Massachusetts Department of Elementary & Secondary Education

Office for Career/Vocational Technical Education

Vocational Technical Education Framework

ଌ

Construction Occupational Cluster

Cabinetmaking (VCAB)

CIP Code 480703

June 2014

Massachusetts Department of Elementary and Secondary Education
Office for Career/Vocational Technical Education
75 Pleasant Street, Malden, MA 02148-4906
781-338-3910
www.doe.mass.edu/cte/

This document was prepared by the
Massachusetts Department of Elementary and Secondary Education
Mitchell D. Chester, Ed.D.
Commissioner

This document printed on recycled paper

Massachusetts Department of Elementary and Secondary Education
75 Pleasant Street, Malden, MA 02148-4906
Phone 781-338-3000 TTY: N.E.T. Relay 800-439-2370
www.doe.mass.edu

Table of Contents

Acknowledgements

The Massachusetts Department of Elementary and Secondary Education, Office for Career/ Vocational Technical Education, launched the Vocational Technical Education Framework Revision Project in April 2012. This Framework is the result of that effort and of the contributions of many educators across the state. The Department of Elementary and Secondary Education wishes to thank all of the Massachusetts groups that contributed to the development of these standards and all the individual teachers, administrators, and private sector advisory committee members who provided valuable employer validation of the standards for the Cabinetmaking Framework of the Construction Occupational Cluster.

Contributors to the 2012 Cabinetmaking Framework (VCAB) Strands 2, 3 and 6:

Project Administrator:
Richard Nutt, Director of Vocational Programs, Montachusett Regional Vocational Technical School
Katy Whitaker, Development Coordinator, Montachusett Regional Vocational Technical School

Framework Team Leader:
Paul Barba, Montachusett Regional Vocational Technical School

Technical Teachers:
Roland Bessette, Southeastern Regional Vocational Technical High School
Nicholas Bailey, Montachusett Regional Vocational Technical School
Michael Dion, Montachusett Regional Vocational Technical School
Ray Mahon, Bay Path Regional Vocational Technical High School
Ronald Silvia, Jr., Diman Regional Vocational Technical High School

Academic Teachers:
Paula deDiego, Science Teacher, Montachusett Regional Vocational Technical School
Gary Farr, Math Teacher, Montachusett Regional Vocational Technical School
Samantha McGuane, English Teacher, Montachusett Regional Vocational Technical School

Program Advisory Members:
Felix Carbone, New England Institute of Technology, 2500 Post Road, Warwick, RI 02886
David Silvia, Horner Millwork, 1255 Grand Army Highway, Somerset, MA
Joe Melason, Woodmeister, 120 Industrial Drive, Holden, MA
Donald Travers, South Shore Millworks, 7 Maple Street, Norton, MA 02766
Bruce Tilley, Concord Lumber Corporation, 55 White Street, PO Box 1526, Littleton, MA 01460
Ken Hanson, Marlboro High School, 431 Bolton Street, Marlborough, MA 01752

Administrative Assistance:
Elba I. Guzman, Secretary, Montachusett Regional Vocational Technical School

CVTE Frameworks Project Advisory Committee

Roger Bourgeois, Superintendent/Director
Essex Agricultural and Technical High School
Christine Shaw, Executive Director
Northeast Regional Readiness Center
Peter Dewar, Director of Professional Development
Massachusetts Association of Vocational Administrators
John McDonagh, Grants Coordinator
Southeastern Regional Vocational Technical High School

Massachusetts Department of Elementary and Secondary Education
Patricia Gregson, Associate Commissioner
Vocational, Workforce and College Readiness Programs

Office for Career/Vocational and Technical Education – Framework Revision Strands 2, 3 and 6
Lisa Sandler, Acting State Director of Career/Vocational Technical Education

Maura Russell, Ramona Foster, Karen DeCoster
Lisa Weinstein, Margie Roberts, Janice Crocker

Consultants

Dr. Frank Llamas, Maura McMahon

Contributors to the 2014 Cabinetmaking Framework (VCAB) Strands 1, 4 and 5:

Project Administrator
Thomas Hickey, Superintendent
South Shore Vocational Technical High School

Project Managers
Rebecca Buck, Northern Berkshire Vocational Regional School District
Kristin Steiner, Northern Berkshire Vocational Regional School District

MAVA Consultants
Kathy Conole Deborah DePaolo John McDonagh

Massachusetts Department of Elementary and Secondary Education
Patricia Gregson, Associate Commissioner
Vocational, Workforce and College Readiness Programs

