Massachusetts Department of Elementary & Secondary Education

Office for Career/Vocational Technical Education

Vocational Technical Education Framework

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Construction Occupational Cluster

Painting & Design Technologies (VPAINT)

CIP Code 460408

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Massachusetts Department of Elementary and Secondary Education
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Table of Contents

Acknowledgements

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Mitchell D. Chester, Ed.D.
Commissioner

July 2014

Dear Colleagues,

I am pleased to present to you the *Massachusetts Vocational Technical Education Frameworks,* adopted by the Department of Elementary and Secondary Education in June 2014. These frameworks, one for each of the 44 vocational technical programs, include standards in multiple strands representing all aspects of the industries that students in the vocational technical education program are preparing to enter.

The frameworks also include a crosswalk between the technical standards and relevant standards in Massachusetts Curriculum Frameworks to support effective integration of academic and technical content.

The comments and suggestions received during revision of the 2007 *Massachusetts Vocational Technical Education Frameworks* have strengthened these frameworks. We will continue to work with schools and districts to implement the 2014 *Massachusetts Vocational Technical Education Frameworks* over the next several years, and we encourage your comments.

I want to thank everyone who worked with us to create challenging learning standards for Massachusetts students. I am proud of the work that has been accomplished.

Sincerely,

Mitchell D. Chester, Ed.D.
Commissioner of Elementary and Secondary Education

Introduction

Overview & Organization and Key Changes

Overview

The Massachusetts Department of Elementary and Secondary Education understands the necessity of maintaining current Vocational Technical Education Frameworks which ensure career/vocational technical education students across the Commonwealth are taught the most rigorous standards aligned to the needs of business and industry.

With the advent of the Massachusetts Teaching & Learning System the Office for Career/Vocational Technical Education (CVTE) recognized the significance of including career/vocational technical education in the system and developed a comprehensive plan for including vocational technical education. The plan was designed in a Two Phase Process. Phase One included the revision of strands two, three, and six, of all of the Vocational Technical Education Frameworks. Phase Two consisted of three major components (projects) all equally crucial;

1. The revision of Strands One, Four, and Five to complete the revision of all six strands of the Vocational Technical Education Frameworks;

2. Statewide Professional Development on all revised strands, with training on strands two, three, and six delivered fall 2013, and training on strands one, four, and five delivered spring 2014;

3. The creation and development of additional Model Curriculum Unit (MCU) Teams.

The Office for Career/Vocational Technical Education Framework Team, with support from consultants, began Phase One in the 2012-2013 school year, to revise three of the six strands contained in all of the Vocational Technical Education (VTE) Frameworks. The state was organized into "Collaborative Partnerships" comprised of teams of project administrators, highly qualified subject matter educators, and business and industry partners, whose task was to revise Strand Two – Technical, Strand Three – Embedded Academics, and Strand Six – Technology Literacy. Each team met with a vocational advisory committee which included business and industry representatives and postsecondary education professionals, whose mission was to review and revise the team's draft document during the revisionary process. Once strand two was revised, academic teachers (typically one English Language Arts teacher, one Mathematics teacher, and one Science teacher) worked with the technical subject matter teachers to develop a crosswalk between academic curricula standards and the technical standards, and provided examples of embedded academic content.

The Office for Career/Vocational Technical Education solicited statewide input from technical and academic teachers and administrators at the annual Massachusetts Association of Vocational Administrators (MAVA)/Massachusetts Vocational Association (MVA) - Connecting for Success Conference. Each framework team met with their content colleagues and reviewed the draft revisions and obtained valuable feedback. Additionally, all drafts were reviewed and revised by the Massachusetts Vocational Technical Teacher Testing Program, to ensure appropriate measurable language.

Project consultants designed a new template to ensure all framework teams entered new standards and additional resources in a consistent manner. The framework teams created an "Appendix" listing potential industry recognized credentials attainable by secondary students; lists of professional, student, and relevant government organizations; and useful resources and websites. ** It is important to note that although most Framework Teams provided information for the "Appendix", not all teams did. Therefore, sub-headings within the "Appendix" without information have been deleted. Disclaimer: Reference in the Appendices Section to any specific commercial products, processes, or services, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement or recommendation by the Massachusetts Department of Elementary and Secondary Education.*

The Office for Career/Vocational Technical Education facilitated a comprehensive vetting process throughout the Commonwealth. During the fall of 2012 districts throughout Massachusetts solicited feedback from each Vocational Program's Advisory Committee members at the Fall Board meetings. Additionally, the Office for Career/Vocational Technical Education met with various licensing boards at the Massachusetts Division of Professional Licensure and provided the applicable draft framework to each board for review. All framework drafts were posted on the CVTE website for public comment. Comments and suggested revisions received were shared with each framework team for response and edits, as appropriate.

The Phase I Process was completed on an accelerated timetable and resulted in all Vocational Technical Education Frameworks; Stand Two and Strand Six, revised with current, rigorous, relevant standards. Strand Three has been redesigned into a crosswalk which directly correlates academic and technical standards. An appendix of useful material for technical teachers recommended by their peers was added to each framework.

Phase II of the Framework Revision Process consisted of three major projects;

1. The Strands One, Four & Five Project, to complete the revision of all six strands of the Vocational Technical Education Frameworks;
2. Statewide Professional Development on all revised strands, with training on strands two, three, and six delivered fall 2013, and training on strands one, four, and five delivered spring 2014;
3. The creation and development of additional Model Curriculum Unit (MCU) Teams.

The Strands One, Four, & Five Project began in the fall of 2013 with the formation of a leadership team and three work groups. Co-Managers led the leadership team comprised of three Strand Coordinators who facilitated work teams and reviewed, researched, and revised these common strands. All skills specific to the vocational technical program have been included into Strand Two Technical.

The Strand One Team revised the safety knowledge and skills that all students need to acquire. The team included relevant issues (i.e., bullying, climate), laws, regulations, guidelines and policies pertaining to safety.

The Strand Four Team revised the Employability Knowledge and Skills that all students need to acquire. Teams considered current research on career readiness, including the work of the College Career Readiness Task Force convened by the Department, changes in workplace, technological changes that impact how people perform their work (i.e., communications methods), and included standards that

emphasize the need for lifelong learning and adaptability given the multiple career changes over and an individual's working life. The team recommended this strand be renamed to: Career Readiness.

The Strand Five Team revised the Management & Entrepreneurship Knowledge and Skills that all students need to acquire. All business owners and employees must possess management and financial skills to be productive members of society. Skills included financial knowledge and basic business management skills.

All Strand One, Four and Five Project Teams worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Massachusetts Career and Technical Student Organizations to crosswalk standards to national Career & Technical Student Organizations Curricula, as applicable.

The Office for Career/Vocational Technical Education contracted the MAVA Consultant Team to work closely with the office to complete all of the work accomplished during Phase II of the Project.

A remarkable amount of work was accomplished through the efforts of hundreds of professionals who collaborated and diligently supported this work. The Office for Career/Vocational Technical Education is grateful for all the support received from the field, particularly all of the teachers (technical and academic), administrators, advisory committee members, business and industry representatives, the Division of Professional Licensure - boards, the Massachusetts Association of Vocational Administrators, the MAVA Consultants, and the Massachusetts Vocational Association, whose contributions were tremendous.

Special thanks to all staff in the Office for Career/Vocational Technical Education and the CVTE Framework Revision Team who provided guidance and numerous contributions during Phase One of the project.

Organization and Key Changes

This section contains the following:

- Highlights of Changes to the Vocational Technical Education Frameworks; which includes a summary of changes made to each strand.
- Organization of the Frameworks – Strand Two illustrates structure of topic headings, standards and objectives, and performance examples.

Highlights of Changes to the Vocational Technical Education Frameworks:

Strand One:

Safety and Health Knowledge and Skills have been revised to contain the safety standards that are common to all programs. The Strand One Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Career and Technical Student Organizations (CTSO) to crosswalk standards to national CTSO Curricula, as applicable.

- No objectives were deleted, only modified.
- Language and wording was clarified.
- Additions included a focus on maintaining a safe school and workplace in terms of creating a positive climate/environment.
- Student safety credential program has been revised.
- Safety attire has been revised.
- Emergency equipment and fire safety has been revised.
- Many new Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

Strand Two:

The Technical Standards Knowledge and Skills have been revised to reflect business and industry changes since the adoption of the 2007 Vocational Technical Education Frameworks (VTEF). There are additional changes to Strand Two below:

- The Technical Knowledge and Skills (Strand Two) section contains standards specific to the particular vocational program; suffix "a" (as common to all programs) and suffix "c" (as common within a cluster) have been removed.
- Each VTEF Strand Two begins with safety and health knowledge and skills specific to the particular vocational program.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below

titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

- Strand Two of the Frameworks for Animal Science, Environmental Science and Technology, and Horticulture, begin with core standards required for all participants in the programs, followed by a series of standards organized in concentrations. See the section below titled: "Organization of the Frameworks – Strand Two" for more information.
- An update to some of the vocational programs framework is the addition of advanced or supplemental standards which are noted in Strand Two by an asterisk (*). *These standards are not required, but are provided as suggestions that districts may choose to use to increase the depth of a particular topic, or add additional topics, particularly for advanced students or for those seniors who do not participate in cooperative education.* See the section below titled: "Organization of the Frameworks – Strand Two" for more information.

