non-durable goods.

STCO**.08.06.c** Differentiate among the individual qualities of materials (i.e., natural, synthetic, or mixed).

STCO**.08.06.d** Demonstrate how a mass production system and/or an assembly line incorporate interchangeable parts that increase the efficiency of the outcome.

STCO**.08.07** 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.b** Explain the interchangeable systems of structural innovations.

STCO**.08.07.c** Demonstrate sustainable practices used in modern construction.

MOPP**.01** Technical Skills: Use the technical knowledge and skills required to pursue the targeted careers for all pathways in the career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.

MOPP**.01.01** Read, interpret, and use technical drawings, documents, and specifications to plan a project.

MOPP**.01.01.a** Interpret drawings used in project planning.

MOPP**.01.01.b** Use architect's plan, manufacturer's illustrations and other materials to communicate specific data and visualize proposed work.

MOPP**.01.02** Use and maintain appropriate tools, machinery, equipment, and resources to accomplish project goals.

MOPP**.01.02.a** Select tools, machinery, equipment, and resources that match requirements of the job.

MOPP**.01.02.b** Identify sources of information concerning state-of-the-art tools, equipment, materials, technologies and methodologies.

MOPP**.01.02.c** Demonstrate use of tools, machinery, equipment and other resources commonly used in design and construction.

Design Tech II Academic Vocabulary

Word	Definition
BOM	Bill of materials. A table that lists the components of a route, such as connectors, clips and coverings.
Cable	An electrical cable that has two or more conductors, called cores, bundled together.
Centerline	A geometrical line running through the center of a route.
Component	A part,or subassembly.
Conduit	In electrical applications, a rigid or flexible pipe that is used to channel wires or cable.
Connection point (CPoint)	A point in a fitting (flange, elbow, electrical connector, and so on) where a routing segment (pipe, tube, or cable) begins or ends.
Connector table	A table that lists the pins and associated wires for the selected connectors.
Core	A single wire strand. It can be by itself or in a cable that has two or more wires.
Covering	Material such as insulation or split sleeves placed on routed items to protect them.
Cut list	A table that lists conductor-wire identification, color, length, and from-to information. Also used for other routing applications.
Design table	A table with size data that controls the dimensions in the configurations of the fittings. In addition, it controls the parameters of the connection points for each configuration. See *SolidWorks Help*: *Creating a Design Table*.
Element	Markup tag in an .xml file. You can assign values to attribute files.
Fittings	Parts that make connections, such as elbows or flanges.
Flattened route	A flattened configuration of a 3D model used in electrical design.
Formboard	A template used in a factory for manufacturing purposes, for example to lay out cables for a harness.
From-To list	A spreadsheet that defines connection data for each wire in a cable assembly, and the components to which the wires connect.
Hardware	Parts such as clips and brackets used to fasten or secure pipes, tubes, or cables. This class also includes supports and hangers.
In-line fitting	Fittings such as reducers, valves, or tees that are added along the line of a routing assembly component.
Mates	Geometric relationships and constraints between assembly components. See *SolidWorks Help*: *Mates Overview*.
Nozzle	A connection for a pipe or tube on a piece of equipment. See also Port.
Piping Isometric	A schematic drawing, typically A3 or A4 in size, that defines all the information required to manufacture a pipe. A piping isometric usually shows an unscaled isometric view that uses symbols for the fittings and includes dimensions, a BOM, and sometimes additional manufacturing data.
Port	The point at which a pipe attaches to a piece of equipment or a part. You must include a connection point (CPoint) or a mate reference at each port. Include mate references with pipe fittings, such as flanges.
Raw stock	Pipe, tube or cable material purchased from a supplier. See also Stock length.
Routable	A term used to refer to any object that can be routed, such as pipe, tube, etc.
Route	The path that a pipe or other routable takes between parts and equipment. A route can exist between several objects in a model. Also,**to route,**the act

	of creating a route. See also Segment, route.
Route assembly	An assembly document that contains the design information for a route. It is similar to a typical assembly document, but contains information that is used only for routing. Routing assembly documents are created as subassemblies within the context of a larger design assembly.
Route point (RPoint)	A point in a fitting (flange, elbow, electrical connector, and so on) that is used to position the fitting at an intersection or endpoint in the route sketch.
Route properties	The default attributes that are used for new route segments. They include templates, pipe and elbow options, and cable diameter.
Route segment properties	The attributes of a route segment, such as diameter, specification, pipe file and configuration. See also Route properties.
Routing template	A template in the Routing Library Manager you can customize to set company standards for components used in routing.
Segment, route	A portion or branch of a route. It can include more than one sketch segment. A route segment has the same properties along its entire length.
Segment, sketch	A sketch entity, such as a line, arc, or spline.
SolidWorks Content	An area in the Design Library that contains additional piping, tubing, routing, and weldments parts and assemblies that are ready to use with SolidWorks Routing. The models are bundled as .zip files for easier access.
Specification	The set of attribute values for a project to which parts, equipment and routables are designed to conform, for example, wall thickness or material.
Standard cable	A cable with a connector at each end, such as a power lead. Typically a purchased part, the cable has a fixed length and a fixed part number.
Standard tube	A tube or hose with a fixed length and a fitting at each end.
Stock length	A standard length of pipe or tube. Two or more lengths of pipe can be joined for longer lengths.