Office for Career/Vocational and Technical Education – Framework Revision Strands 1, 4 and 5
Lisa Sandler, Massachusetts Methods of Administration Coordinator
Gary Gomes, Accountability & Monitoring Supervisor
Marnie Jain, Education Specialist

Framework Strand 1 Leader:
Michael Nixon, MassBay Community College

Team Members:
Patricia Allen, Greater New Bedford Regional Technical High School
Cheryl Bomal, Greater Lowell Technical High School
Deborah Brightman, Greater New Bedford Regional Technical High School
Martin Dooley, Lower Pioneer Valley Career and Technical Education Center
Darla Hartung, Taunton High School
Rhonda Moran, Lower Pioneer Valley Career and Technical Education Center
John Morash, Plymouth South High School
John Taylor, Greater Lowell Technical High School

Resource Experts:
Anne Gilligan, DESE-Learning Support Service, Safe and Healthy Schools Coordinator
David Edmonds, DESE-CVTE, Education Specialist
Lisa Sandler, DESE-CVTE, Massachusetts Methods of Administration Coordinator

Framework Strand 4 Leader:
Marcia Kessler, Old Colony Regional Vocational Technical High School

Team Members:
Erin Carerra, Taunton High School
Gillian Granger, Blackstone Valley Regional Vocational Technical High School
Carol Hartnett, Blue Hills Regional Technical High School
Christina Melvin, Worcester Technical High School
Cecilia Smith, Greater Lawrence Technical School
EJ Smith, Blackstone Valley Regional Vocational Technical High School
Michael Viggiano, Madison Park High School

Resource Experts:

Gary Gomes, DESE-CVTE, Accountability and Monitoring
Elizabeth Hennessy, Blackstone Valley Regional Vocational Technical High School, Dir. of Counseling
Marnie Jain, DESE-CVTE,
Judith McKinstry, Business Professionals of America Director
Lisa Sandler, DESE – CVTE, Massachusetts Methods of Administration Coordinator
Shailah Stewart, DESE - College & Career Readiness, Connecting Activities Coordinator
Karen Ward, SkillsUSA Director

Framework Strand 5 Leader:

Margaret Ellis, JP Keefe Technical High School

Team Members:

Lori Alie, Blackstone Valley Regional Vocational Technical High School
Lori Carr, Taunton High School
Barbara-jean Chauvin, Norfolk County Agricultural High School
Cheryl Hackenson, Tantasqua Regional High School
Clifford Keirstead, Whittier Regional Technical High School
Lynn McKiernan, Assabet Valley Regional Technical High School
John Oldham, Old Colony Regional Vocational Technical High School
Arlene Thompson, Worcester Technical High School

Resource Experts:

Jennifer Green, Network For Teaching Entrepreneurship Executive Director
Donna McFadden, MA DECA Director
Lisa Sandler, DESE –CVTE, Massachusetts Methods of Administration Coordinator

Massachusetts Department of Elementary and Secondary Education

75 Pleasant Street, Malden, Massachusetts 02148-4906 Telephone: (781) 338-3000
TTY: N.E.T. Relay 1-800-439-2370

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.*
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.

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.

Construction Occupational Cluster

Cabinetmaking Framework (VCAB)

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 Cabinetmaking Health and Safety Skills

2.A.01 Complete safety training on all related equipment and materials.

- 2.A.01.01 Describe and demonstrate cabinetmaking health practices.
- 2.A.01.02 Demonstrate body mechanics for the work place including ergonomics according to OSHA standards.
- 2.A.01.03 Explain various safety concerns and issues in the cabinetmaking field.
- 2.A.01.04 Explain dangers associated with finishes and finishing operations.
- 2.A.01.05 Describe and demonstrate cabinetmaking safety practices.
- 2.A.01.06 Explain and discuss OSHA rules and regulations pertaining to the cabinetmaking field.
- 2.A.01.07 Demonstrate first aid procedures according to policy and OSHA standards.
- 2.A.01.08 Identify and apply OSHA and other health and safety regulations related to tasks and jobs in cabinetmaking.

2.A.01 Performance Example:

- Students will successfully complete OSHA 10-hour certification training.

2.B Wood Technology

2.B.01 Describe properties of wood.

- 2.B.01.01 Identify wood species, growth, and characteristics.
- 2.B.01.02 Discuss wood harvesting, drying, and defects.
- 2.B.01.03 Define wood grading and ordering procedures.

