

# Contextualized Curriculum

for Adult Learners in Math and Literacy

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## Mastering Machines

Print:   

*How a Computer Numerically Controlled ([CNC](#)) [machine operator](#) uses reading comprehension of expository texts.*

**Industry Sector:** [Advanced Manufacturing](#)

**Content Area:** [Literacy](#)

**Core Topic:** [Reading technical information](#)

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### Common Core State Standards

**CCSS.ELA-Literacy.CCRA.R.1** Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

**CCSS.ELA-Literacy.CCRA.R.7** Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

**CCSS.ELA-Literacy.CCRA.R.10** Read and comprehend complex literary and informational texts independently and proficiently.

### Adult Basic Education Standards

**R1.3a** Identify critical information in formatted texts (e.g. forms, timelines, tables, maps, calendars, advertisements, charts, graphs)

**R1.4a** Distinguish between fact and opinion, fact and fiction, relevant and irrelevant information.

**R1.4d** Summarize ideas and information from texts of increasing length and complexity of content.

**R1.4f** Draw conclusions and make predictions and inferences from information or ideas presented in texts of various genres (e.g. historical documents, newspaper and magazine articles, fiction and non-fiction, job related materials).

## Industry Overview

### Today's Manufacturing Workplace

A manufacturing renaissance is occurring in the United States. The United States is the largest manufacturing economy in the world, producing 21 percent of the goods manufactured across the globe. In addition to the 12 million Americans working directly in the manufacturing industry, manufacturing supports more than 6.5 million other jobs, thus accounting for nearly 17 percent of all private sector jobs in the United States. In 2010, the average U.S. manufacturing worker earned \$77,186, including pay and [benefits](#) (the average in all industries was \$56,436).<sup>1</sup>

While manufacturing jobs in Massachusetts have declined, as they have nationally, manufacturing is still a critical industry in this state and provides opportunities for good, high-paying jobs. In the Greater Boston area, most of the manufacturing jobs are in computer and electronics companies, and much of the state relies on manufacturing positions in these and other very high-tech areas, such as aerospace and biotechnology.<sup>2</sup>

Advanced manufacturing involves the use of computers and technology in the [manufacture](#) of products. While not all manufacturing companies use technological innovations in developing their products or processes, the competitive advantage of the United States in the [manufacture](#) of goods relies on technological innovations. This means that today's manufacturing workplace is usually highly technical, which accounts for the high-paying positions many workers in this field receive in compensation for their work. It also means that today's advanced manufacturing workplace is very different from many people's conceptions of factories and mills as dark, dirty, and unsafe. Today's advanced manufacturing facilities are usually bright, clean, and very safe, and the emphasis is on working efficiently—with as little waste as possible.

In the advanced manufacturing industry, there has been a marked [shift](#) from the traditional role of [line workers](#) to workers who demonstrate creativity and innovation. Innovation is a hallmark of the U.S. manufacturing industry, and key to maintaining its position in the global market since products can often be produced at a lower cost in developing countries. Critical-thinking, problem solving and reasoning are important components of the innovation process. Today's manufacturing workers are expected to formulate solutions to problems using critical thinking and reasoning skills while working independently and/or in teams.

1. <http://www.nam.org/~media/AF4039988F9241C09218152A709CD06D.ashx>
2. <http://www.bostonglobe.com/business/2012/05/08/high-end-factory-jobs-boston-paying-high-wages/3gZuNc6GywDGKoYNP2hnaO/story.html?camp=pm>

### Careers in Advanced Manufacturing

The manufacturing sector includes jobs related to planning, managing, and performing the processing of materials into intermediate or final products and related activities such as production planning and control, maintenance, and engineering. Thus, this industry includes not only those people who actually produce the manufactured goods, but also managers, maintenance staff, scientists and researchers, analysts, administrative personnel, and IT personnel.