Strand Three:

Since the purpose of Strand Three was to correlate academic content that was *embedded* in the knowledge and skills necessary to perform certain technical skills, it was logical to highlight those connections through a crosswalk between the academic curriculum standards and the technical standards (Strand Two). The crosswalk directly correlates the English Language Arts (2011) and Mathematics (2011) Frameworks, incorporating the Common Core Standards and the Science and Technology/Engineering Frameworks. The crosswalk can be found in the appendix of each vocational framework. The crosswalk also includes performance examples which illustrate integrated academic and technical content.

- Embedded Academics has been replaced with a crosswalk between the academic curriculum standards and the technical knowledge and skills standards. The crosswalk is located in the Appendices.

Strand Four:

Employability (and Career Readiness) Knowledge and Skills focused on providing students with general knowledge and skills to be college and career ready. The Strand Four Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Career and Technical Student Organizations to crosswalk standards to national CTSO Curricula, as applicable.

- Language and wording were clarified.
- Additions included a focus on providing students with skills for employability/career readiness.
- Modifications included Career Exploration & Navigation, Communication in the Workplace, and Work Ethic & Professionalism.
- New Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

Strand Five:

Strand Five contains Management and Entrepreneurship Knowledge and Skills that are general for all students. The Strand Five Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Massachusetts Career and Technical Student Organizations to crosswalk standards to national Career & Technical Student Organizations Curricula, as applicable.

- Language and wording were clarified and organized into a logical format.
- The Strand Five Team felt that the 2007 curriculum remained valid.
- Additions included a focus on providing students with skills for management and entrepreneurship applicable to all vocational programs.
- Modifications included Starting and Managing a Business, Marketing, and Financial Concepts & Applications in Business, and Legal/Ethical/Social Responsibilities.
- New Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

Strand Six

Strand Six Technology Literacy Knowledge and Skills has been replaced with the 2008 Massachusetts Technology Literacy Standards and Expectations Framework.

Appendix[1]

Each framework contains an "Appendix" section which includes an Embedded Academic Crosswalk, Industry Recognized Credentials, Statewide Articulation Agreements, Professional, Governmental, and Student Organizations, Resources, and relevant websites.

The Appendix[2] contains:

- Embedded Academic crosswalks for English Language Arts, Mathematics, and Science & Technology/Engineering.
- Statewide Articulations: Current statewide Articulation Agreements and/or Apprenticeship Programs available to the specific vocational program are listed on this page. The development of new statewide articulations continues, and therefore these pages will be revised as new agreements are finalized.

- Industry-Recognized Credentials: Technical Teacher Teams generated lists of credentials for the vocational programs. Program Advisory Committees throughout the state reviewed and provided recommendations through the validation process. *The credential list has been provided as a resource only and districts are not obligated to provide all of the specified credentials for students.*

- Other: These pages provide lists of reference materials, government agencies, professional and student organizations, and useful websites created by each framework team. These are intended as helpful resources for technical teachers, identified by peers. These are not recommended or required by the Department of Elementary & Secondary Education.

[1] *Note:* Although most Framework Teams provided information for the "Appendix", not all teams did. *Therefore, sub-headings within the "Appendix" without information have been deleted.*

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Organization of the Frameworks – Strand Two

The Vocational Technical Education Frameworks contain knowledge and skills covering all aspects of industry, reflected in six strands: Safety and Health, Technical, Embedded Academics, Employability, Management and Entrepreneurship, and Technological.

Within each strand, standards and objectives were grouped under topic headings, which are displayed in bold. Each standard is followed by a performance example. In the excerpt below, 2.A is the topic; 2.A.01 is the first standard and 2.A.01.01 and 2.A.01.02 are the objectives under that standard.

2.A Automotive Technology Specific Safety Practices

2.A.01 Identify and describe safety procedures when dealing with different types of automotive lifts according to current industry standards.

2.A.01.01 Demonstrate procedures for safe lift operations.

2.A.01.02 Demonstrate safe use, placement and storage of floor jacks and jack stands.

2.A.01 Performance Example:

- Student will set up lift using manufacturer's suggested lift points.

2.A.02 Demonstrate and describe safety procedures when dealing with high pressure systems including necessary ventilation according to current industry standards.

2.A.02.01 Describe and demonstrate the importance of safety procedures to be used when servicing high pressurized systems (fuel systems, brakes, air conditioning, suspension, hydraulic systems, etc.).

2.A.02.02 Describe and demonstrate safe use of oxygen/acetylene torches and electric welding equipment.

2.A.02.03 Demonstrate ventilation procedures to be followed when working in the lab/shop area.

2.A.02 Performance Example:

- Student will relieve fuel system pressure to perform necessary repairs.

2.A.03 Identify and describe safety procedures when dealing with electrical circuits according to current industry standards.

2.A.03.01 Describe safety procedures to be followed when servicing supplemental restraint systems.

2.A.03.02 Demonstrate safety awareness of high voltage circuits of electric or hybrid electric vehicles and related safety precautions.

2.A.03 Performance Example:

- Safely disable Supplemental Restraint System (SRS) air bag for repair using manufacturer's recommendations.

There are additional changes to some of the Frameworks Strand Two (Technical Knowledge and Skills). Specifically, Strand Two of the Frameworks for Animal Science, Environmental Science and Technology and Horticulture begin with core standards required for all participants in the programs, followed by a series of standards organized in concentrations. For example, Strand Two of the Horticulture Framework begins with the core standards required of all Horticulture students

(Topics 2.A through 2.I). These standards are followed by the three concentrations: Arboriculture (Topics 2.J through 2.L), Greenhouse Management and Floriculture (Topics 2.J. through 2.L) and Landscape and Turf Management (Topics 2.M through 2.Q).

Advanced / Supplemental Standards (Not Required)

Another variation that is new to the revised Strand Two Frameworks is the addition of advanced or supplemental standards which are noted with the use of an asterisk (*). *These standards are not required, but are provided as suggestions that districts may choose to use to increase the depth of a particular topic, or add additional topics, particularly for advanced students or for those seniors who do not participate in cooperative education.*

The following is an example from Automotive Technology, where entire topics were added:

Advanced Automotive Technology Technical Knowledge and Skills

Note: The following competencies are optional, supplementary competencies suitable for advanced students. These are not required.

2.CC Demonstrate appropriate engine repair techniques.

2.CC.01 Perform appropriate cylinder Head Repair.

2.CC.01.01* Diagnose, remove and replace cylinder head(s).

2.CC.01.02* Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition; determine necessary action.

The following is an example from the Strand Two Radio and Television Broadcasting Framework that shows the addition of an advanced objective, 2.B.04.08*:

2.B.04 Explain concepts fundamental to shooting in cinema and video.

2.B.04.01 Compare and contrast a single-camera and a multiple-camera production.
2.B.04.02 Explain the importance of shooting for the edit (i.e., match on action, sequencing, coverage).
2.B.04.03 Explain the importance of continuity.
2.B.04.04 Explain the 180° Rule line, and its application in various cinema scenarios.
2.B.04.05 Identify and establish a specific point-of-view when shooting from a script.
2.B.04.06 Analyze the methods in which specific shots can evoke emotion from an audience.
2.B.04.07 Define drop frame and non-drop frame code shooting and explain how to account for both when preparing for an edit.
2.B.04.08* Describe various cinematographic methods necessary when shooting scenes that incorporate post-production visual effect

2.B.04 Performance Examples:

- Students will list similarities and differences of single-camera and multiple-camera shoots.
- Students will describe multiple shooting considerations that are useful in streamlining the editing process.

Strand 1: Safety and Health Knowledge and Skills

1.A Fundamentals of Health and Safety

1.A.01 Describe and apply health and safety regulations.

- 1.A.01.01 Identify, describe and apply health and safety regulations that apply to specific tasks and jobs. Students must complete a safety credential program, e.g., Occupational Safety and Health Administration 10, CareerSafe and ServSafe.
- 1.A.01.02 Identify, describe and apply Environmental Protection Agency (EPA) and other environmental protection regulations that apply to specific tasks and jobs in the specific occupational area.
- 1.A.01.03 Identify, describe and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the specific occupational area.
- 1.A.01.04 Explain procedures for documenting and reporting hazards to appropriate authorities.
- 1.A.01.05 Identify and describe potential consequences for non-compliance with appropriate health and safety regulations.
- 1.A.01.06 Identify and list contact information for appropriate health and safety agencies and resources.

1. A.01 Performance Examples:

- List and define OSHA Health and Safety Regulations, EPA and other environmental protection regulations to occupational area.
- List and define Right-to-Know regulations and reporting of hazards and contact information for appropriate health and safety agencies.
- List the laws and rules of regulatory agencies governing sanitation and safety.
- Utilize OSHA as well as health and safety websites for purposes of research.

1.A.02 Demonstrate appropriate health and safety practices based on the specific occupational area.