2.B.01 Performance Examples:

- Identify unknown samples of various wood species.

2.C Prints and Layout Projects

2.C.01 Read and interpret working drawings.

- 2.C.01.01 Determine true measurements from print using Architect's Scale.
- 2.C.01.02 Identify and define basic print terms.
- 2.C.01.03 Read working, perspective, cabinet, and shop drawings.

2.C.01 Performance Examples:

- Draw a small cabinet project to scale.
- Make a stock list from a working drawing.

2.C.02 Layout a project.

- 2.C.02.01 List woodwork components.
- 2.C.02.02 Create a layout rod.
- 2.C.02.03 Compile a material takeoff.
- 2.C.02.04 Layout woodwork for fabrication.

2.C.02 Performance Example:

- The student will demonstrate the techniques used in developing the layout for a project using a materials list and the creation of a layout rod.

2.C.03 Demonstrate methods of measurement.

- 2.C.03.01 Read a ruler in sixteenths of an inch.
- 2.C.03.02 Identify and use layout, measuring, and checking devices.

2.C.03 Performance Example:
- The student will demonstrate the methods for measuring by preparing a project layout.

2.D Hand Tools

2.D.01 Demonstrate safe use of hand tools.
- 2.D.01.01 Demonstrate use and maintenance of sharp edge tools (i.e. saws, chisels, and boring tools).
- 2.D.01.02 Demonstrate use and maintenance of pounding and prying tools.

2.D.01 Performance Example:
- Fabricate small project using hand tools

2.E Cabinetmaking Joinery Fabrication

2.E.01 Layout and fabricate joinery.
- 2.E.01.01 Layout and fabricate lap joints.
- 2.E.01.02 Layout and fabricate dovetail.
- 2.E.01.03 Layout and fabricate mortise and tenon joints.
- 2.E.01.04 Layout and fabricate tongue and groove joints.
- 2.E.01.05 Layout and fabricate miter joints.
- 2.E.01.06 Layout and fabricate spline.
- 2.E.01.07 Layout and fabricate bridle.
- 2.E.01.08 Layout and fabricate dado joints.
- 2.E.01.09 Layout and fabricate dowel joints.
- 2.E.01.10 Layout and fabricate rabbet joints.
- 2.E.01.11 Layout and fabricate cope and stick joints.
- 2.E.01.12 Layout and fabricate scarf joints.
- 2.E.01.13 Layout and fabricate biscuit joints.
- 2.E.01.14 Layout and fabricate butt joints.

2.E.01 Performance Examples:
- Create a joint tree using various woodworking joints.
- Identify and list various woodworking joints found throughout your home.

2.F Hand Sanding

2.F.01 Identify and demonstrate hand sanding equipment and procedures.
- 2.F.01.01 Identify and select appropriate sandpaper for a specific application.
- 2.F.01.02 Demonstrate flat sanding.
- 2.F.01.03 Demonstrate curved sanding.

2.F.01 Performance Example:
- Sand project by hand using ascending grits.

2.G Gluing and Clamping

2.G.01 Describe and apply adhesives and demonstrate clamping procedures.
- 2.G.01.01 Identify types and uses of glues.
- 2.G.01.02 Identify types and uses of clamps.
- 2.G.01.03 Demonstrate flat clamping procedures.
- 2.G.01.04 Demonstrate curve clamping procedures.

2.G.01 Performance Example:
- Glue and clamp a panel.

2.H Stationary Power Equipment

2.H.01 Set up and operate a jointer.
- 2.H.01.01 Demonstrate face jointing.
- 2.H.01.02 Demonstrate edge jointing.
- 2.H.01.03 Demonstrate tapering.

2.H.01 Performance Examples:
- Pass a written safety test with 100% accuracy.
- Flatten a face of a board on the jointer.

2.H.02 Operate a planer.
- 2.H.02.01 Plane stock to specified thickness.
- 2.H.02.02 Square stock using a planer.

2.H.02 Performance Example:
- The student will demonstrate the use of a planer according to industry and OSHA standards.

2.H.03 Operate a band saw.
- 2.H.03.01 Change blade on a band saw.
- 2.H.03.02 Cut curves.
- 2.H.03.03 Rip using a fence.
- 2.H.03.04 Re-saw stock.

2.H.03 Performance Example:
- The student will demonstrate the operation and use of a band saw.

2.H.04 Set up and operate a table saw.
- 2.H.04.01 Change blade on a table saw.
- 2.H.04.02 Perform ripping operation.
- 2.H.04.03 Perform crosscut operation.
- 2.H.04.04 Perform specialty cuts including dado, rabbet, groove, chamfer, and miter.