### Career Pathways

The manufacturing industry includes six career pathways:

- Production is the construction and assembly of parts and final products. People in these positions work in factories and mills, with machines, to make or assemble parts, construct components of parts (such as plastics), and print materials. Occupations in this pathway range from production helpers who move parts and materials around the factory, to numerical control machine operators who run the computer-controlled machines that modify metal and plastic to create products, to manufacturing production technicians who oversee production.
- Manufacturing production process development occupations are involved in designing products and manufacturing processes. People in these occupations work with production workers to set

up the machines and processes to develop new products. These occupations include engineers and production managers.

- Maintenance, installation and repair workers take care of products after they've been sold and delivered to customers—they install the products, perform maintenance on machines, tools, and equipment so that they work properly, and repair systems that are not performing adequately. Workers in this pathway include automotive technicians, automotive electronics installers, building maintenance workers, industrial electronics repairers, industrial machinery mechanics, millwrights, and small engine mechanics.
- Quality assurance is provided by quality control inspectors and technicians, who ensure that products both meet design standards and are of high quality.
- Logistics and [inventory](#) control workers ensure that those working in Production have the materials they need to complete their work. Workers in these occupations [inventory](#) materials and products, move materials to the line, and pack and ship finished products. Thus, they include production and planning clerks, and operators of moving machinery such as cranes and forklifts, and packers.
- Health, safety and environmental assurance occupations are focused on keeping the workplace safe by ensuring that workers are using equipment safely and that manufacturing processes are as safe as they can be. They also conduct investigations and conduct inspections.

### **Mathematics and Communication Skills Needed in Advanced Manufacturing**

Mathematics and communication are key skills needed for success in today's high-performance advanced manufacturing workplaces. Mathematics is used in the advanced manufacturing industry to measure the amounts and sizes of materials and parts, create "recipes" used to [manufacture](#) man-made materials, and analyze data. Data analysis is critical at many levels of a manufacturing organization in order to ensure quality and to continuously improve both quality and processes. Today's manufacturing industry must operate extremely efficiently and produce very high-quality products in order to maintain competitiveness. Many front-[line workers](#) are involved in collecting data and working to improve quality and efficiency. Thus, in addition to basic mathematical calculations (which rarely involve simple whole numbers), workers are engaged in mathematical reasoning and solving problems using a variety of mathematical tools.

To succeed and move up the ladder in today's advanced manufacturing workplace, workers need reading skills to understand technical concepts, vocabulary, and to bring together information needed for a particular situation; to locate, organize, and document written information from various sources needed by co-workers and customers; and to locate written information needed by co-workers and customers. They need to use correct grammar, punctuation and terminology to write and edit documents and to develop and deliver formal and informal presentations using appropriate media to engage and inform audiences. In addition, they need to interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants; apply active listening skills to obtain and clarify information; and interpret and use information in tables, charts, and figures to support written and oral communications. They also must communicate with co-workers and customers using technology tools. As they move up the corporate ladder they will need to explain written organizational policies, rules and procedures to help employees perform their jobs.

### **Career Opportunities in Advanced Manufacturing with Education from Community Colleges**

Massachusetts Community Colleges play an important role in preparing the state's citizens to take advantage of the career opportunities available in advanced manufacturing. Degree and certificate programs prepare students to enter advanced manufacturing occupations, including:

- production occupations, including people who work as assemblers (such as airplane assemblers), machine operators, machinists, systems operators, [CNC](#) machine tool operators, machine setters, laminators/fabricators, metal and plastic workers, packers, molders, semiconductor processing operators, welders and solderers, tool and die makers, and other production workers;
- manufacturing production process development occupations, including numerical control tool programmers who write the programs that control machine tools and industrial production

managers who plan and oversee production;

- maintenance, installation and repair occupations include automotive, electronics, and biotechnology technicians, industrial machinery mechanics, and millwrights (who install and maintain heavy equipment);
- quality assurance occupations including quality control technicians and inspectors.

