



Vocational Technical Education Framework



Arts & Communication Services Occupational Cluster

Graphic Communications (VGC)

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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

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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



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Contributors to the 2012 Graphic Communications Framework (VGC) Strands 2, 3 and 6:

Project Administrator:

Leslie Weckesser, Vocational Director, Southeastern Regional Vocational Technical School

Framework Team Leader:

Kathleen Burroughs, Southeastern Regional Vocational Technical School

Technical Teachers:

Steve Champeau, Worcester Technical High School; Mark Chauvin, Tri-County Regional Vocational School; Chuck Gurlach, Somerville High School; Wayne McCarthy, Waltham High School; Brenda Waslick, Minuteman Tech; Frances Williams, Tri-County Regional Vocational Technical School

Academic Teachers:

Karen Maguire, Vice-Principal, Southeastern Regional Vocational Technical School; Heidi Driscoll, Director of Academics, Southeastern Regional Vocational Technical School; Colleen Glidden, Math Instructor, Southeastern Regional Vocational Technical School

Program Advisory Members:

John Kelley, Owner J.L. McIntosh
Barry Budwit, Graphics Business Unit Manager- Finline Graphics
Barbara-jean Chauvin, Voc. Dir, South Shore Voc Tech H.S. Specialty is Graphic Comm
Gary Shea, Owner- Fleming printing.
Andrew Sullivan- Mathews Brand Solutions
Gilbert Ricci – Owner Art Shirt Co.
James Glennon-Alpha Graphics

Administrative Assistance

Terri Tello, Southeastern Regional Vocational Technical School

CVTE Frameworks Project Advisory Committee

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

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

Commissioner's Letter



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; Strand 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.

Appendix¹

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 Appendix² 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.

Arts & Communication Services Occupational Cluster

Graphic Communications Framework (VGC)

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 Graphics Communications Safety Knowledge and Skills

- 2.A.01 Demonstrate an understanding of safety practices related to Graphic Communications.
- 2.A.01.01 Utilize a systematic safety program which meets OSHA requirements and promotes a safe working environment.
 - 2.A.01.02 Demonstrate safety procedures when using all equipment.
 - 2.A.01.03 Demonstrate preventive maintenance and lubrication procedures for all equipment.
 - 2.A.01.04 Demonstrate awareness that all machine guards are in place and operating properly before using equipment.
 - 2.A.01.05 Identify the existence of pinch points located behind the machine guarding on all equipment.
 - 2.A.01.06 Utilize Lockout/Tagout system.

2.A.01 Performance Examples:

Demonstrate effective safety practices

- Students will operate work environment equipment safely.
- Students will maintain a clean and orderly work environment.
- Students will maintain good safety records and carefully document injuries.
- Students will comply with safety personnel policies (e.g., personal protection equipment: safety shoes, hearing protection, glasses, gloves, etc.).
- Students will create information and training materials to promote a safe workplace.
- Students will create a chemical container label that quickly communicates potential hazards such as how the chemical reacts with other chemicals, whether it is flammable, and what type of protective equipment should be used when handling it.
- Students will comply with all safety requirements for operating binding, finishing, and mailing and distribution equipment by following manufacturer's instructions and all program policies.
- Students will use proper procedures to ensure that safety devices are in working order.
- Students will follow shop reporting procedures for unusual wear, machine noises, and other faults

2.B Historical Importance of Communication and Printing

- 2.B.01 Demonstrate an understanding of the significant role of printing in the history of mankind.
- 2.B.01.01 Describe the role of communication in the advancement of learning and education.
 - 2.B.01.02 Describe the historical impact of communication in establishing advanced civilizations.
 - 2.B.01.03 Describe the role of communication and printing in the rapid dissemination of information ushering in the age of enlightenment.
 - 2.B.01.04 Describe the role of movable type in increasing the pace of the spread of knowledge.
 - 2.B.01.05 Describe the significance of communication and printing as related to the First Amendment to the Constitution of the United States.
 - 2.B.01.06 List and describe the historical consequences of failures in communication.
 - 2.B.01.07 Explain the impact on comprehension of material in the usage of various delivery methods (oral, paper, electronic, etc.).

- 2.B.01 Performance Examples:
 Define the paths used to disseminate information to a large audience over the course of history.
- Students will create an image that contains a message of importance to an audience of one's peers for each of the following: 10,000 BCE, 5,000 BCE, 500 AD, 1500 AD, 1775 AD, present.
 - Students will decide the hierarchy of importance to be shown in a diagram.
 - Students will define the consequences of failure to reach the intended audience.
 - Students will determine the best path to reach the greatest percentage of the audience.