2.H.04 Performance Example:
- The student will demonstrate the setup and operation of a table saw using the crosscut and ripping techniques.

2.H.05 Set up and operate a drill press.
- 2.H.05.01 Drill hole to given depth.
- 2.H.05.02 Drill multiple holes using stops.
- 2.H.05.03 Drill holes using jigs and fixtures.

2.H.05 Performance Example:
- The student will demonstrate the operation of a drill press using various drill jigs and fixtures according to industry and OSHA standards.

2.H.06 Set up and operate a grinder.
- 2.H.06.01 Grind cutting tools including chisels and planes.

2.H.06 Performance Example:
- The student will demonstrate the techniques for operating a grinder for sharpening tool bits according to industry and OSHA standards.

2.H.07 Set up and operate a lathe.
- 2.H.07.01 Perform spindle turning.
- 2.H.07.02 Perform faceplate turning.
- 2.H.07.03 Perform duplicate turning.

2.H.07 Performance Example:
- The student will demonstrate the use of wood turning using lathe equipment according to industry and OSHA standards.

2.H.08 Set up and operate a shaper.
- 2.H.08.01 Identify and install shaper cutters.
- 2.H.08.02 Perform straight edge shaping.
- 2.H.08.03 Perform face shaping.

2.H.08 Performance Example:
- The student will demonstrate the operation of a shaper for edge and face shaping according to industry and OSHA standards

2.H.09 Set up and operate different types of sanders.
- 2.H.09.01 Sand stock using wide belt sander.
- 2.H.09.02 Sand stock using edge sander.
- 2.H.09.03 Sand stock using spindle sander.

2.H.09 Performance Example:
- The student will demonstrate the operation of various types of sanding equipment both electrical and air operated according to industry and OSHA standards.

2.H.10 Identify and demonstrate the use of computer numerically controlled machines.
- 2.H.10.01 Describe the basic fundamentals of design software.
- 2.H.10.02 Produce a drawing using design software.
- 2.H.10.03 Use CAD/CAM equipment to manufacture a product or component.

2.H.10 Performance Example:
- The student will demonstrate the operation of CNC equipment, according to industry and OSHA standards, produce a drawing using design software, and describe the fundamentals of design software.

2.H.11 Set up and operate an electric miter box saw.
- 2.H.11.01 Perform crosscut, miter, and compound miter.
- 2.H.11.02 Perform multiple cuts using stops.

2.H.11 Performance Example:
- The student will demonstrate the operation of an electric miter box using crosscut and compound miter techniques, according to industry and OSHA standards

2.H.12 Use production equipment.
- 2.H.12.01 Demonstrate the use of a 32mm machine.
- 2.H.12.02 Demonstrate the use of a horizontal boring machine.
- 2.H.12.03 Demonstrate the use of an edge bander.
- 2.H.12.04 Demonstrate the use of a power feeder.
- 2.H.12.05 Demonstrate the use of a panel saw.
- 2.H.12.06 Demonstrate the use of a radial arm saw.

2.H.12 Performance Example:
- The student will demonstrate the use of variety production equipment according to industry and OSHA standards. These may include a horizontal boring machine, and edge bander, power feeder and panel saw.

2.I Portable Power Tools

2.I.01 Demonstrate the ability to use a pistol drill.
- 2.I.01.01 Identify correct drill bit.
- 2.I.01.02 Drill holes to given dimension.

2.I.01 Performance Examples:
- Pass a written safety test with 100% accuracy.
- Accurately bore a hole to a specified dimension.

2.I.02 Identify the methods of using an oscillating sander.
- 2.I.02.01 Identify sandpaper according to grit.
- 2.I.02.02 Sand surfaces with an oscillating sander.

2.I.02 Performance Example:
- The student will demonstrate the use of an oscillating sander by sanding surfaces and identifying the various sanding grits used for each operation according to industry and OSHA standards.

2.I.03 Demonstrate the ability to use an electric router.
- 2.I.03.01 Identify types of router bits.
- 2.I.03.02 Rout edges.
- 2.I.03.03 Demonstrate ability to make specialty cuts using guides and templates.

2.I.03 Performance Example:
- The student will demonstrate the operation of a router; identify the tooling and the techniques for various surfaces according to industry and OSHA standards.