### **Recent Career Opportunities in Massachusetts**

The following is a sample of advanced manufacturing job listings in Massachusetts that require associate's degree or certificate:

- Manufacturing Engineering Technician, Randstad Corporation, Framingham, MA, [[show](#)]
- Quality Control Technician, QD Vision, Lexington, MA [[show](#)]
- Manufacturing Technican, Hologic, Marlborough, MA [[show](#)]

### **Employment Outlook for Advanced Manufacturing**

Advanced manufacturing continues to be a high-growth industry, given the knowledge capital in the United States. However, the work in this industry is increasingly technical and requires far fewer workers as more tasks are automated. Entry-level positions in this industry require the same skills that only a select group of highly-experienced and well-paid workers once had. Unfortunately manufacturers find it difficult to fill these high-skill positions. A 2011 survey found that there is a persistent skills gap between the skills that are needed in the today's manufacturing workplace and the skills that candidates bring to the workforce.

Most of the advanced manufacturing companies in Massachusetts are small to mid-sized operations that employ smaller numbers of workers and rely on computer-operated machinery for production. While the numbers of workers are smaller than in the past, the more highly-skilled nature of the work means that these are high-paying jobs and provide workers with opportunities to grow through training and education and to be part of the effort to innovate.

### **Resources:**

Advanced Manufacturing Industry

- [National Council for Advanced Manufacturing](#)
- [Advanced Manufacturing](#)
- Brookings: "[Why Does Manufacturing Matter? Which Manufacturing Matters?](#)" (2012)
- National Association of Manufacturers: "[A Manufacturing Renaissance: Four Goals for Economic Growth](#)" (2012)

Advanced Manufacturing Industry Outlook Information

- [Bureau of Labor Statistics: Manufacturing Industry at a Glance](#)
- [Massachusetts Labor Market Data](#)
- [Massachusetts Career Information System](#)

Careers in Advanced Manufacturing

- [Massachusetts Career Information System](#)
- [Manufacturing Career Opportunities](#)
- [Manufacturing Career Pathways](#)
- [Industry Competency Model for Advanced Manufacturing](#) shows the skills and knowledge needed to work in this industry
- [National Association of State Directors of Career Technical Education Consortium's Common Career Technical Core](#)
- [National Association of State Directors of Career Technical Education Consortium's Knowledge and Skills: Manufacturing](#)
- [O\\*NET](#)

- [WorkKeys Occupational Profiles](#)
- [Manufacturing's Missing Generation](#)
- [A Career in Toolmaking or Machining Technologies: The Right Choice for Students, Community, & Country](#)

## Workplace Scenario (8th Grade Level)

This scenario is based on the work of a Computer Numerically Controlled ([CNC](#)) [machine operator](#). For more information, view [this video](#) and/or review [this article](#).

You are a Computer Numerically Controlled ([CNC](#)) [machine operator](#) at a small company. You need to know how to perform several duties. First, you need to power up the machine. You then prepare to produce a program test run. This involves reviewing the [CNC](#) programs provided to you. You must also prepare the equipment to perform the necessary work. You download the program to guide the creation of the materials requested. You then place the required tools and metal or plastic into the machine and perform a test run. This test run will let you know where the program is running correctly. You must be able to compare the finished product to the specifications on the order. This is how you check if the machine is operating correctly. If there are any problems with the test run, you need to determine the cause. To do so, you may need to refer to the machine manual and directions. Through careful reading you can detect where the error may have occurred and correct the problem. You will then complete an additional test run. Once all errors are corrected, you will run the needed amount of product.

Your company has provided training on using certain machines. However, you must also be able to read and follow machine instructions and safety procedures on your own. These procedures are often found in the machine manual. They may also be found in safety documents provided by the manufacturer. For example, [this safety document](#) contains a list of important information. You must be able to read, comprehend and relate the information to the machine you are using.