2.C Job Engineering Skills for Graphic Communications

- 2.C.01 Demonstrate project management skills through the use of communication and collaboration.
- 2.C.01.01 Describe procedures that prepare products for publishing/distribution.
 - 2.C.01.02 Describe responsibilities of production personnel.
 - 2.C.01.03 Choose appropriate methods of invoicing and delivery.
 - 2.C.01.04 List practices used to schedule project workflow.
 - 2.C.01.05 State the importance of obtaining approvals/sign-offs.
 - 2.C.01.06 Discuss methods for planning and coordinating production.
 - 2.C.01.07 Demonstrate techniques used to monitor production quality.
 - 2.C.01.08 List ways to match customer needs and expectations with production process requirements (e.g., layout dummies/mock ups).
 - 2.C.01.09 Determine and explain the potential for use of variable-data processes.
 - 2.C.01.10 List criteria used to analyze and critique a product.
 - 2.C.01.11 Compare and contrast various printing processes, including digital, offset, flexography, and screen printing, etc.
 - 2.C.01.12 Demonstrate ecologically sound printing practices.
 - 2.C.01.13 Define and explain the purpose of the Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC) certified printing processes.
 - 2.C.01.14 Explain the purpose of the International Standards Organization (ISO).
 - 2.C.01.15 Describe and follow gripper margin requirements to accommodate intended output device.
- 2.C.02 Demonstrate knowledge of fundamental measuring systems.
- 2.C.02.01 Define units of measurement and proper uses of each.
 - 2.C.02.02 Demonstrate measuring skills (rulers, scales and percentage/proportion wheels).
 - 2.C.02.03 Demonstrate accurate use of weight and measure.
 - 2.C.02.04 Demonstrate methods and techniques of paper counting.
- 2.C.03 Demonstrate effective customer service practices.
- 2.C.03.01 Estimate costs and produce quotation for customer.
 - 2.C.03.02 Establish a budget.
 - 2.C.03.03 Utilize proper etiquette when communicating by telephone.
 - 2.C.03.04 Demonstrate positive interpersonal skills in customer communications.
 - 2.C.03.05 Identify accurate information gathering skills needed to complete job tracking and production methods.
 - 2.C.03.06 Demonstrate proper order entry method.
 - 2.C.03.07 Complete the required job order ticket for either digital or offset with all customer contact and job information.
 - 2.C.03.08 Place follow up calls or emails to make sure customer was satisfied with the product and service.
 - 2.C.03.09 Demonstrate fluency with cloud-based client proofing systems and procedures.

- 2.C.03 Performance Examples:
Accept printing request from customer
- Students will greet customer and carefully listen to their request and determine their print production needs.
 - Students will collect all necessary information to satisfy customer's requirements, and production process requirements.
 - Students will complete order entry forms and methods to prepare quotation
 - Students will collaborate with classmates and teacher to investigate path of workflow necessary to successfully deliver high quality products.
 - Students will determine equipment, processes, and supply costs anticipated for production.
 - Students will contact customer with authorized written quotation detailing terms, delivery options and any other pertinent details.

2.D Digital File Preparation

- 2.D.01 Apply knowledge of digital prepress systems.
- 2.D.01.01 Identify specific computer platforms and associated operating systems.
 - 2.D.01.02 Identify and perform procedures for backing up and archiving files.
 - 2.D.01.03 Describe major imaging operations and workflow through the design and layout process (e.g., CTP computer to plate, computer to film).
 - 2.D.01.04 Identify software applications used in print and web media.
 - 2.D.01.05 Understand and utilize current industry appropriate software.

- 2.D.01 Performance Example: Students will accept printing request from customer.
Repurpose customer file for use on multiple output platforms (i.e. web, print, mobile device)
- Students will receive customer file.
 - Students will correct, interpret, and convert native file format for PDF output.
 - Students will configure PDF file specifications for appropriate output device.
 - Students will output PDF file for intended use.

- 2.D.01 Performance Examples:
- Students will create a basic trouble shooting. worksheet/flowchart used to correct basic computer performance problem(s).
 - Student will assess and remedy networking, printing, and/or slow performance issues.
 - Student will subsequently create a troubleshooting flowchart detailing each item.

2.E Graphic Design Practices

- 2.E.01 Demonstrate an understanding of the principle rules of typography.
- 2.E.01.01 Compare and contrast the use of body copy and display type.
 - 2.E.01.02 Identify type selection through the use of font classification, styles and families.
 - 2.E.01.03 Compare and contrast the differences between font formats (e.g., postscript, true type, open type).
 - 2.E.01.04 Explain the proper procedures for loading and utilizing font management systems.
 - 2.E.01.05 Demonstrate keyboard skills, including short cuts and function keys.
 - 2.E.01.06 Read, convert, and measure using the pica and point system.
 - 2.E.01.07 Practice proper principles of font usage (kerning, tracking, leading, and alignments).

2.E.01.08 Practice guidelines of type readability and legibility.

- 2.E.01 Performance Examples:
Create typography specimen booklet
- Identify and label parts of a type character.
 - Collect various type classifications samples.
 - Group type according to type families.
 - Collect various alignment samples of type.
 - Collect samples of body and display type.

- 2.E.02 Demonstrate an understanding of the principal elements of design.
- 2.E.02.01 Define principles of design (balance, contrast, unity, rhythm, and proportion).
- 2.E.02.02 Define elements of design (line, shapes, mass, texture, color, etc.).
- 2.E.02.03 Explain and adhere to the rules of basic color theory as they apply to the imaging process.
- 2.E.02.04 Explain the fundamentals of how light and paper characteristics affect color perception.
- 2.E.02.05 Compare and contrast raster and vector images and list their uses.
- 2.E.02.06 Create and manipulate a vector image using illustration software.

- 2.E.02 Performance Examples:
- Create a printed piece which demonstrates the use of principles and elements of design including: balance, contrast, unity, rhythm, proportion, line, shapes, mass, texture, and color.