2.I.04 Demonstrate the use of a belt sander.
- 2.I.04.01 Change belt on a belt sander.
- 2.I.04.02 Sand a surface using a belt sander.

2.I.04 Performance Example:
- The student will demonstrate the use and operation of a belt sander according to industry and OSHA standards

2.I.05 Demonstrate the use of a sabre saw.
- 2.I.05.01 Change blade of a sabre saw.
- 2.I.05.02 Cut curves and straight lines using a sabre saw.

2.I.05 Performance Example:
- The student will demonstrate the use of a sabre saw to cut curved and straight lines according to industry and OSHA standards.

2.I.06 Demonstrate the use of a circular saw.
- 2.I.06.01 Use circular saw.

2.I.06 Performance Example:
- The student will demonstrate operation of a circular saw according to industry and OSHA standards.

2.I.07 Demonstrate the use of a biscuit joiner.
2.I.07.01 Use biscuit joiner.

2.I.07 Performance Example:
- The student will demonstrate the operation of a biscuit joiner according to industry and OSHA standards.

2.I.08 Demonstrate how to use pneumatic fasteners.
2.I.08.01 Use pneumatic fasteners.

2.I.08 Performance Example:
- The student will demonstrate the operation of pneumatic fasteners according to industry and OSHA standards

2.J Woodwork Quality Standards

2.J.01 Identify quality standards of woodworking materials.
2.J.01.01 Identify Sheet goods.
2.J.01.02 Identify Solid woods.
2.J.01.03 Identify Mill work.

2.J.01 Performance Example:
- Differentiate between sheet goods.

2.K Casework and Furniture Fabrication.

2.K.01 Machine parts and assemble components.
2.K.01.01 Describe and demonstrate planning, measuring, and layout of furniture/casework for a specified area.
2.K.01.02 Layout, machine, and demonstrate assembly and installation of furniture/casework.
2.K.01.03 Construct and install doors and drawers.

2.K.01 Performance Example:
- Cut parts and assemble a base cabinet.

2.L Hardware/Fasteners

2.L.01 Install hardware and fasteners.
2.L.01.01 Identify types and describe uses of hardware and fasteners.
2.L.01.02 Layout and Install hardware and fasteners.

2.L.01 Performance Example:
- Select and install hardware from a catalog for a project.

2.M Architectural Millwork

2.M.01 Fabricate and install architectural millwork.
2.M.01.01 Identify and fabricate trim and molding.
2.M.01.02 Install trim and molding.

2.M.01 Performance Example:
- Install base, chair rail, and crown molding on a wall.

2.N Countertops

2.N.01 Create template, fabricate, and install counters.
2.N.01.01 Identify countertop materials.

2.N.01.02 Create template and fabricate countertops.
2.N.01.03 Install countertops.

2.N.01 Performance Example:
- Create template, fabricate, and install a countertop.

2.O Finishing

2.O.01 Select and apply finishes.
2.O.01.01 Prepare surface for finishing.
2.O.01.02 Identify and use appropriate methods of finishes.
2.O.01.03 Identify and use stains, sealers, and top coats.

2.O.01 Performance Examples:
- Apply finish to a project using spray equipment.
- Research the use of HVLP spray equipment and prepare a report to describe its applications.

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.

Term	Definition
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).
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 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 other support to learn about features of hardware and software, as well as to 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.B.01 2.C.01 2.F.01 2.G.01 2.H.08 2.J.01 2.L.01 2.K.01 2.M.01 2.N.01 2.O.01	RST Grades 9-10 #4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a technical context relevant to grades 9-10 texts and topics.
Performance Example: • Students will select the proper hardware from a catalog for a project.		
2.C.02 2.H.10	WHST Grades 9-10 #2(a, d)	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
Performance Example: • Students will make a stock list from a working drawing.		
2.B.01 2.G.01 2.J.01 2.L.01 2.K.01 2.M.01 2.O.01	RST Grades 9-10 #5	Analyze the structure of relationships among concepts in a text, including relationships among key terms.
Performance Example: • Students will pass a written safety test with 100% outcome.		
2.B.01	SL Grades 9-10 #1 (a-d)	Initiate and participate effectively in a range of collaborative discussions with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
Performance Example: • Students will visit a lumber mill, where they will be encouraged to engage in discussions with diverse partners on topics including the properties, characteristics, and harvesting of various wood products and their uses.		
2.C.01 2.C.03 2.K.01	RST Grades 9-10 #3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in a text.
Performance Example: • Students will cut parts and assemble a base cabinet.		
2.C.01 2.H.10	RST Grades 11-12 #7	Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed visually or mathematically into words.
Performance Example: • Students will lay out a project creating a layout rod/story pole, effectively translating text into a technical		

drawing/plan.		
2.C.02	W Pre-9th #2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
Performance Example: • Students will demonstrate the necessary techniques used in developing the layout for a project, develop a materials list, and create a layout rod/story pole.		

Embedded Mathematics

CVTE Learning Standard Number	Math Content Conceptual Category and Domain Code Learning Standard Number	Text of Mathematics Learning Standard
2.C.01	N-Q1 G-SRT1	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. Verify experimentally the properties of dilations given by the center and a scale factor.
Performance Examples: • Students will draw a polygon on a coordinate grid. • Given different scale factors (larger and smaller), students will re-draw polygon.		
2.C.03	N-Q3 MA.3.a	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure.
Performance Examples: • Given a set of plans, students will estimate the cost of material, and then determine exact amount of material needed. • Students will compare level of variance between methods and how it results in cost structure.		
2.E.01	G-GPE6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
Performance Examples: • Given a specific amount of cardboard, students will determine how different dimensions can change the volume and the cost to build a rectangular prism. • Students will be asked to cite real-world examples (e.g. Dell Computer, Coca-Cola, etc.).		
2.H.02	G-CO12 G-GPE5	Make formal geometric constructions with a variety of tools and methods. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
Performance Example: • Students will determine the equations of parallel and perpendicular lines that pass through a given point on a coordinate plane.		
2.H.03	G-C5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of the sector.
Performance Example: • Given the diameters, students will draw different size circles, determine circumferences, and cut different arc lengths.		
2.H.05	G-C1	Prove that all circles are similar.

Performance Example: • Students will compare different sized spheres. Using a compass, students will draw different sized circles and solve for area.		
2.H.08	G-MG1	Use geometric shapes, their measures, and their properties to describe objects.
Performance Example: • Students will draw a rectangle manually, and then redraw with a ruler. When complete, students will determine if any 90 degree angles were formed.		
2.H.12	G-CO12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software).
Performance Example: • Build a cardboard rectangular prism with given dimensions. Illustrate door opening, hinges, and fasteners.		
2.I.01	G-MG3 MA.4	Apply geometric shapes, their measures, and their properties to describe objects. Use dimensional analysis for unit conversions to confirm that expressions and equations make sense.
Performance Examples: • Measure a rectangular prism with various units of measure (yards, feet, inches, meters, centimeters, millimeters). • Convert between the different units.		
2.J.01	G-GPE6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
Performance Example: • Find the midpoint and distance of a line given the two end points.		

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.J.01	3. Earth Processes and Cycles 3.6	Describe the rock cycle, and the processes that are responsible for the formation of igneous, sedimentary, and metamorphic rocks. Compare the physical properties of these rock types and the physical properties of common rock-forming minerals.
Performance Example: • Students will identify countertop materials such as granite and marble, fabricate and install.		

Life Science (Biology)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Biology Learning Standard
2.B.01	Life Science, Classification of Organisms 1	Classify organisms into the currently recognized kingdoms according to characteristics that they share. Be familiar with organisms from each kingdom.
Performance Example: • Given samples of wood, students will identify various species, properties, and characteristics.		

Physical Science (Chemistry)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Chemistry Learning Standard
2.B.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: • Given samples of wood, students will identify various species, properties, and characteristics.		

Physical Science (Physics)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Physics Learning Standard
2.F.01	1. Motion and Forces 1.6	Distinguish qualitatively between static and kinetic friction, and describe their effects of the motion of objects.
Performance Example: • Students will sand a project by hand, using ascending grits.		
2.F.01 2.H.01 2.H.12	1. Motion and Forces 1.8	Describe conceptually the forces involved in circular motion.
Performance Examples: • Students will sand a project, demonstrating an understanding of flat sanding vs. curved sanding. • Students will demonstrate proper and safe power equipment operation.		
2.N.01	3. Heat and Heat Transfer 3.4	Explain the relationships among temperature changes in a substance, the amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.
Performance Examples: • Students will template, fabricate, and install a countertop, selecting materials and substances that resist heat. • Students will demonstrate the safe and proper operation of power equipment, explaining the relationship between heat transfer and friction (sanding of materials).		

