Minnesota Dual-Training Pipeline
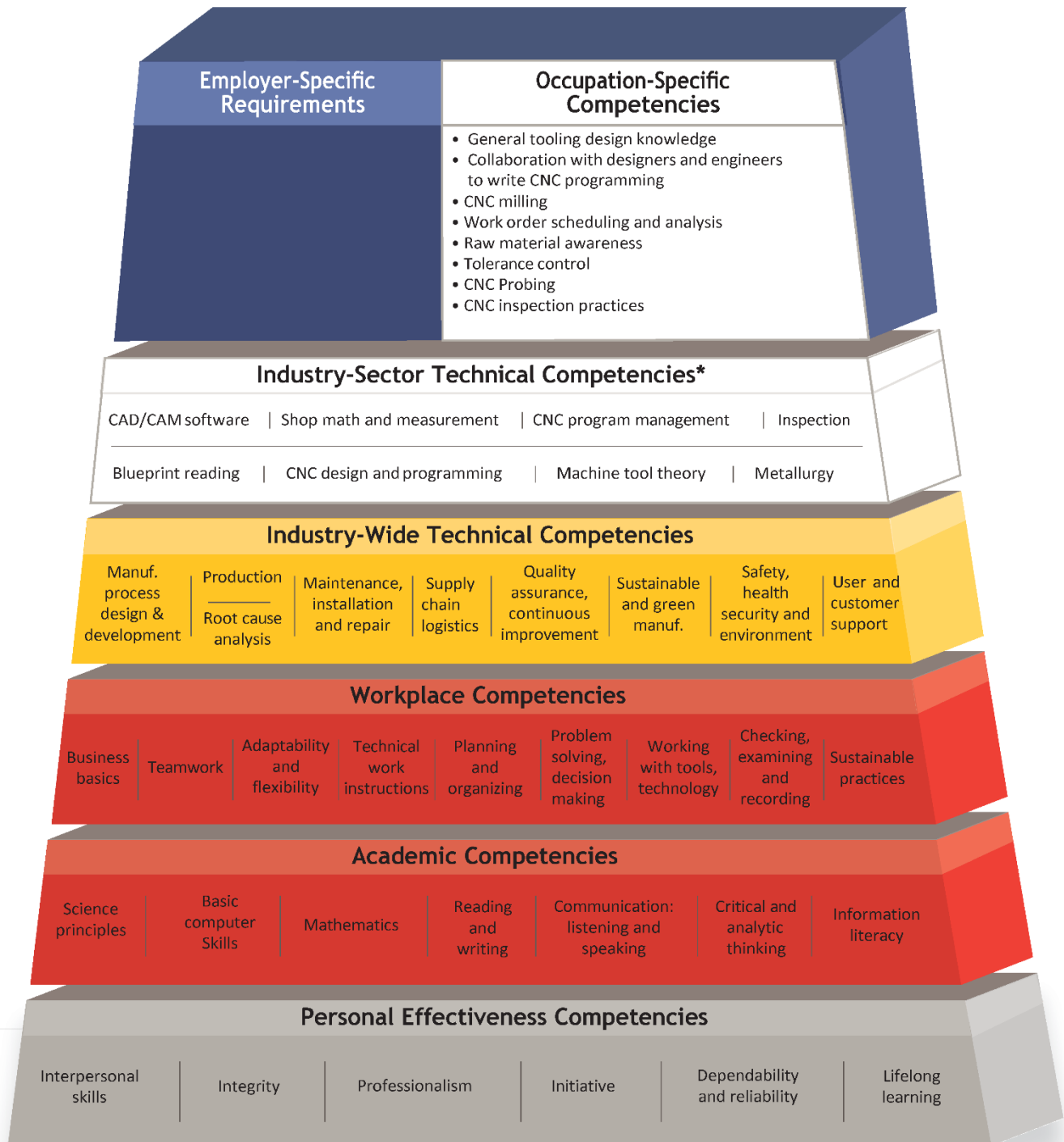## Competency Model for Advanced Manufacturing
Occupation: Computer Numerical Control (CNC) Programmer