- 2.E.03 Manipulate and scan images and materials.
- 2.E.03.01 Scan materials into appropriate file formats and resolutions.
- 2.E.03.02 Describe and apply basic digital photographic principles as used in printing.
- 2.E.03.03 Improve the color and tonal balance of an image for reproduction purposes.
- 2.E.03.04 Retouch, modify, and correct images using various image-editing techniques.
- 2.E.03.05 Manipulate raster image using photo-editing software.
- 2.E.03.06 Re-purpose an existing photo/illustration that was previously used in a CMYK printed project, to remove moire' pattern.
- 2.E.04 Demonstrate effective page layout practices as it applies to the production process.
- 2.E.04.01 Create documents with a professional page layout program.
- 2.E.04.02 Determine appropriate size, resolution, and format, and place graphic into a document.
- 2.E.04.03 Create multiple page documents using master pages and style sheets.
- 2.E.04.04 Import copy from a word processing program into a page layout program.
- 2.E.04.05 Save documents in a variety of formats (native, PDF, EPS).
- 2.E.04.06 Organize, select and label artwork for identification of links.
- 2.E.04.07 Prepare file for separations and output.
- 2.E.04.08 Convert or repurpose print files for multiple media (web, mobile media, and presentation).
- 2.E.04.09 Manage the flow of information from a wide variety of sources for variable data output.
- 2.E.04.10 Identify and demonstrate basic proofreading marks.
- 2.E.04.11 Proofread and edit a document using proofreading marks.

- 2.E.04.12 Edit a marked-up document using proofreader marks.
- 2.E.04.13 Explain the impact of prepress (imaging) and finishing processes on press operations.
- 2.E.04.14 Describe gripper margin requirements to accommodate intended output device.

2.E.04 Performance Examples:

Create artwork and provide proof for approval:

- Set up artwork for job as described above.
- Choose typestyles, fonts, colors to be used in production.
- Using rules of typesetting, determine font sizes, line lengths and page layout characteristics to create a mock-up of the finished piece.
- Locate and store in appropriate folder all images and text to be used in finished artwork.
- Set-up artwork to reflect all gripper margin requirements of intended output device.
- Follow rules of contrast, repetition, alignment and proximity in creation of artwork.
- Submit artwork for proofreading purposes.
- Make changes and corrections and create PDF file for proofing by customer.
- Upload PDF proof on protected cloud-based server for remote customer access.
- Review customer comments, changes, or alterations and repeat as necessary.
- Design and layout a stationary package to include the following: letterhead, business card, envelope.
- Design and layout a brochure using correct resolution, bleeds, and trim specifications. Produce and fold.

2.F Preparation and Assembly Practices for Output to Various Media

- 2.F.01 Demonstrate appropriate file management practices.
 - 2.F.01.01 Demonstrate the use of folders and hierarchical organizational structures in file management.
 - 2.F.01.02 Identify and correct common file errors (for input and output).
 - 2.F.01.03 Explain the benefits of PDF documents and their settings.
 - 2.F.01.04 Identify and describe file types (jpeg, tiff, eps, ps).
 - 2.F.01.05 Identify and describe file sizes and explain how they affect output.
- 2.F.02 Demonstrate effective pre-flight practices.
 - 2.F.02.01 Perform pre-flight operations and save to storage media.
 - 2.F.02.02 Collect and package digital files for output and portability.
 - 2.F.02.03 Soft proof job.
 - 2.F.02.04 Impose job for the proper layout.
- 2.F.03 Demonstrate effective output practices.
 - 2.F.03.01 Prepare document for file output.
 - 2.F.03.02 Operate output devices to produce print to pre-defined client specifications.
 - 2.F.03.03 Identify and correct common output errors.
 - 2.F.03.04 Expose, process, and store film and/or plates.
 - 2.F.03.05 List considerations to identify the correct plate materials (paper, polyester, metal) for a given job.
 - 2.F.03.06 Demonstrate maintenance routines and techniques used to maintain and prolong film processor and/or plate-making equipment life.
 - 2.F.03.07 Describe and demonstrate the use of input and output devices (e.g., digital camera, laser printer).

- 2.F.03.08 Explain the importance of image control marks to identify centers, bleeds, trims, register marks, side guides, and signature collation.
- 2.F.03.09 Explain and demonstrate trapping, knockouts, and overprints.

- 2.F.03 Performance Examples:
 Assemble document for output.
- Build and prepare a document including, trapping and preflight.
 - Create and inspect proofs.
 - Prepare/correct a document for output.

2.G Offset Print Production Practices

- 2.G.01 Demonstrate an understanding of feeder and registration systems.
 - 2.G.01.01 Describe the various types of feeder systems and their components.
 - 2.G.01.02 Explain paper classifications and characteristics of various printing substrates.
 - 2.G.01.03 Describe procedures for jogging and loading paper stock into the feeder.
 - 2.G.01.04 Describe the various types of registration systems and their components.
 - 2.G.01.05 Describe techniques used to maintain register.
 - 2.G.01.06 Set up the feeder and registration systems accurately.
- 2.G.02 Demonstrate an understanding of inking and dampening systems.
 - 2.G.02.01 Describe the components of the inking system.
 - 2.G.02.02 Explain the characteristics of different inks.
 - 2.G.02.03 Describe the proper way to measure and mix ink.
 - 2.G.02.04 Describe procedures for preparing and maintaining the inking system.
 - 2.G.02.05 Explain the characteristics of various chemicals used in the printing process.
 - 2.G.02.06 Describe the components of the dampening system.
 - 2.G.02.07 Describe the function of fountain solution.
 - 2.G.02.08 Describe procedures for preparing and maintaining the dampening system.
 - 2.G.02.09 Set up the inking and dampening systems accurately.
- 2.G.03 Demonstrate an understanding of cylinder systems.
 - 2.G.03.01 Describe the components of the various types of cylinder systems.
 - 2.G.03.02 Determine methods of packing plates and blankets following the manufacturer's specifications.
 - 2.G.03.03 Identify basic cylinder configurations.
 - 2.G.03.04 Compare plate characteristics.
 - 2.G.03.05 Identify the causes of and list solutions for image transfer problems.
 - 2.G.03.06 Describe methods of mounting plates.
 - 2.G.03.07 Describe method for installing a blanket.
 - 2.G.03.08 Set up the cylinder system accurately.
- 2.G.04 Demonstrate an understanding of delivery systems.
 - 2.G.04.01 Describe the components of the various types of delivery systems.
 - 2.G.04.02 Set up the delivery system accurately.
 - 2.G.04.03 Identify various drying systems (IR, spray, thermography).
- 2.G.05 Demonstrate effective use of make-ready on an offset press.
 - 2.G.05.01 Set up feeder and registration systems.
 - 2.G.05.02 Prepare the ink and inking system.
 - 2.G.05.03 Prepare dampening system.
 - 2.G.05.04 Prepare the cylinder system (mount plates, set impression).
 - 2.G.05.05 Set up delivery and drying systems.
- 2.G.06 Demonstrate an understanding of printing operations on an offset press.