- 1.A.02.01 Identify, describe and demonstrate the effective use of Safety Data Sheets (SDS).
- 1.A.02.02 Read and interpret chemical, product and equipment labels to determine appropriate health and safety considerations.
- 1.A.02.03 Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
- 1.A.02.04 Demonstrate safe dress and use of relevant safety gear, personal protective equipment (PPE) and ergonomics, e.g., wrist rests, adjustable workspaces, equipment, gloves, proper footwear, earplugs, eye protection and breathing apparatus.
- 1.A.02.05 Demonstrate appropriate safe body mechanics, including appropriate lifting techniques and ergonomics.

1.A.02.06 Locate emergency equipment, first aid kit, SDS information directories and emergency action/response plan/escape routes in your lab, shop and classroom, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM), eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches and emergency exits.

1.A.02.07 Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO).

1.A.02.08 Describe safety practices and procedures to be followed when working with and around electricity, e.g., ground fault circuit interrupter (GFCI) and frayed wiring.

1.A.02.09 Handle, store, dispose of and recycle hazardous, flammable and combustible materials, according to EPA, OSHA and product specifications.

1.A.02.10 Demonstrate appropriate workspace cleaning, sanitation, disinfection and sterilization procedures required in specific occupational areas, e.g., Workplace Housekeeping OSHA Regulations.

1. A.02 Performance Examples:

- Identify, describe and demonstrate the use of SDS.
- List and demonstrate shop dress code, safety procedures and location of emergency equipment in labor classroom.
- Define and demonstrate safe storage and maintenance of equipment and proper disposal or recycling of hazardous, flammable and combustible materials.
- Identify, describe and demonstrate the Universal Precautions set of guidelines.

1.A.03 Demonstrate appropriate responses to situations that may threaten health and safety.

1.A.03.01 Describe First Aid procedures for potential injuries and other health concerns in the specific occupational area.

1.A.03.02 Describe the importance of emergency preparedness and an emergency action/response plan.

1.A.03.03 Describe procedures used to handle emergency situations, defensive measures and accidents, including identification, reporting, response, evacuation plans and follow-up procedures.

1.A.03.04 Identify, describe and demonstrate safety practices in specific occupational areas used to avoid accidents.

1.A.03.05 Identify and describe fire protection, protection, precautions and response procedures.

1.A.03.06 Discuss the role of the individual and the company/organization in ensuring workplace safety including transportation to and from school, school activities and the workplace.

1.A.03.07 Discuss ways to identify, prevent and report school and workplace violence, discrimination, harassment and bullying.

1.A.03.08 Demonstrate positive and appropriate behavior that contributes to a safe and healthy environment in school and the workplace.

1. A.03 Performance Example:
- Define first aid procedures and protocols used to handle emergency situations and practices used to avoid accidents.
- View safety videos and discuss the role of workplace safety.
- Attend or participate in a human rights alliance organization presentation.
- Observe and/or demonstrate the appropriate use of a fire extinguisher using the (PASS) technique: Pull, Aim, Squeeze, Sweep.
- Review and discuss specific policies, procedures and protocols regarding discrimination, harassment and bullying.
- Discuss and/or role-play proper and respectful behavior that contributes to a positive climate.
- Discuss and/or demonstrate behavior that contributes to a collaborative/teamwork environment.

Selected Websites

- Bullying Prevention and Intervention Resources : www.doe.mass.edu/bullying
- Centers for Disease Control and Prevention: www.cdc.gov
- Environmental Protection Agency : www.epa.gov
- "Lost Youth – Four Stories of Injured Young Workers"– WorkSafeBC: http://www2.worksafebc.com/Publications/Multimedia/Videos.asp?reportid=34291
- Massachusetts Department of Elementary and Secondary Education. (2011). Career/Vocational Technical Education Safety Guide: www.doe.mass.edu/cte
- Massachusetts Department of Elementary and Secondary Education: www.doe.mass.edu
- Massachusetts Emergency Management Agency: www.mass.gov/eopss/agencies/mema
- Massachusetts General Law: www.malegislature.gov
- Massachusetts Health and Human Services: www.mass.gov/dph
- Massachusetts Right to Know Law Summary: http://www.mass.gov/lwd/docs/dos/mwshp/hib397.pdf
- Safety Data Sheet: www.sdsonline.com
- National Fire Protection Association: www.nfpa.org
- Protection of Student Rights: Massachusetts General Law: https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXII/Chapter76/Section5
- Occupational Safety and Health Administration: www.osha.gov
- Readiness and Emergency Management for Schools: www.rems.ed.gov
- Safe and Healthy Learning Environments: www.doe.mass.edu/ssce/safety.html

Strand 2: Technical Knowledge and Skills

2.A Painting and Design Safety and Health Knowledge and Skills

2.A.01 Complete safety training for working on elevation equipment.

- 2.A.01.01 Identify and describe mechanical platform lift and material handling equipment safety practices and procedures.
- 2.A.01.02 Use and maintain fall arrest systems.
- 2.A.01.03 Identify and describe ladder and scaffold safety practices and procedures.

2.A.01 Performance Example:

- Create a presentation highlighting and demonstrating safety practices, according to OSHA standards.

2.A.02 Successfully complete lead safety training.

- 2.A.02.01 Describe hazards and protection measures associated with lead coatings.

2.A.02 Performance Example:

- Write a research paper identifying the dangers associated with lead coatings.

2.B Fundamentals of Painting and Design

2.B.01 Explain concepts fundamental to Painting and Design.

- 2.B.01.01 Describe the history of painting and design technology.
- 2.B.01.02 List various career options within the Painting and Design field.
- 2.B.01.03 Compare the duties and educational requirements of various occupations related to Painting and Design.

2.B.01 Performance Examples:

- Write a research paper identifying career opportunities, educational and credential requirements for the Painting and Design field.
- Create a portfolio that includes a resume and a cover letter.

2.C Finishes

2.C.01 Explain concepts fundamental to finishes.

- 2.C.01.01 Explain properties and function of pigments, resins, solvents & additives in paints and coatings.
- 2.C.01.02 Identify the appropriate coating product based on a desired sheen, durability, UV resistance, and the type and condition of the substrate.
- 2.C.01.03 Describe composition of various sealants.
- 2.C.01.04 Compare the differences between stains and other coatings.
- 2.C.01.05 Describe types of clear finishes.

2.C.01 Performance Example:

- Create a visual presentation that identifies, compares and contrasts the chemical and physical properties of various coatings.

2.C.02 Demonstrate practices related to surface preparation.

- 2.C.02.01 Demonstrate the use of surface preparation tools & materials.
- 2.C.02.02 Identify surface substrates in construction.

2.C.02.03 Evaluate surface conditions of substrates.
2.C.02.04 Recognize and correct various coating failures.
2.C.02.05 Describe and demonstrate proper use of tools and materials for protecting surfaces.
2.C.02.06 Describe and demonstrate general preparations for various substrates.
2.C.02.07 Identify and demonstrate the use of cleaners and strippers.
2.C.02.08 Demonstrate the use of power washers.
2.C.02.09 Apply caulking, fillers, and patching materials to substrates.
2.C.02.10 Demonstrate clean-up of adjacent surfaces.

2.C.02 Performance Example:
- Create sample boards that mimic the chemical and physical properties of various coating failures (i.e. blistering, peeling, chalking, efflorescence, etc.).

2.C.03 Demonstrate practices related to finish applications.
2.C.03.01 Identify and use tools for finish applications.
2.C.03.02 Demonstrate finish application methods using brushes and rollers.
2.C.03.03 Paint various architectural surfaces.
2.C.03.04 Paint various door styles.
2.C.03.05 Paint various window styles.
2.C.03.06 Identify application considerations unique to stains.
2.C.03.07 Demonstrate the selection and setup of various spray equipment and accessories for coating applications.
2.C.03.08 Prepare material for various spray painting applications.
2.C.03.09 Apply product using an airless sprayer.
2.C.03.10 Apply product using a conventional sprayer.
2.C.03.11 Apply product using a H.V.L.P. sprayer.
2.C.03.12 Describe uses of an airbrush.
2.C.03.13 Describe uses of an electrostatic sprayer.
2.C.03.14 Demonstrate methods of clean-up and disposal of paints.
2.C.03.15 Describe environmental conditions for paint application.

2.C.03 Performance Examples:
- Identify and explain the process and steps involved in painting a 6 panel door.
- Explain the atomization and viscosity of a fluid when performing spray application.

2.D Drywall Finishing

2.D.01 Explain concepts fundamental to drywall finishing.
2.D.01.01 Identify and describe drywall finishing tools.
2.D.01.02 Identify and describe materials used in drywall finishing.

2.D.01 Performance Example:
- Draw and label drywall tools with a description of their uses.

2.D.02 Demonstrate practices related to drywall finishing.
2.D.02.01 Repair and patch damaged drywall.
2.D.02.02 Finish drywall using finishing tools.

2.D.02 Performance Example:
- Finish drywall by applying drywall tape and compound to wallboard joints, and finishing joints and screw heads according to current industry standards.

2.E Fundamentals of Interior Design

2.E.01 Evaluate the factors influencing housing needs and decisions.

- 2.E.01.01 Describe the factors which affect housing choices.
- 2.E.01.02 List the types of housing options.
- 2.E.01.03 Evaluate client's needs, goals, and resources in creating design plans for residential and commercial interiors and furnishings.