Employer-Specific Requirements	Occupation-Specific Competencies
	• General tooling design knowledge • Collaboration with designers and engineers to write CNC programming • CNC milling • Work order scheduling and analysis • Raw material awareness • Tolerance control • CNC Probing • CNC inspection practices

Industry-Sector Technical Competencies*

CAD/CAM software	Shop math and measurement	CNC program management	Inspection
Blueprint reading	CNC design and programming	Machine tool theory	Metallurgy

Industry-Wide Technical Competencies

Manuf. process design & development	Production / Root cause analysis	Maintenance, installation and repair	Supply chain logistics	Quality assurance, continuous improvement	Sustainable and green manuf.	Safety, health security and environment	User and customer support

Workplace Competencies

Business basics	Teamwork	Adaptability and flexibility	Technical work instructions	Planning and organizing	Problem solving, decision making	Working with tools, technology	Checking, examining and recording	Sustainable practices

Academic Competencies

Science principles	Basic computer Skills	Mathematics	Reading and writing	Communication: listening and speaking	Critical and analytic thinking	Information literacy

Personal Effectiveness Competencies

Interpersonal skills	Integrity	Professionalism	Initiative	Dependability and reliability	Lifelong learning

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 Computer Numerical Control (CNC) Programmer

Computer Numerical Control (CNC) Programmer – An individual who assists in the design and production on CNC machines that shape parts from metal or plastic. 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 help determine which tools will be the right ones for the CNC machine to use to ensure product reliability and machine shop efficiency. These professionals additionally detect malfunctions using precision measuring instruments such as micrometers, dial calipers, depth gages, indicators, and scales.

Industry-Sector Technical Competencies

Related Instruction for dual training means the organized and systematic form of education resulting in the enhancement of skills and competencies related to the dual trainee's current or intended occupation.

- **CAD/CAM software** -Use the models and assemblies created in CAD software to develop toolpaths that drive machine tools to turn designs into physical parts.

- **Blueprint reading** - Knowledge in reading and understanding industrial prints.

- **Shop math and measurement** – Training in basic math, including linear measurement, metrics and beginning algebra.

- **CNC design and programming** - Knowledge of manual programming of Computer Numerical Control (CNC) machine tools. Learn types of CNC controls, machinery, programming formats and basic terminology. The ability to hide G-code and/or have ways to bypass it to speed up the process of part design is also useful knowledge to have for this role as well.

- **CNC program management -** Knowledge of how to ensure that current software is up to date and aligns with shop needs. Able to also manage time and prioritize programming so that it meets company deadlines and order scheduling goals.

- **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.

- **Metallurgy** - Know the basic principles of metals, the behavior of metals and the processes which affect them, as well as the most common metals used in industrial processes.

- **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 CNC machine.

Occupation-Specific Competencies

On-the-Job Training (OJT) is hands-on instruction completed at work to learn the core competencies necessary to succeed in an occupation. Common types of OJT include job shadowing, mentorship, cohort-based training, assignment-based project evaluation and discussion-based training.

- **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 CNC machines.

- **CNC milling** - Demonstrates the fundamentals of CNC machining processes with skills in work holding, speeds and feeds for various materials and functions and capabilities of CNC machining tools.

- **CNC probing** - Ability to program software for probing tools to be able to maximize the efficiency, quality, and accuracy of CNC machine tools.

- **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 CNC programming.

- **Work order scheduling and analysis** - Demonstrates ability to prioritize certain work orders over others to strive for efficiency to maximize CNC programming and machine output potential.

- **Raw material awareness** - Demonstrates knowledge of steel, aluminum, etc. and how they interact with the CNC and occasionally CMM machines.

- **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.

- **CNC 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 CNC.