- 2.G.06.01 Demonstrate the use of common printing hand tools and measuring instruments.
- 2.G.06.02 Identify common printing problems and their resolutions.
- 2.G.06.03 Perform printing operations.
- 2.G.06.04 Demonstrate the use of quality control standards and techniques: image and color quality, fit and registration, ink and water balance.
- 2.G.06.05 Monitor feeder, registration inking, dampening, cylinder, delivery, and drying systems.
- 2.G.06.06 Demonstrate effective maintenance schedules by adhering to manufacturer's press maintenance schedule.
- 2.G.07 Demonstrate an understanding of thermography printing practices according to current industry standards and manufacturers' specifications.
 - 2.G.07.01 Demonstrate maintenance of equipment following manufacturer's specifications.
 - 2.G.07.02 Demonstrate how to add additive to ink.
 - 2.G.07.03 Demonstrate the application of thermography powder.
 - 2.G.07.04 Set up drying conveyor.
 - 2.G.07.05 Demonstrate cool down procedures.

- 2.G.07 Performance Examples:
 Demonstrate effective offset print production.
- Students will set up, accurately print, and wash up an offset press.
 - Students will perform make ready on an offset press (set up 8.5" x 11" 20# stock).
 - Students will produce 500 sheets of a single color document.
 - Students will demonstrate the use of quality control standards and techniques.
 - Students will produce a multi-color job.

2.H Additional Printing Processes used in Graphic Communications

- 2.H.01 Demonstrate effective digital printing practices according to current industry standards.
 - 2.H.01.01 Configure electronic files for digital output.
 - 2.H.01.02 Manage RIP workstation / job queue.
 - 2.H.01.03 Input appropriate specifications for document scanning.
 - 2.H.01.04 Scan a document using a document handler or flatbed on digital printer.
 - 2.H.01.05 Load substrate into the appropriate feeder.
 - 2.H.01.06 Adjust digital printer for the type of stock.
 - 2.H.01.07 Make proper color or black and white adjustments for best results.
 - 2.H.01.08 Configure settings for finishing unit on digital printer.
 - 2.H.01.09 Add toner/ink to printer.
 - 2.H.01.10 Change waste container.
 - 2.H.01.11 Investigate and report on nano-technology advances which pertain to the print industry.

- 2.H.01 Performance Examples:
Demonstrate effective digital production.
- Students will send a job that requires adjusting position on the RIP and configure settings for finishing.
 - Students will demonstrate effective use of crop marks and bleeds.
 - Students will adjust color balance to achieve the best results.

- 2.H.02 Demonstrate procedures used for screen printing.
- 2.H.02.01 Perform maintenance to equipment as per manufacturer's specifications.
 - 2.H.02.02 Compare the difference between manual process and automatic process.
 - 2.H.02.03 Compare the difference between mesh counts.
 - 2.H.02.04 Prepare positives for production.
 - 2.H.02.05 Add emulsion to a screen.
 - 2.H.02.06 Expose screen using an exposure unit and exposure calculator.
 - 2.H.02.07 Prepare screen for production (masking and taping).
 - 2.H.02.08 Explain ink curing process for a variety of inks.
 - 2.H.02.09 Set and align print heads and off contact.
 - 2.H.02.10 Register multiple screens for multicolor print.
 - 2.H.02.11 Print image using a squeegee.
 - 2.H.02.12 Explain the need for incorporating a flash unit.
 - 2.H.02.13 Demonstrate the use of a flash unit.
 - 2.H.02.14 Demonstrate curing/drying techniques, using infrared thermometer.
 - 2.H.02.15 Demonstrate reclaiming and degreasing of screens.

- 2.H.02 Performance Examples:
- Students will select appropriate screen for assignment.
 - Students will add emulsion to a screen.
 - Students will align positive with screen and expose.
 - Students will mask out screen.
 - Students will set up, print, and reclaim.
 - Students will calibrate print head.
 - Students will print and cure image on substrate at designated location.

- 2.H.03 Demonstrate plotting and sign making practices.
- 2.H.03.01 Demonstrate maintenance of equipment following manufacturer's specifications.
 - 2.H.03.02 Prepare plotting for different substrates.
 - 2.H.03.03 Prepare and execute file for plotting.
 - 2.H.03.04 Demonstrate proper weeding technique.
 - 2.H.03.05 Prepare material for use.
- 2.H.04 Demonstrate an understanding of wide format printing practices.
- 2.H.04.01 Explain resolution requirements and guidelines for wide-format output.
 - 2.H.04.02 Perform preventive maintenance routines to ensure quality product.
 - 2.H.04.03 Navigate paper selection menu to match paper to intended output.
 - 2.H.04.04 Prepare document to be printed on various substrates.
 - 2.H.04.05 Mount document on backing.
 - 2.H.04.06 Laminate large format print.
 - 2.H.04.07 Trim and finish large format print, including grommets.
- 2.H.05 Demonstrate an understanding of embroidery practices according to industry standards and manufacturers' specifications.
- 2.H.05.01 Perform maintenance to machine.

- 2.H.05.02 Demonstrate threading of machine.
- 2.H.05.03 Install needles as to manufacturer's specifications.
- 2.H.05.04 Demonstrate maintenance and threading of bobbin.
- 2.H.05.05 Demonstrate hooping of garment.
- 2.H.05.06 Describe the backing to be used for each process.
- 2.H.05.07 Apply appliqué to garment.
- 2.H.05.08 Prepare and send file to machine.
- 2.H.05.09 Demonstrate trimming of backing.
- 2.H.06 Demonstrate an understanding of dye-sublimation printing practices.
 - 2.H.06.01 Describe resolution requirements and guidelines for dye-sub output.
 - 2.H.06.02 Describe transfer material requirements for intended substrate.
 - 2.H.06.03 Perform preventive maintenance routines to ensure quality product.
 - 2.H.06.04 Prepare document to be printed on various substrates.
 - 2.H.06.05 Navigate substrate selection menu to match paper requirements for intended destination.
 - 2.H.06.06 Align transfer paper to substrate and secure against movement during transfer.
 - 2.H.06.07 Demonstrate handling procedures appropriate to substrate being used.
- 2.I Finishing Practices**
 - 2.I.01 Demonstrate an understanding of the principles of binding and finishing.
 - 2.I.01.01 Identify common imaging and press problems that could adversely affect binding, finishing and distribution quality.
 - 2.I.01.02 Identify the importance of input quality on binding and finishing.
 - 2.I.01.03 Explain the importance of image control marks to identify centers, bleeds, trims, register marks, side guides, and signature collation.
 - 2.I.01.04 Explain how paper characteristics affect binding and folding operations.
 - 2.I.01.05 Describe workflow operations undertaken within finishing and distribution operations.
 - 2.I.01.06 Establish the sequence of production operations within the finishing and distribution area.
 - 2.I.01.07 Minimize paper waste and spoilage prior to printing, and manage waste disposal in finishing and distribution operations.
 - 2.I.01.08 Cut materials to given specifications, utilizing stock cutting math formula.
 - 2.I.01.09 Demonstrate proper folding steps and processes.
 - 2.I.01.10 Perform saddle-stitching and side-stitching finishing techniques.
 - 2.I.01.11 Perform mechanical binding techniques.
 - 2.I.01.12 Set up and use a perforation or score.
 - 2.I.01.13 Collate signatures.
 - 2.I.01.14 Demonstrate adhesive or perfect binding techniques.
 - 2.I.01.15 Trim printed materials.
 - 2.I.01.16 Drill holes with drill press.
 - 2.I.01.17 Perform numbering process.
 - 2.I.01.18 Set up and laminate a job with either heat set laminate or cold set laminate.
 - 2.I.01.19 List procedures for storing raw materials and finished products.

2.I.01 Performance Examples:

Demonstrate effective finishing practices.

- Students will set up paper cutter to cut 23"x35" stock into 11.25"x17.25" using stock cutting math formula.
- Students will produce 48 page dummy for electronic imposition.
- Students will set up paper folder and fold 11.25"x17.25" stock to 8.625"x 11.125".
- Students will number and collate twelve folded signatures into a 48 page dummy.
- Students will set up and saddle stitch dummy.
- Students will set up paper cutter and perform the final trim to 8.5"x11".
- Students will set up paper drill for standard three-hole position, and drill dummy.

2.I.01 Performance Examples:

Demonstrate effective perforation/scoring procedures.

- Students will set up and align perforation/scoring wheels to perforate/score sheet at designated location.

2.I.01 Performance Examples:

Demonstrate effective adhesive binding procedures

- Students will set up paper cutter to cut stock for 10 pads that measure 5.5 x 8.5 with chipboard backing.
- Students will jog and load sheets onto padding press.
- Students will firmly clamp and apply padding compound.
- Students will competently clean all tools and work area.
- Students will separate pads into finished product.

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

Chain of Command and Organizational Structure

**Definition**

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 other support to learn about features of hardware and software, as well as to assess and resolve problems.
 - 6.A.01.02 Install and uninstall software; compress and expand files (if the district allows it).
 - 6.A.01.03 Explain effective backup and recovery strategies.
 - 6.A.01.04 Apply advanced formatting and page layout features when appropriate (e.g., columns, templates, and styles) to improve the appearance of documents and materials.
 - 6.A.01.05 Use editing features appropriately (e.g., track changes, insert comments).
 - 6.A.01.06 Identify the use of word processing and desktop publishing skills in various careers.
 - 6.A.01.07 Identify the use of database skills in various careers.
 - 6.A.01.08 Define and use functions of a spreadsheet application (e.g., sort, filter, find).
 - 6.A.01.09 Explain how various formatting options are used to convey information in charts or graphs.
 - 6.A.01.10 Identify the use of spreadsheet skills in various careers.
 - 6.A.01.11 Use search engines and online directories.
 - 6.A.01.12 Explain the differences among various search engines and how they rank results.
 - 6.A.01.13 Explain and demonstrate effective search strategies for locating and retrieving electronic information (e.g., using syntax and Boolean logic operators).
 - 6.A.01.14 Describe good practices for password protection and authentication.
- 6.A.02 Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.
 - 6.A.02.01 Demonstrate compliance with the school's Acceptable Use Policy.
 - 6.A.02.02 Explain issues related to the responsible use of technology (e.g., privacy, security).
 - 6.A.02.03 Explain laws restricting the use of copyrighted materials.
 - 6.A.02.04 Identify examples of plagiarism, and discuss the possible consequences of plagiarizing the work of others.
- 6.A.03 Design and implement a personal learning plan that includes the use of technology to support lifelong learning goals.
 - 6.A.03.01 Evaluate the authenticity, accuracy, appropriateness, and bias of electronic resources, including Web sites.
 - 6.A.03.02 Analyze the values and points of view that are presented in media messages.
 - 6.A.03.03 Describe devices, applications, and operating system features that offer accessibility for people with disabilities.

- 6.A.03.04 Evaluate school and work environments in terms of ergonomic practices.
- 6.A.03.05 Describe and use safe and appropriate practices when participating in online communities (e.g., discussion groups, blogs, social networking sites).
- 6.A.03.06 Explain and use practices to protect one's personal safety online (e.g., not sharing personal information with strangers, being alert for online predators, reporting suspicious activities).
- 6.A.03.07 Explain ways individuals can protect their technology systems and information from unethical users.
- 6.A.04 Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.
 - 6.A.04.01 Devise and demonstrate strategies for efficiently collecting and organizing information from electronic sources.
 - 6.A.04.02 Compare, evaluate, and select appropriate electronic resources to locate specific information.
 - 6.A.04.03 Select the most appropriate search engines and directories for specific research tasks.
 - 6.A.04.04 Use a variety of media to present information for specific purposes (e.g., reports, research papers, presentations, newsletters, Web sites, podcasts, blogs), citing sources.
 - 6.A.04.05 Demonstrate how the use of various techniques and effects (e.g., editing, music, color, rhetorical devices) can be used to convey meaning in media.
 - 6.A.04.06 Use online communication tools to collaborate with peers, community members, and field experts as appropriate (e.g., bulletin boards, discussion forums, listservs, Web conferencing).
 - 6.A.04.07 Plan and implement a collaborative project with students in other classrooms and schools using telecommunications tools (e.g., e-mail, discussion forums, groupware, interactive Web sites, video conferencing).

Appendices

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

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

Embedded Academic Crosswalks

Embedded English Language Arts and Literacy

CVTE Learning Standard Number	Strand Coding Designation Grades ELAs Learning Standard Number	Text of English Language Arts Learning Standard
2.B.01	(WHST)8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
Performance Example: Each student will research, prepare, and present a paper on the history of the graphic industry and the importance of the industry to our current lifestyle.		
2.B.01.06 2.B.01.07	(RST) 1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
Performance Example: Groups of students will design a project focusing on the ramifications of failures in communication in world history. Students will define the paths used to disseminate information to a large audience over the course of history. Students will create an image that contains a message of importance to an audience of one's peers for each of the following: 10,000 BCE, 5,000 BCE, 500 AD, 1500 AD, 1775 AD, and today. Students will report out as a group on their findings.		
2.C.01.10	(WHST)9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
Performance Example: Develop TQM (total quality management) checklist for use for customer feedback.		
2.C.01.11	(RST) 9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
Performance Example: Students will create a basic worksheet/flowchart to display various printing processes. Flowchart will include pros and cons of each process as well as operational and safety requirements for each with appropriate documentation.		
2.C.01.08 2.C.03.09	(WHST)6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
Performance Example: Create a printed piece by identifying the aesthetic effects of a media presentation and identify and evaluate the techniques used to create them.		
2.E.04.10 2.E.04.11 2E.04.12	(RST) 4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grade</i> .
Performance Example: Students will demonstrate a knowledge and use of editing/proofreading symbols to finalize a document for production/presentation.		
2.G.06.06	(RST) 8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Performance Example:

Students will demonstrate the use of quality control standards and techniques by developing a safety operations document in their own words which describes the proper operation and maintenance of machinery with appropriate documentation.

Embedded Mathematics

CVTE Learning Standard Number	Math Content Conceptual Category and Domain Code Learning Standard Number	Text of Mathematics Learning Standard
2.C.01.08	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
Performance Example: Students will collect and analyze necessary information to satisfy customer requirements, and production process requirements.		
2.C.03.01	6.NS.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
Performance Example: Students will create a quotation derived from customer specifications to include terms and delivery options and submit for customer approval.		
2.C.03.02	7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
Performance Example: Students will determine production workflow by comparing equipment, processes, and anticipated labor costs.		
2.C.03.05	7.SP.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
Performance Example: Students will collaborate with department specialists to investigate production workflow necessary to successfully deliver high quality products.		
2.E.04.02	6.G	Solve real-world and mathematical problems involving area, surface area, and volume.
Performance Example: Student will set up artwork for the job as described above. Choose typestyles, fonts, colors to be used in production. Using rules of typesetting, determine font sizes, line lengths and page layout characteristics to create a mock-up of the finished piece.		
2.E.04.01	7.G.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.
Performance Example: Students will set-up artwork and/or rough comp to reflect all customer specifications.		
2.I.01.03	7.G.1	Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
Performance Example: Students will use customer mock-up to produce an enlarged or reduced document according to accepted design principles.		

DESE Statewide Articulation Agreements

No Statewide Articulation Agreements at this time.

Industry Recognized Credentials (Licenses and Certifications/Specialty Programs)

Occupational Safety and Health Administration—OSHA 10-hour card

Print ED

What is PrintED?

PrintED, administered by the Graphic Arts Education and Research Foundation (GAERF), is a national accreditation program based on industry standards for graphic communications courses of study at the secondary and post-secondary levels.

What are the benefits of accreditation?