Technology/Engineering

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Technology/Engineering Learning Standard
2.B.01 2.C.02	1. Materials, Tools, and Machines 1.1	Given a design task, identify appropriate materials (e.g., wood, paper, plastic, aggregates, ceramics, metals, solvents, adhesives) based on specific properties and characteristics (e.g., strength, hardness, and flexibility).
Performance Examples: • Given samples of wood, students will identify various species, properties, and characteristics. • Students will demonstrate the necessary techniques used in developing the layout for a project, develop a materials list, and create a layout rod/story pole.		

2.C.01 2.C.03 2.D.01 2.F.01 2.H.01 2.H.12 2.I.01 2.I.08 2.K.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
Performance Example: • Students will safely and properly use a variety of measuring, hand, and power tools, including the following: Architect's scale, ruler, stationary power equipment, and portable power tools.		
2.C.01 2.C.03 2.D.01 2.F.01 2.H.01 2.H.12 2.I.01 2.I.08 2.K.01	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 safely and properly use a variety of measuring, hand, and power tools, including the following: Architect's scale, ruler, stationary power equipment, and portable power tools.		
2.H.10 2.K.01 2.M.01 2.N.01	2. Engineering Design 2.1	Identify and explain the steps of the engineering design process, i.e., 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 Examples: • Students will demonstrate the safe and proper use of CNC equipment, produce a drawing using design software, and describe the fundamentals of design software. • Students will template, fabricate, and install a countertop. • Students will cut parts and assemble a base cabinet.		
2.C.01 2.C.02 2.H.10 2.K.01	2. Engineering Design 2.2	Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multi-view drawings.
Performance Example: • Students will demonstrate a fundamental understanding of design software, and will be able to produce a drawing/design used to manufacture a design solution.		
2.C.01 2.C.02 2.F.01 2.H.08 2.I.01 – 2.I.03 2.J.01-2.O.01	2. Engineering Design 2.4	Identify appropriate materials, tools, and machines needed to construct a prototype of a given engineering design.
Performance Examples: • Given samples of wood, students will identify various species, properties, and characteristics, determining the most appropriate materials for a project. • Students will lay out a project creating a layout rod/story pole, effectively translating text into a technical drawing/plan.		

2.C.01 2.C.03	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: • Students will develop a stock list from a working drawing.		
2.C.01, 2.C.02, 2.H.10, 2.I.01 2.I.08 2.J.01- 2.O.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: • Students will demonstrate the safe and proper use of CNC equipment, produce a drawing using design software, and describe the fundamentals of design software.		
2.C.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: • Students will be able to accurately interpret working drawings, recognizing and identifying basic print terms.		
2.J.01 2.M.01	4. Manufacturing Technologies 4.1	Describe and explain the manufacturing systems of custom and mass production.
Performance Example: • Students will be able to determine a variety of quality standards of woodworking materials, and will be able to differentiate between sheet goods, solid works, and mill work.		
2.E – 2.O	4. Manufacturing Technologies 4.4	Explain basic processes in manufacturing systems, e.g., cutting, shaping, assembling, joining, finishing, quality control, and safety.
Performance Example: • Students will understand basic processes in manufacturing systems, safely and properly using a variety of measuring, hand, and power tools.		
2.M.01	5. Construction Technologies 5.1	Describe and explain parts of a structure, e.g., foundation, flooring, decking, wall, roofing systems.
Performance Example: • After identifying and fabricating a variety of trims and moldings, the student will install base, chair rail, and crown molding on a wall.		
2.H.10 2.K.01 2.M.01 2.N.01	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 Examples: • Students will safely and properly use a variety of measuring, hand, and power tools, including the following: Architect's scale, ruler, stationary power equipment, and portable power tools. • Students will demonstrate the safe and proper use of CNC equipment, produce a drawing using design software, and describe the fundamentals of design software. • Students will template, fabricate, and install a countertop. Students will cut parts and assemble a base cabinet.		
2.C.01 2.C.02 2.H.10 2.K.01	1. Engineering Design 1.3	Produce and analyze multi-view drawings (orthographic projections) and pictorial drawings (isometric, oblique, perspective), using various techniques.
Performance Examples: • Students will be able to accurately interpret a variety of working drawings, recognizing and identifying		