In addition, you often have to read charts and graphs. For example, on page 27-29 of the [Haas Machine Manual](#) is a diagram of the machine with labels for each section or part. You will need to be able to compare this diagram to the machine you are using and understand the various parts. The text of the manual will be clearer once you know where the parts are located. You may also need to read and understand flowcharts. For example, the Tool Loading Flowchart on page 86 of the [Haas Machine Manual](#) guides you through loading a new tool.

## Workplace Scenario (High School Level)

This scenario is based on the work of a Computer Numerically Controlled ([CNC](#)) [machine operator](#). For more information, view [this video](#) and/or review [this article](#).

You are a Computer Numerically Controlled ([CNC](#)) [machine operator](#) at a small manufacturing company where your duties include powering up the machine, preparing to produce a program test run, reviewing the [CNC](#) programs provided to you and preparing the equipment to perform the necessary work. You will download the program to guide the creation of the materials requested, place the required tools and metal or plastic that is to be shaped into the machine and perform a test run. This test run will let you know where the program is running correctly. You must be able to compare the finished product to the specifications on the order to be sure the machine is operating correctly. This step requires you to be able to read the order and to compare the specifications to the product produced in the test run. If any problems with the test run are detected, you need to determine why the test run is unsuccessful. To do so, you may need to refer to the machine manual and directions to detect where the error may have occurred and correct the problem. You will then complete an additional test run, and finally once all errors are corrected, you will run the needed amount of product.

Although your company has provided training on using certain machines, you must also be able to read and follow machine instructions and safety procedures on your own. These procedures are often found in the machine manual or in individual safety documents provided by the manufacturer or the

company. For example, [this safety document](#) contains a list of important information, such as this statement on page 2, "The Emergency Stop button is the large, circular red switch located on the Control Panel. Pressing the Emergency Stop button will instantly stop all motion of the machine, the servo motors, the tool changer, and the coolant pump. Use the Emergency Stop button only in emergencies to avoid crashing the machine." This is important safety information you must be able to read, comprehend and relate to the machine you are using.

In addition, you often have to read charts and graphs to understand the information contained in them. For example, on page 27-29 of the [Haas Machine Manual](#) is a diagram of the machine with labels for each section or part. You will need to be able to read this diagram, compare it to the machine you are using and understand the various parts. The text of the manual will be clearer once you know where the parts are located and how to find them on the machine you are using. You may also need to read and understand flowcharts such as the Tool Loading Flowchart on page 86 of the [Haas Machine Manual](#) guides you through loading a new tool.

## Core instructional context

Poor reading skills present significant challenges to students' career and college readiness. While the majority of the adults in this country are functionally literate, a high number of adults are poor readers, and this fact has major implications for employers. Adults with low literacy levels are more likely to be unemployed or hold very low paying jobs. According to the National Center for Educational Statistics "...about 22% of American adults have minimal literacy skills. Some are functionally illiterate in that they can read some words but not enough to understand simple forms or instructions." In order to help students to become good readers, teachers may want to focus on skills to help build overall literacy, including vocabulary, fluency, and comprehension development.

### A good reader

- confidently approaches reading tasks.
- activates their background knowledge before reading.
- knows the purpose for reading.
- can make predictions and choose appropriate strategies for the passage.
- summarizes major ideas and recalls supporting details, makes inferences, and paraphrases.
- can focus their complete attention on reading.
- uses appropriate word decoding skills.
- can monitor his or her comprehension during and after reading.
- can anticipate and predict meaning of words by using context clues and other strategies.
- can create visual and sensory images from text.
- has a large repertoire of strategies to help them attack an unfamiliar passage.

The following tactics are ideas to help build student vocabulary and background knowledge, fluency, and comprehension skills.

*Building Vocabulary and Background Knowledge* In order for students to raise their reading proficiency, they need repeated exposure to new words. Encourage students to skim the assigned text and identify unknown words prior to reading and provide descriptions or an explanation of a new term or word for students. Students should make notes of unknown words to review and learn by reusing the word in an original sentence and practicing the word orally. They can also provide their own description for the word and attempt to connect the word to a picture or make a personal anecdotal connection to the word.