To the student, PrintED provides a career pathway to enter the workplace with verifiable credentials, or to pursue further education with college credit already in hand. To the educator, PrintED ensures an instructional program that is current and relevant, consistent across the nation, and aligned with industry standards. To the employer, PrintED graduates promise a knowledgeable, trained, and skilled workforce.

Does PrintED have defined standards?

PrintED has identified six standards that encompass the elements of a solid training program. In order for a program to receive accreditation, it must meet these standards in at least two areas of accreditation.

Standard 1: *Instructional Staff*

The instructional staff must maintain technical competency, meet the requirements to be an approved PrintED instructor, and meet all state and local requirements for accreditation.

Standard 2: *Facility, Equipment & Safety*

The physical facility must be adequate to permit achievement of the program goals and performance objectives. In addition, the equipment must be of the type and quality found in the industry. Both the facility and equipment must meet today's safety standards.

Standard 3: *Instruction*

Program curriculum must include current industry tasks, safety procedures, acceptable work habits and ethics, and testing and evaluating procedures.

Standard 4: *Purpose*

Program must have clearly stated goals related to student services and employers served.

Standard 5: *Administration*

Administration must insure that instructional activities support and promote the goals of the program.

Standard 6: *Program Budget*

Funding must be provided to meet the approved program goals and performance objectives.

Print ED. Accreditation/Reaccreditation Flow Chart

1. Instructor submits completed application//\$1800 fee to GAERF. GAERF assigns an Evaluation Team Leader (ETL) to serve as a mentor to the instructor.
2. Instructor completes the Instructor Data Form (IDF), which determines whether the individual meets the qualifications to become an approved PrintED instructor.

3. ETL conducts onsite facility inspection, scores the IDF, provides instruction as to how to assemble the Standards Binders, and submits *Facility, Equipment and Safety Inspection Report* to GAERF.
4. The instructor assembles Standards Binders to document that competencies are being taught in each accreditation area. Once the Standards Binders have been completed, the ETL will notify GAERF and self-evaluation documents will be sent to the instructor.
5. Instructor and at least two members of the Advisory Committee conduct a self-evaluation of the program, by using the *Self-Evaluation Packet* and *Standards & Evaluation Guides* provided by GAERF. The instructor forwards the documents and the binder containing Standards One, Two, Four, Five, and Six to the program's ETL for review.
6. ETL reviews documents and the Standards Binder, and makes recommendations to the instructor if changes must be made to the program. If requirements are met, instructor and ETL determine a date for a final evaluation to be scheduled.
7. ETL informs GAERF of the final evaluation date. GAERF forwards final evaluation materials to the instructor. The instructor forms a final evaluation team of local industry professionals and submits the *Team Member Assignment* form and *Accreditation Notification* form to GAERF thirty days prior to the event.
8. GAERF forwards final evaluation materials to ETL. Evaluation team completes evaluation.
9. ETL submits *Final Evaluation Report* to GAERF.
10. GAERF awards five-year accreditation or reaccreditation to the program, forwards the institution a plaque, and lists the accredited program on the GAERF website.

PrintED/SkillsUSA Skill Connect Assessments

PrintED/SkillsUSA Skill Connect Assessments are aligned with PrintED/SkillsUSA competencies and are available in:

- Advertising and Design
- Graphic Communications
- Screen Printing Technology
- Digital File Preparation/Digital File Output
- Offset Press Operations/Binding and Finishing

The online assessments test technical skills and knowledge through questions enriched with animations, videos, drawings and photographs. Assessments may be used as pre-assessments or post-assessments. Immediate grading and feedback is provided. Students who receive passing scores on these examinations receive certificates imprinted with the PrintED, GAERF and SkillsUSA logos.

To purchase assessments visit: www.workforcereadysystem.org

\$10 members (PrintED student or SkillsUSA member)

\$20 nonmembers

Skill Connect Assessments provide career aspirants with a reliable means to measure their progress in acquiring occupational competencies needed in the early stages of professional development.

ADOBE CERTIFICATIONS

Visual Design: Foundations of Design and Print Production

Visual Design is a year-long, project-based curriculum that develops skills in design and print production using Adobe tools. You can use the curriculum in graphic design education or in more general career and technical education.

Visual Design develops key digital communication skills such as design, project management, and graphic and print technology. Each project builds on lessons learned previously.

Visual Design aligns with the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) for Students (2007) as well as the new Adobe Certified Associate Visual Communication objectives to prepare students for certification."

adobe.com

The certification is run through certipoint.com. The school can become a testing site and administer the tests online to students for a fee (see pricing below). There is a couple of options available to purchase tests, either a site license or on a voucher by voucher basis. The site license includes practice exams and unlimited retakes. Voucher only includes the test and up to 2 retests per voucher. In this option the practice exams are extra. The split is approximately 35 exams.

Site license is \$3175.00 for 12 months.

Individual vouchers are \$68.75 per test. Practice exams are \$500.00.

Once a student passes the exam they will be mailed a certificate which validates their entry level skills for that program.