2.E.01 Performance Examples:
- Design a poster that illustrates the levels of Maslow's Hierarchy of Needs as they relate to housing.
- Create a problem statement and design plan to meet a customer's needs.

2.E.02 Demonstrate practices fundamental to Architecture and Design.

- 2.E.02.01 Distinguish between various types and styles of housing.
- 2.E.02.02 Identify common architectural features of a home.
- 2.E.02.03 Identify the types of drawings included in a set of house plans and explain their purposes.
- 2.E.02.04 Determine the utility of a floor plan in relationship to family needs.
- 2.E.02.05 List the rooms, traffic areas and activities involved in a house.
- 2.E.02.06 Evaluate floor plans for efficiency, safety, and functionality.
- 2.E.02.07 Describe the various uses and effects of space, line, shape, form, texture, and color.
- 2.E.02.08 Plan and evaluate a room design according to its scale, proportion, balance, emphasis, and rhythm.
- 2.E.02.09 Draw an interior space to mathematically accurate scale using correct architecture symbols and drafting skills.
- 2.E.02.10 Demonstrate space planning skills required to design a residential or commercial space using computer-aided interior design software.
- 2.E.02.11 Create a presentation board containing a floor plan, a rendering, color schemes, textiles, and furniture samples.

2.E.02 Performance Examples:
- Create a presentation board containing a floor plan, a rendering, color schemes, textiles, and furniture samples.
- Write a research paper identifying the characteristics of architectural design styles.
- Create and present a scale model of a residential or commercial structure.

2.E.03 Evaluate concepts related to selecting furnishings and accessories.

- 2.E.03.01 Describe factors to consider in the arrangement of furniture.
- 2.E.03.02 Identify the distinguishing features of period furniture.
- 2.E.03.03 Create and evaluate the aesthetics and placement of decorative accessories.
- 2.E.03.04 Describe the various types of textiles and fabrics used in housing.

2.E.03 Performance Example:
- Create a presentation showing an understanding of Universal Design and the individual needs of specific clientele.

2.E.04 Demonstrate an understanding of Color Theory.

- 2.E.04.01 Explain how light effects color.
- 2.E.04.02 Identify primary, secondary, & intermediate colors.
- 2.E.04.03 Demonstrate the various uses of a color wheel.
- 2.E.04.04 Determine the hue, value, and chroma of color.
- 2.E.04.05 Explain the use of a munsell color system.
- 2.E.04.06 Demonstrate methods of color matching.
- 2.E.04.07 Differentiate between opaque and transparent finishes.
- 2.E.04.08 Describe the psychological effects of color.

2.E.04 Performance Example:

- Use a color wheel to create a color sample board demonstrating harmonious color schemes.

2.F Decorative Finishes

2.F.01 Explain concepts fundamental to decorative finishes.

- 2.F.01.01 Describe the uses and applications of faux finishes.
- 2.F.01.02 Identify tools and materials used to create faux finishing effects.

2.F.01 Performance Example:

- Create a decorative finish board using various faux finish techniques.

2.F.02 Demonstrate practices fundamental to decorative finishes.

- 2.F.02.01 Prepare a custom mix glaze.
- 2.F.02.02 Create a polished stone faux finish.
- 2.F.02.03 Create a wood grain faux finish.
- 2.F.02.04 Apply a decorative pattern using a stencil.
- 2.F.02.05 Apply wall glazing techniques using a variety of tools.

2.F.02 Performance Example:

- Create a decorative finish board using various faux finish techniques.

2.G Wallcovering

2.G.01 Explain concepts fundamental to wallcoverings.

- 2.G.01.01 Identify basic types of wall coverings.
- 2.G.01.02 Identify tools, equipment, and terminology associated with wallcoverings.

2.G.01 Performance Examples:

- Set up a work area with wallcoverings and the tools used to install them. Identify each tool and explain its purpose.
- Display various types of wallcoverings and explain how they are packaged and sized, then use the symbols on the package labels to describe the products ratings; characteristics; pattern and run numbers; and pattern matches.

2.G.02 Demonstrate practices fundamental to wallcoverings.

- 2.G.02.01 Calculate the amount of wall coverings needed for a given area.
- 2.G.02.02 Apply wallcoverings using proper techniques.
- 2.G.02.03 Recognize and correct common wallcovering failures.

2.G.02 Performance Example:
- Measure a room and create a wallcovering material estimate utilizing various methods of measurement, taking into account pattern match and pattern repeat. Install wallcoverings according to current industry standards.

2.H Sign Making and Mural Art

2.H.01 Demonstrate practices related to sign making.
- 2.H.01.01 Demonstrate computer based layout & design.
- 2.H.01.02 Create a sign layout using appropriate fonts and colors selection.
- 2.H.01.03 Apply vinyl lettering to various substrates.
- 2.H.01.04 Install various types of signage.

2.H.01 Performance Example:
- Design a sign layout for a simulated or actual client.

2.H.02 Demonstrate practices related to mural art.
- 2.H.02.01 Describe & demonstrate various methods for transferring mural graphics.
- 2.H.02.02 Demonstrate use of a stencil graphic.
- 2.H.02.03 Demonstrate methods of producing lines & stripes.

2.H.02 Performance Example:
- Transfer a mural graphic onto a substrate.

2.I Project Management

2.I.01 Demonstrate practices related to architectural drawings and specifications.
- 2.I.01.01 Explain the basic layout of a set of architectural drawings and the accompanying job specification documents.
- 2.I.01.02 Identify and define basic terms, abbreviations, line types, symbols and notes.
- 2.I.01.03 Interpret and follow drawing dimensions.
- 2.I.01.04 Determine true drawing measurements using an Architect's scale.
- 2.I.01.05 Identify plan views, elevations, section and detail views and schedules.
- 2.I.01.06 Differentiate between the types of drawings included in a set of house plans.

2.I.01 Performance Examples:
- Determine area of various surfaces utilizing architectural drawings.
- Create architectural drawings which include floor plans, elevations, line types, symbols and notes for a simulated client.

2.I.02 Demonstrate practices related to estimating.
- 2.I.02.01 Determine quantities of materials for a job.
- 2.I.02.02 Differentiate material, labor and overhead costs.
- 2.I.02.03 Demonstrate the ability to price preparation cost.
- 2.I.02.04 Create material quantity takeoff sheets.

2.I.02 Performance Examples:
- Complete job estimate for a simulated client.

2.I.03 Describe management roles and responsibilities.

- 2.I.03.01 Describe the hierarchy of an apprenticeship program.
- 2.I.03.02 Describe role of a supervisor/foreman.
- 2.I.03.03 Develop a detailed schedule to complete a job.

2.I.03 Performance Examples:

- Perform the duties of a job supervisor/foreman in shop or on a work extension project.

Strand 3: Embedded Academics

Strand 3: Embedded Academics, a critical piece of a Vocational Technical Education Framework, are presented as Crosswalks between the Massachusetts Vocational Technical Education Frameworks and the Massachusetts Curriculum Frameworks. These Crosswalks are located in the Appendix of this Framework.

Academic Crosswalks

Appendix A: English Language Arts
Appendix B: Mathematics
Appendix C: Science and Technology/Engineering
Earth and Space Science
Life Science (Biology)
Physical Science (Chemistry and Physics)
Technology/Engineering

Strand 4: Employability and Career Readiness

4.A Career Exploration and Navigation

4.A.01 Develop a career plan and portfolio.

- 4.A.01.01 Develop and revise career plan annually based on workplace awareness and skill attainment.
- 4.A.01.02 Assess personal strengths and interest areas to determine potential careers, career pathways and career ladders.
- 4.A.01.03 Examine potential career field(s)/discipline(s) and identify criteria to select, secure and keep employment in chosen field(s).
- 4.A.01.04 Research and evaluate a variety of careers utilizing multiple sources of information and resources to determine potential career(s) and alternatives.
- 4.A.01.05 Identify training and education requirements that lead to employment in chosen field(s) and demonstrate skills related to evaluating employment opportunities.
- 4.A.01.06 Explore and evaluate postsecondary educational opportunities including degrees and certifications available, traditional and nontraditional postsecondary pathways, technical school and apprenticeships, cost of education, financing methods including scholarships and loans and the cost of loan repayment.
- 4.A.01.07 Create a portfolio showcasing academic and career growth including a career plan, safety credential, resume and a competency profile demonstrating the acquisition of the knowledge and skills associated with at least two years of full-time study in the Chapter 74 program.

4.A.02 Demonstrate job search skills.

- 4.A.02.01 Conduct a job search and complete written and electronic job applications, resumes, cover letters and related correspondence for a chosen career path.
- 4.A.02.02 Explore and evaluate postsecondary job opportunities and career pathways specific to career technical areas.
- 4.A.02.03 Identify role and use of social media and networking for staying current with career and employment trends as well as networking, job seeking and career development opportunities.
- 4.A.02.04 Demonstrate ability to use social media and networking to develop useful occupational contacts, job seeking and career development opportunities.

4.A.03 Demonstrate all phases of the job interview process.

- 4.A.03.01 Gather relevant information about potential employer(s) from multiple print and digital sources, assessing the credibility and accuracy of each source.

4.A.03.02 Identify employment eligibility criteria, such as drug/alcohol free status, clean driving record, etc.

4.A.03.03 Practice effective interviewing skills: appearance, inquiry and dialogue with interviewer, positive attitude and evidence of work ethic and skills.

4.A.03.04 Explore and evaluate employment benefit packages including wages, vacation, health care, union dues, cafeteria plans, tuition reimbursement, retirement and 401K.

4. A Performance Examples:

- Conduct research to analyze and present on specific careers within a cluster.
- Conduct web-based job search using sites such as Monster.com, CareerBuilder.com, Indeed.com, Snagajob.com, Simplyhired.com and others.
- Create profile on social media/networking site such as LinkedIn and/or LinkedIn University for postsecondary research and employment opportunities.
- Complete online job application.
- Conduct and videotape practice interviews for instructor and student analysis.
- Provide students with sample employment and benefit packages for evaluation.

4.B Communication in the Workplace

4.B.01 Demonstrate appropriate oral and written communication skills in the workplace.

4.B.01.01 Communicate effectively using the language and vocabulary appropriate to a variety of audiences within the workplace including coworkers, supervisors and customers.

4.B.01.02 Read technical and work-related documents and demonstrate understanding in oral discussion and written exercise.

4.B.01.03 Demonstrate professional writing skills in work-related materials and communications (e.g., letters, memoranda, instructions and directions, reports, summaries, notes and/or outlines).

4.B.01.04 Use a variety of writing/publishing/presentation applications to create and present information in the workplace.

4.B.01.05 Identify, locate, evaluate and use print and electronic resources to resolve issues or problems in the workplace.

4.B.01.06 Use a variety of financial and data analysis tools to analyze and interpret information in the workplace.

4.B.01.07 Orally present technical and work-related information to a variety of audiences.

4.B.01.08 Identify and demonstrate professional non-verbal communication.

4.B.02 Demonstrate active listening skills.

4.B.02.01 Listen attentively and respectfully to others.

4.B.02.02 Focus attentively, make eye contact or other affirming gestures, confirm understanding and follow directions.

4.B.02.03 Show initiative in improving communication skills by asking follow-up questions of speaker in order to confirm understanding.

4. B Performance Examples:

- Read and analyze technical instructions to learn what makes them effective.
- Read and analyze technical instructions to follow directions and/or solve a problem.
- Examine a technical document and use it to write a set of instructions for another student to follow and evaluate.
- Analyze websites for effective technical writing and design.
- Create brochures and presentations using software and/or Web 2.0 tools to convey technical information.
- Conduct research using the Internet, print documents, observations and interviews to create a technical guide.

4.C Work Ethic and Professionalism

4.C.01 Demonstrate attendance and punctuality.

- 4.C.01.01 Identify and practice professional time-management and attendance behaviors including punctuality, reliability, planning and flexibility.

4.C.02 Demonstrate proper workplace appearance.

- 4.C.02.01 Identify and practice professional appearance specific to the workplace.
- 4.C.02.02 Identify and practice personal hygiene appropriate for duties specific to the workplace.
- 4.C.02.03 Identify and wear required safety gear specific to the workplace.

4.C.03 Accepts direction and constructive criticism.

- 4.C.03.01 Demonstrate ability (both verbally and non-verbally) to accept direction and constructive criticism and to implement solutions to change behaviors.
- 4.C.03.02 Ask appropriate questions to clarify understanding of feedback.
- 4.C.03.03 Analyze own learning style and seek instructions in a preferred format that works best for their understanding (such as oral, written or visual instruction).

4.C.04 Demonstrate motivation and initiative.

- 4.C.04.01 Evaluate assigned tasks for time to completion and prioritization.
- 4.C.04.02 Demonstrate motivation through enthusiasm, engagement, accurate completion of tasks and activities.
- 4.C.04.03 Demonstrate initiative by requesting new assignments and challenges.
- 4.C.04.04 Explain proposed solutions to challenges observed in the workplace.
- 4.C.04.05 Demonstrate the ability to evaluate multiple solutions to problems and challenges using critical reasoning and workplace/industry knowledge and select the best solution to the problem.
- 4.C.04.06 Implement solution(s) to challenges and/or problem(s) observed in the workplace.
- 4.C.04.07 See projects through completion and check work for quality and accuracy.

4.C.05 Demonstrate awareness of workplace culture and policy.

- 4.C.05.01 Display ethical behavior in use of time, resources, computers and information.
- 4.C.05.02 Identify the mission of the organization and/or department.
- 4.C.05.03 Explain the benefits of a diverse workplace.
- 4.C.05.04 Demonstrate a respect for diversity and its benefit to the workplace.

4.C.06 Interact appropriately with coworkers.

- 4.C.06.01 Work productively with individuals and in teams.
- 4.C.06.02 Develop positive mentoring and collaborative relationships within work environment.
- 4.C.06.03 Show respect and collegiality, both formally and informally.
- 4.C.06.04 Explain and follow workplace policy on the use of cell phones and other forms of social media.
- 4.C.06.05 Maintain focus on tasks and avoid negative topics or excessive personal conversations in the workplace.
- 4.C.06.06 Negotiate solutions to interpersonal and workplace conflicts.

4. C Performance Examples:

- Complete a learning style analysis tool.
- Develop a rubric to assess work ethic and professionalism as detailed in the standards above.

Student Organizations

Business Professionals of America www.bpa.org

Selected Websites

- 5 Ways to Ace a Job Interview: http://kidshealth.org/teen/school_jobs/jobs/tips_interview.html
- America's Career Resource Network: http://acrn.ovae.org/teachers/careerexpclassrm.htm
- Career Cruiser – Florida Department of Education: http://www.fldoe.org/workforce/pdf/cruiser.pdf
- Career Development Guide and Glossary: http://www.doe.mass.edu/connect/cde.html
- Career One Stop: http://www.careeronestop.org/
- Career Plan: http://www.doe.mass.edu/cd/plan/intro.html
- Career Plan Model: http://www.doe.mass.edu/ccr/epp/samples/cpmodel_11x17.pdf
- Checklist: http://www.doe.mass.edu/cd/plan/checklist.pdf
- Career Tech: http://www.okcareertech.org/cac/Pages/resources_products/ethics_web_sites.htm
- Ethics Resource Center: http://www.ethics.org/

- Interaction in the Workplace: http://hrweb.berkeley.edu/guides/managing-hr/interaction/communication
- Individual Learning Plans: How-to Guide: "Promoting Quality Individualized Learning Plans: A How to Guide on the High School Years" http://www.ncwd-youth.info/ilp/how-to-guide
- ILP Fact Sheet: http://www.ncwd-youth.info/fact-sheet/individualized-learning-plan
- ILP Policy Brief: http://www.ncwd-youth.info/ilp/produce-college-and-career-ready-high-school-graduates
- ILP Resources Home Page: http://www.ncwd-youth.info/ilp
- Interview Skills Lesson Plans: http://www.amphi.com/media/1220281/interview%20skills%20lesson%20plan.doc
- Labor and Workforce Development: http://www.mass.gov/lwd/employment-services/preparing-for-your-job-search/
- Maine Community College System – Center for Career Development: http://www.ccd.me.edu/careerprep/CareerPrepCurriculum_LP-6.pdf
- Massachusetts Work-Based Learning: http://skillspages.com/masswbl
- North Dakota Association of Agriculture Educators: http://www.ndaae.org/attachments/File/Preparing_students_for_a_Job_Interview.pptx
- NY CTE Learning Standards—Career Development and Occupational Studies (CDOS) Resource Guide with Core Curriculum : http://www.p12.nysed.gov/cte/cdlearn/cdosresourceguide.html
- Occupational Outlook Handbook: http://www.bls.gov/ooh/
- Purdue OWL Job Search Resources (for writing resumes, applications, and letters): https://owl.english.purdue.edu/engagement/34/
- Soft Skills to Pay the Bills — Mastering Soft Skills for Workplace Success: http://www.dol.gov/odep/topics/youth/softskills/
- US Department of Labor: http://www.dol.gov/dol/audience/aud-unemployed.htm
- Workplace Communication: http://www.regionalskillstraining.com/sites/default/files/content/WC%20Book%201.pdf
- Your Plan For the Future: http://www.yourplanforthefuture.org

Strand 5: Management and Entrepreneurship Knowledge and Skills

5.A Starting a Business

5.A.01 Demonstrate an understanding of the practices required to start a business.

- 5.A.01.01 Define entrepreneurship and be able to recognize and describe the characteristics of an entrepreneur.
- 5.A.01.02 Compare and contrast types of business ownership (i.e., sole proprietorships, franchises, partnerships, corporations).
- 5.A.01.03 Identify and explain the purpose and contents of a business plan.
- 5.A.01.04 Demonstrate an understanding of the principles and concepts of a business's supply chain (i.e., suppliers, producers and consumers.

5. A Performance Examples:

- Develop a presentation pertaining to an entrepreneur and their business.
- Communicate with a business owner and discuss the pros and cons of starting and owning a business. Summarize the main points of the discussion.
- Choose a product or service and describe the process leading to distribution.
- Write a business plan for a business in your community.

5.B Managing a Business

5.B.01 Demonstrate an understanding of managing a business.