basic print terms. • Students will demonstrate a fundamental understanding of design software, and will be able to produce a drawing/design used to manufacture a design solution.		
2.C.01	1. Engineering Design 1.4	Interpret and apply scale and proportion to orthographic projections and pictorial drawings (e.g., ¼" = 1'0", 1 cm = 1 m).
Performance Example: • After demonstrating an understanding of a variety of drawings and basic print terms, students will draw a small cabinet project to scale, incorporating the use of an Architect's scale.		
2.C.01 2.C.02 2.H.10 2.K.01	1. Engineering Design 1.5	Interpret plans, diagrams, and working drawings in the construction of prototypes or models.
Performance Examples: • Students will be able to accurately interpret a variety of working drawings, recognizing and identifying basic print terms. • Students will demonstrate a fundamental understanding of design software, and will be able to produce a drawing/design used to manufacture a design solution. • Students will template, fabricate, and install a countertop. Students will cut parts and assemble a base cabinet.		
2.C.03 2.D.01 2.F.01 2.H.01 2.H.09 2.H.11- 2.H.12 2.I.01- 2.I.08	Technology/ Engineering, 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 Examples: • Students will fabricate a small project using a hand tools (sharp edge, pounding, and prying), and will sand project by hand using ascending grits. • Students will set up and operate a wide variety of stationary power equipment, including: jointer, planer, band saw, table saw, drill press, grinder, lathe, shaper, and a variety of sanders.		
2.O.01	7. Manufacturing Technologies 7.1	Describe the manufacturing processes of casting and molding, forming, separating, conditioning, assembling, and finishing.
Performance Example: • Students will identify and use appropriate methods of finishes, including HVLP spray equipment.		
2.J.01 2.L.01 2.M.01	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 Examples: • Students will select the proper hardware from a catalog for a project. • After identifying and fabricating a variety of trims and moldings, students will install base, chair rail, and crown molding on a wall.		
2.C.01 2.C.03 2.D.01 2.F.01 2.H.01 2.H.12 2.I.01 2.I.08 2.J.01 2.O.01	7. Manufacturing Technologies 7.3	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 understand basic processes in manufacturing systems, safely and properly using a variety of measuring, hand, and power tools.

DESE Statewide Articulation Agreements

ARTICULATION AGREEMENT

Between

New England Carpenters Apprenticeship & Training Fund

And

Massachusetts High Schools with Chapter 74-Approved
Vocational Technical Education Cabinetmaking Programs

Industry Recognized Credentials (Licenses and Certifications/Specialty Programs)

The United Brotherhood of Carpenters and Joiners of America Union,
https://www.carpenters.org/Home.aspx

WCA Woodwork Career Alliance of North America
P.O. Box 636
Nellysford, VA 22958-0636
http://woodworkcareer.org/

NKBA National Kitchen & Bath Association
http://www.nkba.org/

Other

Reference Materials

- Woodworking Technology, Hammond/Donnelly/Harrod/Rayner by Glencoe Publishing Company Book
- Modern Cabinetmaking, William D. Umstattd/Charles W. Davis by The Goodheart-Willcox Company, Inc. Book
- Woodworking for Industry: Technology and Practices, 3rd ed. Rev., by John Louis Feirer, Book
- Wood: Technology & Process, by John Louis Feirer , Book
- Cabinetmaking Trainee Guide, by NCCER, Book
- Com-link with basic skills and academic linkages: custom cabinetmaking, by NEWJ, Book
- Exploring Woodworking – Fundamentals of Technology and instructor's guide, by Zimmerman, Book
- Modern Woodworking: Tools, Materials, and processes, by Wagner, Book
- Fresh Wood, by Asbury, Book
- Modern Cabinetmaking, by UMSTATTD, Book
- Architectural Woodwork Quality Standards (Illus.), by AWI, Book
- Cabinetmaking Trainee Guide, by NCCER, Book
- Multimedia woodshop Safety, SHOPWARE, CD
- Modern carpentry: Teacher's resource binder, by Wagner, Binder
- Practical Problems in Mathematics for Carpenters, by Huth, Book

Related National, Regional, and State Professional Organizations

- AWI Architectural Woodwork Institute, http://awinet.org/
- National Woodwork Manufacturers Association

Student Organizations

- Skills USA, Massachusetts, 250 Foundry Street, South Easton, MA 02375 www.maskillsusa.org
- SkillsUSA National, 14001 SkillsUSA Way, Leesburg, Virginia 20176, http://www.skillsusa.org/index.shtml

Selected Websites

- United States Department of Labor, http://www.bls.gov/ooh/production/woodworkers.htm
- Construct MyFuture.com, http://www.constructmyfuture.com/Choose.asp
- WMIA-Woodworking Machinery Industry Association Scholarships, http://www.wmia.org/scholarships/
- Carpentry and Construction Career, http://www.khake.com/page14.html