Other

Reference Materials

Handbook of Print Media

Prof. Helmut Kipphan
Springer-Verlag Berlin Heidelberg New York
ISBN 3-540-67326-1

The Non-Designer's Design Book

Design and Visual Typographic Principles for the Visual Novice
Robin Williams
Peachpit Press Berkeley, CA
ISBN 1-56609-159-4

Offset Lithographic Technology

Good-Heart Wilcox Company
Tinley Park, Illinois
ISBN 1-56637-621-1

Exploring In Design

Author: Terry Rydberg
Edition: 001
Product Type: Book w/Multimedia (CD, DVD or Electronic)
ISBN 13: 9781418052638
ISBN 10: 1418052639
Copyright: 2008

Exploring Illustrator

Author: Annesa Hartman; Ken Sholar
Edition: 001
Product Type: Book w/Multimedia (CD, DVD or Electronic)
ISBN 13: 9781418052577

Exploring Photoshop

Author: Annesa Hartman; Ken Sholar
Edition: 001
Product Type: Book w/Multimedia (CD, DVD or Electronic)
ISBN 13: 9781418052591
ISBN 10: 1418052

Exploring Typography

Author: Tova Rabinowitz
Edition: 001
Product Type: Bound Book

ISBN 13: 9781401815059
ISBN 10: 1401815057
Copyright: 2006

Entrepreneurship, Ideas in Action

Cynthia L. Greene
Thomson, South-western
South-Western, 5191 Natorp Boulevard
Mason, OH 45040
ISBN 0-538-44122-4

Hearlihy screen-printing curriculum 2009

Screen Printing: A Contemporary Approach

Author Samuel Hoff
Illustrated Publisher Delmar, 1997 Original
0827371284, 9780827371286

Multiple Intelligences and Instructional Technology

Walter McKenzie
ISTE
Eugene, Oregon and Washington, DC
180 West 8th Avenue, Suite 300
Eugene, OR 97401
ISBN 978-1-56484-188-9

Printing Technology 5th Edition

J. Michael Adams
Penny Ann Dolin
DELMAR, Thomson Learning
3 Columbia Circle, P.O. Box 15015
Albany, NY 12212-5015
ISBN 0-7668-2232-X

AIGA

Professional Practices in Graphic Design

Second Edition
Allworth Press
10 East 23rd Street,
New York, NY 10010
ISBN -13: 978-1-58115-509-9

Design Fundamentals for New Media

James Gordon Bennett
THOMSON, Delmar Learning
Executive Woods

5 Maxwell Drive, PO Box 8007
Clifton Park, New York 12065-8007
ISBN 1-4018-3779-4

Teaching Graphic Design

Stephen Heller
Allworth Press
10 East 23rd Street,
New York, NY 10010
ISBN-10: 1-58115-305-8

Leading with Character

Farmer, Farmer, Burrow
South-Western, Cengage Learning
5191 Natorp Boulevard
Mason, OH 45040
ISBN-13: 978-0-538-44486-6

MAVCC

Orientation to Graphic Communication-2012, Advertising and Design-2012,
Digital File Preparation and Output-2008,
Press Operations-2006,
Binding and Finishing-2006

Graphic Communications, 5th Edition

By: Z. A. Prust
Goodheart Wilcox Company
Copyright: © 2010
ISBN: 978-1-60525-061-8

Offset Lithographic Technology, 4th Edition

By: Kenneth F. Hird and Charles E. Finley
Copyright: © 2010
ISBN: 978-1-60525-068-7

Against the clock

InDesign, Illustrator, Photoshop
copyright 2010
Graphic Design Portfolio

The Graphic Design Exercise Book

Jessica Glaser, Carolyn Knight
ISBN 13 9781600614637

Graphic Comm Central

<http://www.graphiccommcentral.org/>

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Visual Design-Certiport

Related National, Regional, and State Professional Organizations

- OSHA- Occupational Safety and Health Administration
- P.I.N.E - Printing Industries of New England
- G.A.T.F. - Graphic Arts Technical Foundation
- P.I.A. Printing Industries of America
- N.E.G.,C.C. -New England Graphic Communications Club (formally the Boston Litho Club)
- Label Printing Industries of America
- G.A.G. - Graphic Artist Guild
- N.A.P.P. - National Association of Photoshop Users
- N.A.P.L. - National Association of Print Leadership

Student Organizations

Skills USA www.maskillsusa.org

TSA

TSA Technology Student Association

1914 Association Drive

Reston, VA 20191-1540

<http://www.tsaweb.org/High-School-Competitions>

Future Business Leaders of America

<http://www.fbلا-pbl.org/>

Business Professionals of America

Business Professionals of America

5454 Cleveland Avenue

Columbus, OH 43231-4021

www.bpa.org

DECA

DECA Inc.

1908 Association Drive

Reston, VA 20191

<http://www.deca.org/membership/highschool/>

National Technical Honor Society

NTHS National Office Staff
P. O. Box 1336
Flat Rock, NC 28731
<https://www.nths.org/>

World Skills International

Keizersgracht 62-64
1015 CS Amsterdam
The Netherlands
http://www.worldskills.org/index.php?option=com_frontpage&Itemid=1

Office of Vocational and Adult Education

U.S. Department of Education Press Office
400 Maryland Avenue, SW, 7E-247
Washington, DC 20202.
<http://www2.ed.gov/about/offices/list/ovae/pi/cte/vso.html>

Future Educators Association

FEA
P.O. Box 7888
Bloomington, IN 47407-7888
<http://www.futureeducators.org/index.htm>

National Research Center for Career and Technical Education

NRCCTE
University of Louisville
College of Education and Human Development
Louisville KY 40292
<http://www.nrccte.org/>

National Business Education Association

NBEA
<http://www.nbea.org/>

Selected Websites

- <http://www.graphiccommcentral.org/>
- <http://www.gaerf.org/>
- <http://www.gaerf.org/PrintED.aspx>
- <http://www.sgia.org/>
- <http://whattheythink.com/>
- <http://www.howdesign.com/magazine/>

- <http://www.bamagazine.com/>
- <http://www.piag.org/>
- <http://www.printing.org/>
- <http://www.podi.org/>
- <http://www.piworld.com/>
- <http://adage.com/>
- <http://www.gammag.com/>
- <http://www.macdermidautotype.com/>
- <http://www.adobe.com/>