- 5.B.01.01 Formulate short- and long-term business goals.
- 5.B.01.02 Demonstrate effective verbal, written and visual communication skills.
- 5.B.01.03 Utilize a decision-making process to make effective business decisions.
- 5.B.01.04 Identify a business's chain of command and define its organizational structure.
- 5.B.01.05 Identify and apply effective customer service skills and practices.
- 5.B.01.06 Identify, interpret and develop written operating procedures and policies.
- 5.B.01.07 Track inventory, productivity and labor cost.
- 5.B.01.08 Demonstrate business meeting skills.
- 5.B.01.09 Identify professional organizations and explore their benefits.

5. B Performance Examples:

- Working as a team, role-play situations that an entrepreneur might face in dealing with customers or employees.
- Contact a relevant professional organization and request information about its benefits, membership requirements and costs.
- Plan and conduct a business meeting.
- Identify companies that are known for customer service and list the practices that help differentiate themselves from all others in their industry.

5.C Marketing a Business

5.C.01 Demonstrate an understanding of marketing and promoting a business.

- 5.C.01.01 Explain the role of business in the economy.
- 5.C.01.02 Describe the relationship between business and community.
- 5.C.01.03 Describe methods of market research and identifying target markets.

5.C.01.04 Describe and apply the concepts of a marketing mix (the 4Ps of marketing: product, price, place and promotion).
5.C.01.05 Compare and contrast the promotional tools and techniques used to sell products, services, images and ideas.
5.C.01.06 Describe the impact of supply and demand on a product or business.
5.C.01.07 Identify direct and indirect competition on a business.
5.C.01.08 Identify and use sales techniques to meet client needs and wants.
5.C.01.09 Discuss strategies to acquire and retain a customer base.

5. C Performance Examples:
- Research reliable sources to identify marketing and industry data related to a business.
- Conduct market research by developing a survey and presenting the results.
- Create a promotional campaign using a variety of media.
- Write a marketing plan for a product.

5.D Financial Concepts and Applications in Business

5.D.01 Demonstrate an understanding of financial concepts and applications.

5.D.01.01 Identify essential financial reports and understand their purpose (i.e., budget, balance sheet and income statement).
5.D.01.02 Describe payroll practices (i.e., deductions – federal, FICA and state taxes and insurances).
5.D.01.03 Identify the importance of maintaining accurate records.
5.D.01.04 Apply practices related to pricing, purchasing and billing.
5.D.01.05 Maintain and reconcile a checking account.
5.D.01.06 Identify the options for funding a business.

5. D Performance Examples:
- Given an employee time card and rate of pay, calculate gross pay, taxes, deductions and net pay.
- Develop a budget for a simulated business or project.
- Analyze and discuss financial documents from a company.
- Research various methods of funding a business.

5.E Legal/Ethical/Social Responsibilities

5.E.01 Demonstrate an understanding of legal, ethical and social responsibility for businesses.

5.E.01.01 Identify state and federal laws and regulations related to managing a business.
5.E.01.02 Describe and identify ethical business practices.
5.E.01.03 Demonstrate an understanding of business contracts.
5.E.01.04 Explain the role of diversity in the workplace.
5.E.01.05 Explain the role of labor organizations.
5.E.01.06 Identify practices that support clean energy technologies and encourage environmental sustainability.
5.E.01.07 Demonstrate an understanding of how technology advancements impact business practices.

5.E Performance Example:
- Read and interpret a contract.
- Complete an application for a license, permit or certificate.
- Research federal, state and local regulations and laws required for a business.
- Participate in and summarize a discussion with a member of a labor or civil rights organization.

Selected Websites

- CVTE Strand 1, 4, and 5 Resources: https://sites.google.com/a/mccanntech.org/cvte-strands-1-4-and-5-resources/
- Entrepreneur: http://www.entrepreneur.com
- Inc. Magazine: http://www.inc.com/
- Junior Achievement "Be Entrepreneurial Program": https://www.juniorachievement.org/web/ja-usa/home
- Kahn Academy Interviews with Entrepreneurs: https://www.khanacademy.org/economics-finance-domain/entrepreneurship2/interviews-entrepreneurs
- Kauffman Founders School: http://www.entrepreneurship.org/en/founders-school.aspx
- National Federation of Independent Business: www.nfib.com
- National Foundation for Teaching Entrepreneurship (NFTE): www.nfte.com
- SBA Loans: http://www.sba.gov
- SkillsUSA Professional Development Program Competency List: http://www.skillsusa.org/downloads/PDF/lessons/professional/PDPPreview.pdf
- Small Business Administration: www.sba.gov

Glossary

Term	**Definition**
Balance sheet	A statement of the assets, liabilities and capital of a business at a particular point in time.
Budget	An estimate of income and expenditure for a set period of time.
Business Ownership	Types of business ownership refer to the legal structure of an organization. Legal structures include: Sole Proprietorship, Partnerships, Corporations and Limited Liability Companies.
Business Plan	A written document that describes in detail your business goals and how you are going to achieve them from a marketing, operational and financial point of view.
Chain of Command and Organizational Structure 	Refers to the management structure of an organization. It identifies lines of authority, lines of communication, and reporting relationships. Organizational structure determines how the roles, power and responsibilities are assigned and coordinated and how information flows between the different levels of management. (A visual representation of this structure is called an org chart).

Term	Definition
FICA	Federal Insurance Contributions Act requires taxes deducted from pay for supporting Social Security.
Income Statement	A financial statement providing operating results for a specific time period showing a business's revenues, expenses and profit or loss.
Market Research	• Primary: Surveys, Focus Groups, Observation • Secondary: Websites, Internet
Marketing Mix	A set of controlled variables that formulate the strategic position of a product or service in the marketplace. These variables are known as the 4 P's of marketing and include product, place, price and promotion.
Methods to Track Inventory, Productivity and Labor Cost	Refers to the processes a business uses to account for: 1) the inflows and outflows of inventory and materials related to inventory; 2) the efficiency of operations and 3) the cost of labor including salary and benefits.
Promotional Tools and Techniques	The six elements of a promotional mix are: advertising, visual merchandising, public relations, publicity, personal selling and sales promotion.
Supply Chain	The supply chain, or channel of distribution, describes how the product is handled and/or distributed from suppliers with materials, to the manufacturer, wholesaler or retailer and finally to the consumer.
Target Market	Those who are most likely to buy your product or service.

Strand 6: Technology Literacy Knowledge and Skills

6.A Technology Literacy Knowledge and Skills (Grades 9 through 12)

6.A.01 Demonstrate proficiency in the use of computers and applications, as well as an understanding of the concepts underlying hardware, software, and connectivity.

- 6.A.01.01 Use online help and other support to learn about features of hardware and software, as well as to assess and resolve problems.
- 6.A.01.02 Install and uninstall software; compress and expand files (if the district allows it).
- 6.A.01.03 Explain effective backup and recovery strategies.
- 6.A.01.04 Apply advanced formatting and page layout features when appropriate (e.g., columns, templates, and styles) to improve the appearance of documents and materials.
- 6.A.01.05 Use editing features appropriately (e.g., track changes, insert comments).
- 6.A.01.06 Identify the use of word processing and desktop publishing skills in various careers.
- 6.A.01.07 Identify the use of database skills in various careers.
- 6.A.01.08 Define and use functions of a spreadsheet application (e.g., sort, filter, find).
- 6.A.01.09 Explain how various formatting options are used to convey information in charts or graphs.
- 6.A.01.10 Identify the use of spreadsheet skills in various careers.
- 6.A.01.11 Use search engines and online directories.
- 6.A.01.12 Explain the differences among various search engines and how they rank results.
- 6.A.01.13 Explain and demonstrate effective search strategies for locating and retrieving electronic information (e.g., using syntax and Boolean logic operators).
- 6.A.01.14 Describe good practices for password protection and authentication.

6.A.02 Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.

- 6.A.02.01 Demonstrate compliance with the school's Acceptable Use Policy.
- 6.A.02.02 Explain issues related to the responsible use of technology (e.g., privacy, security).
- 6.A.02.03 Explain laws restricting the use of copyrighted materials.
- 6.A.02.04 Identify examples of plagiarism, and discuss the possible consequences of plagiarizing the work of others.

6.A.03 Design and implement a personal learning plan that includes the use of technology to support lifelong learning goals.

- 6.A.03.01 Evaluate the authenticity, accuracy, appropriateness, and bias of electronic resources, including Web sites.
- 6.A.03.02 Analyze the values and points of view that are presented in media messages.
- 6.A.03.03 Describe devices, applications, and operating system features that offer accessibility for people with disabilities.

6.A.03.04 Evaluate school and work environments in terms of ergonomic practices.

6.A.03.05 Describe and use safe and appropriate practices when participating in online communities (e.g., discussion groups, blogs, social networking sites).

6.A.03.06 Explain and use practices to protect one's personal safety online (e.g., not sharing personal information with strangers, being alert for online predators, reporting suspicious activities).

6.A.03.07 Explain ways individuals can protect their technology systems and information from unethical users.

6.A.04 Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.

6.A.04.01 Devise and demonstrate strategies for efficiently collecting and organizing information from electronic sources.

6.A.04.02 Compare, evaluate, and select appropriate electronic resources to locate specific information.

6.A.04.03 Select the most appropriate search engines and directories for specific research tasks.

6.A.04.04 Use a variety of media to present information for specific purposes (e.g., reports, research papers, presentations, newsletters, Web sites, podcasts, blogs), citing sources.

6.A.04.05 Demonstrate how the use of various techniques and effects (e.g., editing, music, color, rhetorical devices) can be used to convey meaning in media.

6.A.04.06 Use online communication tools to collaborate with peers, community members, and field experts as appropriate (e.g., bulletin boards, discussion forums, listservs, Web conferencing).

6.A.04.07 Plan and implement a collaborative project with students in other classrooms and schools using telecommunications tools (e.g., e-mail, discussion forums, groupware, interactive Web sites, video conferencing).

Appendices

The framework teams created an "Appendix" listing potential industry recognized credentials attainable by secondary students; lists of professional, student, and relevant government organizations; and useful resources and websites. **** It is important to note that although most Framework Teams provided information for the "Appendix", not all teams did. Therefore, sub-headings within the "Appendix" without information have been deleted.***

Disclaimer: Reference in the Appendices Section to any specific commercial products, processes, or services, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement or recommendation by the Massachusetts Department of Elementary and Secondary Education.

Embedded Academic Crosswalks

Embedded English Language Arts and Literacy

CVTE Learning Standard Number	Strand Coding Designation Grades ELAs Learning Standard Number	Text of English Language Arts Learning Standard
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	SL Grades 9-12 #1 (a-d)	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grades 9-12 topics, texts, and issues, building on other's ideas and expressing their own clearly and persuasively. a. Come to discussions prepared having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, and presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
Performance Example: • Students participate in various types of discussion on a daily basis, discussing topics as a class, collaborating on projects, and evaluating results with teachers and other students.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	SL Grades 9-12 #4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
Performance Example: • Given a potential client's needs, goals and resources, the student will evaluate design plans for both residential or commercial interiors and furnishings. Students then present their findings and defend their choices.		
2.A, 2.B, 2.C, 2.E, 2.H, 2.I	SL Grades 9-12 #5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Performance Example: • Students present an original presentation board that includes a floor plan, a rendering, color schemes, textiles, and furniture samples, explaining their choices for each. Students should use a variety of digital media to create their board and/ or presentation.		
2.A, 2.B,	L Grades 6-8 #2 (a.c)	Demonstrate command of the conventions of standard English

2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I		capitalization, punctuation, and spelling when writing. a. Use punctuation (comma, ellipsis, dash) to indicate a pause or break. c. Spell correctly.
Performance Example: • When writing or presenting reports, writing papers, or creating finished products, students will use standard English in order to demonstrate professionalism.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	L Grades 9-12, #4 (a.d)	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies. a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase. d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).
Performance Example: • Students define technical terms and unfamiliar vocabulary from textbook and other texts, using both context clues and appropriate reference materials.		
2.A, 2.B, 2.C, 2.E, 2.F, 2.H, 2.I	RST Grades pre and Grades 9-12 #1	(pre) Cite specific textual evidence to support analysis of science and technical texts. (9-10)Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (11-12)Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
Performance Example: • Students will cite textbook or other materials to support their reasoning in discussion and in writing when appropriate. For example, students write a short report describing the proper environmental conditions for paint application, using evidence from either the textbook or another resource.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	RST Grades 11-12 #2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
Performance Example: • After reading about faux finishes, the student creates a polished stone faux finish and then summarizes the process.		
2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	RST Grades 9-12 #3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Performance Example: • Student uses an established recipe as a guide to create a faux finish effect. After completing the project, they write a process paper explaining the steps they used to get their specific results.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	RST Grades 9-12 #4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 and 11–12 texts and topics.
Performance Example:		

• When examining architectural drawings, students recognize and identify basic terms, abbreviations, line types, symbols, and notes.		
2.E.04	RST Grades 9-10 #5	Analyze the structure of the relationships among concepts in a text, including relationships among key terms.
Performance Example: • Students learning about color theory can explain how light affects color and how the three dimensions of color (hue, value, and chroma) determine color variation.		
2.C, 2.E, 2.H, 2. I	RST Grades 9-10 #7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Performance Example: • Students interpret and follow drawing dimensions. Students use plans to determine quantities of materials needed for a given job and describe those materials, the labor and overhead costs.		
2.A, 2.E, 2.I	RST Grades 11-12 #7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
Performance Example: • Given a design problem, students use multiple sources of information to create a presentation showing an understanding of Universal Design and the individual needs of specific clientele.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	RST Grades 9-12 #10	By the end of grade (9, 10, 11, 12), read and comprehend science/technical texts in the grades 9–CCR text complexity band independently and proficiently.
Performance Example: • Students read various levels of text (textbook, articles, journals), including the adopted textbook.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-10 #2 (a-f)	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
Performance Example:		

• Students write process, compare-contrast, and other expository papers/ reports when appropriate. For example, students write a short essay comparing two occupations related to Painting and Design.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-12 #4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Performance Example: • Students read an article or a chapter from the textbook and write a summary.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-12 #5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience
Performance Example: • For their portfolio, students must revise goals and ambitions papers, cover letters and resumes.		
2.A, 2.B, 2.C, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-12 #7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
Performance Example: • Students write research papers identifying the characteristics of architectural design styles.		
2.A, 2.B, 2.C, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-12 #9	Draw evidence from informational texts to support analysis, reflection, and research.
Performance Example: • Students read text and write about their findings, citing information from research. For example, students cite text when given the question, "How does color affect people psychologically?" students conduct research and write a short report about the effects and uses of one color, including specific examples found while researching.		
2.A, 2.B, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H, 2.I	WHST Grades 9-12 #10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
Performance Example: • Students will write formally (process papers), informally (journals and logs), and for short periods (exams) as well as revising and using extended periods for projects.		

Embedded Mathematics

CVTE Learning Standard Number	Math Content Conceptual Category and Domain Code Learning Standard Number	Text of Mathematics Learning Standard
2.E, 2.H, 2.I	**7.G .1**	**Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.**
Performance Example: • Create a mural graphic from a scaled drawing.		
2.E.02	7.G.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the

		conditions determine a unique triangle, more than one triangle, or no triangle.
Performance Example: • Create and present a scale model of a residential or commercial structure.		
2.I.02	8.EE.7	Solve linear equations in one variable.
Performance Example: • Solving for quantities of materials, labor, and overhead costs.		
2.H.01	8.NS.1	Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
Performance Example: • Round measurements up to the nearest decimal place when determine layouts for various types of signage.		
2.E.02	G.GMD.4	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
Performance Example: • Create a presentation board containing a floor plan, a rendering, color schemes, textiles, and furniture samples.		
2.I.01 2.G.01	G.GPE.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
Performance Example: • Determine area of various surfaces utilizing architectural drawings.		
2.E.03	G.MG.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
Performance Example: • Create a presentation showing an understanding of Universal Design and the individual needs of specific clientele.		
2.G.02	G.MG.4	Use dimensional analysis for unit conversion to confirm that expressions and equations make sense.
Performance Example: • Convert metric system to standard English equivalent units while calculating wallpaper coverage.		
2.E, 2.G, 2.H, 2.I	G.CO.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
Performance Example: • Understand the definition of shapes and mathematical terms as they relate to various substrates.		
2.E.02	G.CO.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
Performance Example: • Create drawings, renderings and scale models of residential and commercial structures.		
2.H.02	8.G.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real world and mathematical problems in two and three dimensions.
Performance Example: • Use Pythagorean Theorem to calculate sizes when scaling graphics.		
2.I.02	S.ID.1, S.ID.2	Represent data with plots on the real number line (dot plots,

		histograms, and box plots). Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
Performance Example: • Calculate average amount of time needed to price preparation of material and costs of a job.		
2.E.02	G.SRT.6	Define trigonometric ratios and solve problems involving right triangles. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
Performance Example: • Use trigonometric ratios to find angles and missing sides of right triangles when creating or drawing a floor plan.		
2.E.04	F.IF.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*
Performance Example: • Use formula guides and charts to determine the quantities of pigments needed when color mixing.		
2.E, 2.F, 2.G, 2H	G.MG.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
Performance Example: • Design a geometric pattern for use on a decorative faux finish panel.		
2.H.01	N.Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
Performance Example: • Create scaled layouts for a customer's sign design.		
2.I.03	N.Q.2	Define appropriate quantities for the purpose of descriptive modeling.
Performance Example: • Develop a detail schedule to complete a job using unit cost estimating and material quality take-offs.		
2.I.02	N.Q.3a	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure.
Performance Example: • Identify estimate errors when overhead costs are not accounted for.		
2.E.01	A.CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
Performance Example: • Calculate mortgage costs when evaluating factors that influence housing needs and decisions.		

Embedded Science and Technology/Engineering

Earth and Space Science

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Earth and Space Science Learning Standard
2.E.04	1.Matter and Energy in the Earth System 1.2	Describe the characteristics of electromagnetic radiation and give examples of its impact on life and Earth's systems.
Performance Example: • Describe how light affects color and that light is part of the visible spectrum of electromagnetic waves which includes heat, radio waves, and microwaves.		

Physical Science (Chemistry)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Chemistry Learning Standard
2.C.01	1.Properties of Matter 1.1	Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.
Performance Example: • Explain the physical and chemical properties of resins and how they interact with pigments and solvents.		
2.C	1.Properties of Matter 1.2	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.
Performance Example: • Students explain coalescence and the curing of coatings.		
2.C.03	4.Chemical Bonding 4.3	Use electronegativity to explain the difference between polar and nonpolar covalent bonds.
Performance Example: • Explain the unique properties of an electrostatic sprayer and the process of spray applications.		
2.F.02, 2.G	7.Solutions, Rates of Reactions, and Equilibrium 7.1	Describe the process by which solutes dissolve in solvents.
Performance Example: • Describe the process used to mix wall covering adhesive.		
2.C.02	7.Solutions, Rates of Reactions, and Equilibrium 7.5	Identify factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst)
Performance Example: • Explain factors that affect coatings during finish applications.		
2.C.02	8.Acids and Bases and Oxidation-Reduction Reactions 8.2	Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).
Performance Example: • Students will neutralize the acid properties of a stripper prior to applying a coating or stain.		

2.C.02	8.Acids and Bases and Oxidation-Reduction Reactions 8.4	Describe oxidation and reduction reactions and give some everyday examples, such as fuel burning and corrosion. Assign oxidation numbers in a reaction.
Performance Example: • Create sample boards that mimic the chemical and physical properties of various coating failures (i.e. blistering, peeling, oxidation, efflorescence, etc.		
2.G.02	SIS1.Make observations, raise questions and formulate hypothesis	Observe the world from a scientific perspective. Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.
Performance Example: • Students will research various publications with information about wallcovering failures to determine the causes.		
2.E.03	SIS3 Analyze and interpret results of scientific investigations	Represent data and relationships between and among variables in charts and graphs. Use appropriate technology (e.g., graphing software) and other tools.
Performance Example: • Create a presentation showing an understanding of Universal Design and the individual needs of specific clientele.		
2.I.01, 2.E.02	SIS4 Communicate and apply the results of scientific investigations	Develop descriptions of and explanations for scientific concepts that were a focus of one or more investigations Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (e.g., presentation software) and other tools to present findings.
Performance Example: • Create architectural drawings which include floor plans, elevations, line types, symbols and notes for a simulated client.		

Physical Science (Physics)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Physics Learning Standard
2.E.04	4.Waves4.1	Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, and period).
Performance Example: • Students will be able to identify various wavelengths in the visible spectrum.		
2.E.04	4.Waves4.2	Distinguish between mechanical and electromagnetic waves.
Performance Example: • Students will be able to compare and contrast sound and light waves.		
2.C.01, 2.E.04	4.Waves4.4	Describe qualitatively the basic principles of reflection and refraction of waves.
Performance Example: • Students will be able describe reflection and refraction in relating it to degrees of gloss in a paint sheen.		
2.E.04	6.Electromagnetic Radiation6.2	Describe the electromagnetic spectrum in terms of frequency and wavelength, and identify the locations of radio waves, microwaves, infrared radiation, visible light (red, orange, yellow, green, blue, indigo, and violet), ultraviolet rays, x-rays, and gamma rays on the spectrum.
Performance Example: • Students will be able to identify and describe the electromagnetic spectrum and identify where visible light falls on the spectrum.		

Technology/Engineering

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Technology/Engineering Learning Standard
2.E.02	1.Materials, Tools, and Machines 1.3	Identify and explain the safe and proper use of measuring tools, hand tools, and machines (e.g. band saw, drill press, sander, hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) needed to construct a prototype of an engineering design.
Performance Example: • Students will use measuring tools and hand tools to build a model of a building from a design that they created.		
2.E, 2.H	2.Engineering Design 2.1	Identify and explain the steps of the engineering design process, ie, identify the need or problem, research the problem, develop possible solutions, select the best possible solution (s), construct a prototype, test and evaluate, communicate the solution (s), and redesign
Performance Example: • Students will research and build a model of a building from a design that they created.		
2.E.02, 2.H	2.Engineering Design 2.2	Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multi view drawings.
Performance Example: • Create a presentation board containing a floor plan, a rendering, color schemes, textiles, and furniture samples.		
2.E.02	2.Engineering Design 2.3	Describe and explain the purpose of a given prototype.
Performance Example: • Create and present a scale model of a residential or commercial structure.		
2.E.02	2.Engineering Design 2.4	Identify appropriate materials, tools, and machines needed to construct a prototype of a given engineering design.
Performance Example: • Students will construct a scale model of a residential or commercial structure from an architectural print.		
2.E.01	2.Engineering Design 2.5	Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.
Performance Example: • Create a design plan and concept boards to meet a customer's needs.		
2.I.01	3.Communication Technologies 3.2	Identify and explain the appropriate tools, machines, and electronic devices (e.g. drawing tools, computer-aided design, and cameras) used to produce and/or reproduce design solutions (e.g. Engineering drawings, prototypes, and reports.
Performance Example: • Create architectural drawings which include floor plans, elevations, line types, symbols and notes for a simulated client using drawing tools and computer-aided design software.		
2.I.01	3. Communication Technologies 3.4.	Identify and explain how symbols and icons (e.g. international symbols and graphics) are used to communicate a message.
Performance Example: • Locate line types, symbols, and notes from a set of architectural drawings, and explain their meaning.		
2.E.02	1.Engineering Design 1.1	Identify and explain the steps of the engineering design process: identify the problem, research the problem, develop possible solutions, select the best possible solution (s), construct prototypes

		and/or models, test and evaluate, communicate the solutions, and redesign.
Performance Example: • Students will research a client's design problem statement and develop concept boards, drawings, and models to solve the client's design needs.		
2.C.01	1.Engineering Design 1.2	Understand that the engineering design process is used in the solutions of problems and the advancement of society. Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified.
Performance Example: • Students identify a product or material to be used in a design project. Then, they will conduct research to find a comparable product that is more eco-friendly.		
2.E.02.11	1.Engineering Design 1.3	Produce and analyze multi-view drawings (orthographic projections) and pictorial drawings (isometric, oblique, perspective), using various techniques.
Performance Example: • Create a presentation board containing a floor plan, a rendering, color schemes, textiles, and furniture samples.		
2.H	1.Engineering Design 1.4	Interpret and apply scale and proportion to orthographic projections and pictorial drawings (e.g. 1/4''=1'0'', 1 cm=1m).
Performance Example: • Students will to create a sign from a scaled layout.		
2.I.01	1.Engineering Design 1.5	Interpret plans, diagrams, and working drawings in the construction of prototypes or models.
Performance Example: • Determine area of various surfaces utilizing architectural drawings.		
2.A, 2.C, 2.D, 2.E, 2.F, 2.G, 2.H	2.Construction Technologies 2.5	Identify and demonstrate the safe and proper use of common hand tools, power tools, and measurement devices used in construction.
Performance Example: • Complete written and performance exams that demonstrate the safe and proper use of shop tools		
2.1.01	2.Construction Technologies 2.6	Recognize the purposes of zoning laws and building codes in the design and use of structure.
Performance Example: • Students will investigate local building codes for simulated project.		
2.E.01	4.Energy and Power Technologies-Thermal Systems 4.3	Explain how environmental conditions such as wind, solar angle, and temperature influence the design of buildings.
Performance Example: • Students will be able to describe how environmental factors influence the design and construction of houses.		
2.C	7.Manufacturing Technologies 7.2	Identify the criteria necessary to select safe tools and procedures for a manufacturing process (e.g., properties of materials, required tolerances, end-uses).
Performance Example: • Students will take a field trip to a paint manufacturing facility and write a paper describing the processes used to create the paints and coatings.		

DESE Statewide Articulation Agreements

No Statewide Articulation Agreements at this time.

Industry Recognized Credentials (Licenses and Certifications/Specialty Programs)

OSHA 10 Hour Outreach Training Program

Other

Reference Materials

- Lewis, Evelyn L. & Turner, Carolyn S. (2004).
  Housing decisions. Tinley Park, IL:
  Goodheart –Wilcox Company, Inc.

- Kicklighter, Clois E. & Joan C. Kicklighter. (2005).
  Residential housing & interiors.
  Tinley Park, IL: Goodheart –Wilcox Company, Inc.

- NCCR, (1997), Trainee Guide Painting
  Columbus, OH:, Prentice-Hall, Inc

- (2007). Homes and interiors.
  New York, NY: Glencoe/McGraw Hill

Related National, Regional, and State Professional Organizations

- Painting and Decorating Contractors of America
  New England Council Inc., PDCA
  888-732-2632, www.newenglandcouncilpdca.org

- IUPATDC35 (PAINTERS UNION)
  25 Colgate Rd. Roslindale, MA 02131
  Phone (617) 522-0520, http://www.iupatdc35.org/

- AMERICAN SOCIETY OF INTERIOR DESIGN, http://www.asid.org/

Student Organizations

- Skills USA www.maskillsusa.org

Selected Websites

- Painting and Decorating Contractors of America, http://www.pdca.org/
- DC35 (PAINTERS UNION), http://www.iupatdc35.org/
- AMERICAN SOCIETY OF INTERIOR DESIGN, http://www.asid.org/