Vocabulary in expository texts may be highly technical (Tier III) and require students to learn words associated with an unfamiliar topic.

Dr. Robert Marzano describes a six-step process for the [instruction of vocabulary](#). (Marzano, 2005).

1. The teacher gives a description, explanation, or example of the new term.
2. The teacher asks the learner to give a description, explanation, or example of the new term in his/her own words.
3. The teacher asks the learner to draw a picture or symbol, or to locate a graphic to represent the new term.

4. The learner will participate in activities that encourage a deeper understanding of the words in their vocabulary notebooks (graphic organizer).
5. The learner will discuss the term with other learners.
6. The learner will participate in games that provide more reinforcement of the new term.

An example of a game to reinforce new terms is [Vocabulary Bingo](#). Create bingo cards, writing in selected vocabulary words. Call out the definitions while students match the definitions to the terms on their cards. This activity is at the recall level on Bloom's Taxonomy, but is a good way to get students started familiarizing themselves with terms and their definitions.

Another way to help students build vocabulary is to help them build [semantic maps](#), placing the word to be defined in the center and brainstorming ideas about the word. As students identify words that define the main word or mean the same, draw the semantic map to show relationships. The website [Visuwords](#) is an online thesaurus that provides semantic maps for words. Once a word is entered, rolling over the word in the semantic map provides the definition. Using this website is one way for students to build knowledge about families of words.

Students can also be encouraged to learn Greek and Latin prefixes, suffixes and common root words. Point out to students that they can unlock the meaning of a significant number of new words by knowing these word forms. One resource students might use is "[Root Words, Roots and Affixes](#)" or the list "[English Language Roots](#)". One strategy the instructor can use is to identify roots and affixes of word that may be unknown to students during a vocabulary lesson. For example, the word "auditor," contains the root *aud-* meaning "to hear or listen" and the suffix *-tor* meaning "one who" or "one who hears or listens" and is used with this meaning in the scenario for this module. Finally, have students keep their own vocabulary journal to record unknown words, especially academic words. The [Academic Word List](#) is a resource to help with identifying academic words, Have students record graphics and definitions in their own words as this can help students to better retain words over time.

### *Building Fluency*

Fluency—the ability to read with accuracy, speed and expression—is important because it allows the reader to avoid the process of decoding each word along the way. One effective strategy to build fluency is repeated reading or the strategy of reading short passages several times and attempting to read a little faster each time. It will be more difficult for instructors to understand the students' reading issues if they are only asked to read silently. According to Guglielmino (2005), "finding a balance of activities (such as explicit instruction, guided reading, echoing the teacher's reading, reading in pairs, and silent reading) every day within a safe and non-threatening environment is most likely to produce positive results."

One specific strategy to build fluency is [WARE](#), which encourages students to:

- Widen your eye span. Read groups of words or phrases rather than one word at the time.
- Avoid skip backs. Keep reading even if you are not sure you understand.
- Read silently. Even if you have to place a finger on your lips to remind you.
- Flex your reading rate. When reading important information, read more slowly than when you are reading less important, less detailed information.

Other strategies to improve fluency include timed reading, repeated and monitored oral reading, teacher modeling, paired (partner) reading, tape-assisted reading, and chunking. For more information on these strategies, see [Florida GED PLUS College Preparation Program Curriculum and Resource Guide](#).

### *Difficult Material*

Although fluency is important, when material is highly technical, reading more slowly may be more important than speed. Highly technical information is likely to be densely packed with concepts and technical vocabulary the learner needs to grasp. Slowing down will make this process easier. Strategies students can use to better understand the content are using thinking notes, highlighting important details and adding margin notes. As the student completes reading sections of the material, suggest he use the "look away" method to check for understanding and memory. (This is also a good study technique!) This page describes a [process for reading difficult material](#).

### *Improving Comprehension*

It is important to teach students that, with practice, reading can become easier. Instructors should

consider their approach to teaching comprehension in terms of where particular students' confidence levels are in regards to reading.

Useful strategies for comprehension include retelling or summarizing the passage, discussing the reading and evaluating what was read. Writing a summary of what was read also reinforces the reading-writing connection. Encourage students to take notes as they read using a system such as [Cornell Notes](#) or [Thinking Notes](#). Using graphic organizers to help students before, during, and after reading are also great tools, such as [these graphic organizers](#) from Scholastic.

Help students learn pre-reading strategies such as [TIPP?](#). This strategy uses skimming to preview the text and develop questions students think the text may answer as they read. Point out that scanning is a different strategy used to locate specific information, such as the answer to a question. This is also a good time to activate prior knowledge with the use of a [KWL chart](#) or other strategy to help students recall what they already know about the topic. This video provides some ideas for pre-reading strategies: [Silent Tea Party: Pre-Reading for Challenging Texts](#).

Finally, writing for understanding is a way for students to show and for instructors to check for comprehension. Students can keep a journal to predict what a reading will be about and then summarize the entire text after they read sections or individual passages, making note of any questions they have about the text. This is an easy way to model comprehension strategies in the classroom as well.

### *Reading Technical Texts*

Technical texts such as the machine and safety manuals discussed in the scenario are especially challenging to read and comprehend. Reading experts (Fry, 2012, p. 74) suggest five kinds of information to look for in technical text: definitions and terms, examples, classifications and listings, comparison and contrast, and cause and effect. Fry also suggests a seven-step plan for students as they attack technical material.

1. Learn the technical terms.
2. Analyze the structure and understand it.
3. Skim the text, identifying questions you have.
4. Be sure you have a full understanding of each section before moving on.
5. Read slowly.
6. Pay attention to examples
7. Summarize after reading.

### *Example*

Ask students to practice the seven-step plan as they read technical information. Assign an excerpt from [Haas Machine Manual](#), for example pages 1-13, for students to read using the seven-step plan. Student

Seven-Step Plan Template for Technical Material	
Step	Notes
1. Technical terms: Identify technical vocabulary and definitions	
2. Structure: How is the material organized?	
3. Skim: What questions do you have about the material?	



4. Understanding of each section: What are the key ideas of each section?	
5. Read slowly: Write your notes on the document or in this space.	
6. Examples: What examples are used?	
7. Summary: Write a summary of the text.	

#### *Assessment*

Review the chart that students created to guide their reading or assess students' written summaries of technical text they have read by using a classroom rubric. Also, use vocabulary quizzes or content quizzes to assess students' knowledge and understanding of the content they've read.

Sample rubrics to use or adapt include these:

- [Assessing Critical Reading Competencies from a Student-Produced Text: Rubrics](#)
- [Rubric for Reading Technical Information](#)

### Contextualized learning activities

#### *1. Reading for comprehension and following instructions for creating a product*

This scenario highlights the importance of being able to follow instructions based on a set of specifications for a product, and being able to compare a final product with those specifications to make sure it is correct.

To help students begin practicing this skill, create a set of instructions for building a structure or other creation out of marshmallows and toothpicks (perhaps call the marshmallows "widgets" and the toothpicks "connectors"). Provide a model and have students follow the directions for how to build it. Have them compare their final product to your model and note how well they met the specifications and where there may have been misunderstanding. Consider having students create their own marshmallow structures and having their classmates recreate them based on written directions.

As an alternative, have students work in a jigsaw format in which each person has part of the instructions and they have to share information and communicate in order to assemble the whole structure. This will help them understand how the part they are responsible for building needs to work in the context of a greater whole.

#### *2. The ins and outs of manuals/using contextual clues*

- In many advanced manufacturing jobs, the ability to read a manual accurately is critical to performing the job. Have students read excerpts from a few sample manuals (for example, the [Digital Prototyping Lab CNC Machining Manual](#) or the [Haas Mill Operators Manual](#)). