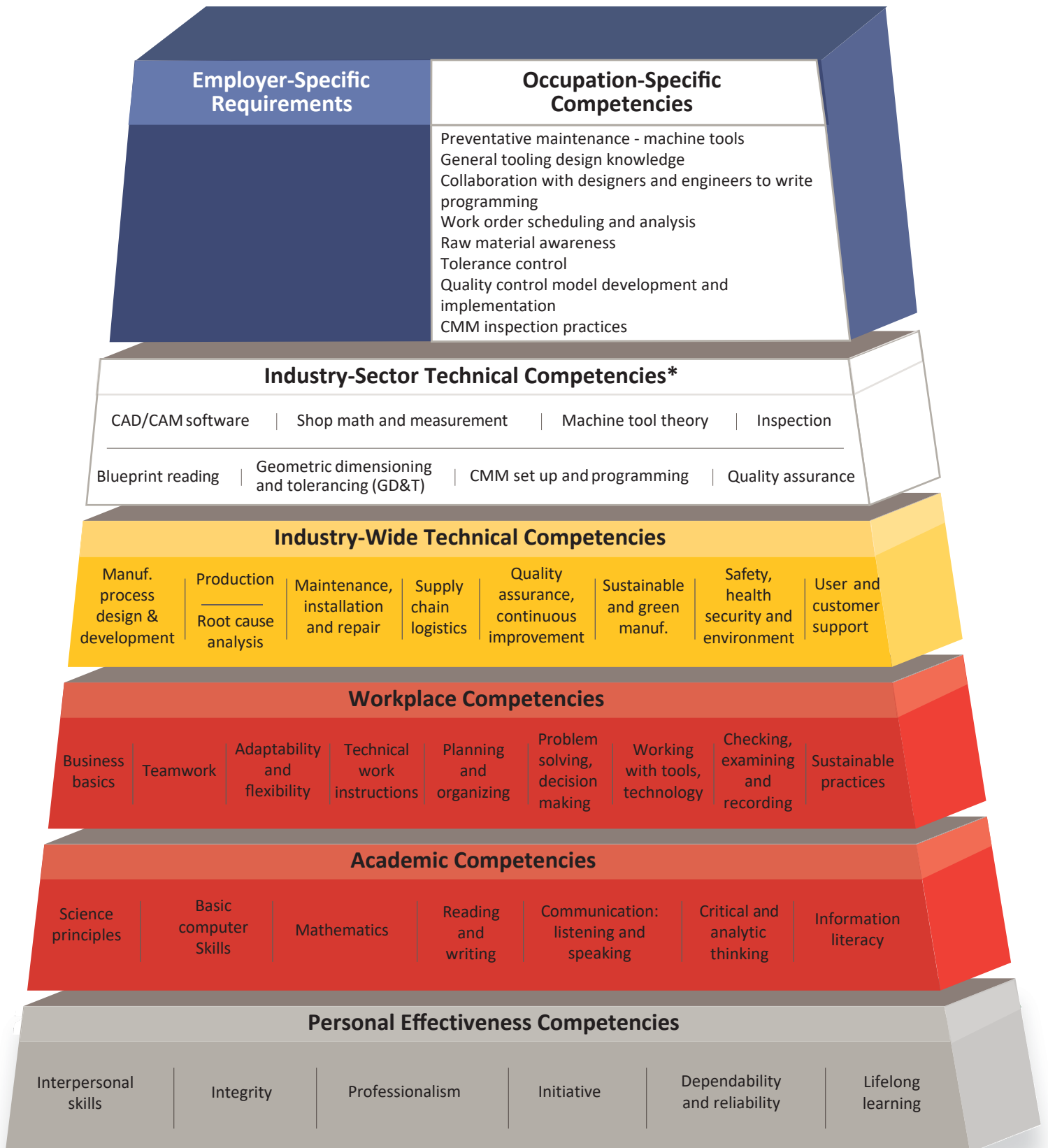


# Minnesota Dual-Training Pipeline

## Competency Model for Advanced Manufacturing

### Occupation: Coordinate Measuring Machine (CMM) Programmer



Based on: Advanced Manufacturing Competency Model Employment and Training Administration, United States Department of Labor, April 2010.

\*Pipeline recommends the Industry-Sector Technical Competencies as formal training opportunities (provided through related instruction) and the Occupation-Specific Competencies as on-the-job training opportunities

# Competency Model for Advanced Manufacturing

## Coordinate Measuring Machine (CMM) Programmer

A Coordinate Measuring Machine Programmer assists in the design and production of inspection equipment programming to ensure the highest quality possible for each product. They must create designs and interpret blueprints, manuals and other work instructions. They also study sample parts to determine dimensions of finished work pieces and equipment setup requirements. They work closely with engineers to note areas for improvement or to make corrections in order to help determine which tools will be the right ones for the CNC machine to use to ensure product reliability and machine shop efficiency. CMM Programmers inspect work pieces throughout a production run. These professionals additionally detect malfunctions using precision measuring instruments such as micrometers, dial calipers, depth gages, indicators and scales.

### Industry-Sector Technical Competencies

- CAD/CAM software -Use the models and assemblies created in CAD software such as PC-DMIS, Calypso, etc. to develop toolpaths that drive machine tools to turn designs into physical parts that meet quality standards.
- Blueprint reading - Knowledge in reading and understanding industrial prints.
- Shop math and measurement – Training in basic math, including linear measurement, metrics and beginning algebra.
- CMM set up and programming -Knowledge of manual programming of Coordinate Measuring Machine tools. Learn types of CMM controls, machinery, programming formats and basic terminology.
- Machine tool theory - Learn to complete the processes required for manufacturing a precision part, use standard shop safety practices, set-up and operate standard manufacturing machines, complete accurate lay-outs, explain applications of hand tools and use correctly and use basic measuring tools.
- Geometric dimensioning and tolerancing (GD & T) – Understand the system for defining and communicating engineering tolerances through symbolic language on engineering drawings and blueprints as well as computer generated models to assist in utilizing CMM operations.
- Quality assurance – Understands basic principles of precise measurement and attention to detail to ensure product meets exact standards as laid out in production plans.
- Inspection – Knowledgeable of the proper methods and instruments used to effectively inspect parts in the shop, including using instruments such as the caliper, micrometer, and of course CMM machine.

### Occupation-Specific Competencies

- Preventative maintenance- Machine tools - Practice industry approved procedures for preventative maintenance on CMM machines and any related tools.

- General tooling design knowledge - Demonstrate knowledge of methods, and procedures for common machine shop benchwork and hand tool work as well as ability to do basic design and development of fixtures to support CMM machines.
- Collaboration with designers and engineers to write programming - Demonstrates ability to write programs using CAD/ CAM software and the skill to collaborate with engineers and peers to develop CMM programming.
- Work order scheduling and analysis - Demonstrates ability to prioritize certain work orders over others to strive for efficiency to maximize CMM programming benefits to overall production output potential.
- Raw material awareness- Demonstrates knowledge of steel, aluminum, etc. and how they interact with the CMM and occasionally a CNC machine.
- Tolerance control - Demonstrates knowledge of raw materials and how CMM and CNC machine use could potentially damage the materials. Takes steps to avoid damage to materials and machines.
- Quality control model development and implementation - Demonstrate ability to create models via files, drawing, blueprints, etc. to ensure product quality.
- CMM inspection practices - Demonstrate the proper methods and instruments used to effectively inspect parts in the shop, including using instruments such as the caliper, micrometer, and CMM.

### CMM Programmer Occupational Training Plan

	List Course/Training Name and Title	Description of Courses and/or Training Program	List Responsible Provider: Company, College, Trainer, or other	Anticipated Completion Date
<i>Related Instruction Competencies</i>				
CAD/ CAM software				
Blueprint reading				
Shop math and measurement				
CMM set up and programming				
Machine tool theory				
Quality assurance				
Inspection				
Geometric dimensioning and tolerancing (GD & T)				

<i>On-The-Job Training Competencies</i>				
Preventative maintenance –machine tools				
General tooling design knowledge				
Collaboration with designers and engineers to write programming				
Work order scheduling and analysis				
Raw material awareness				
Tolerance control				
Quality control model development and implementation				
CMM inspection practices				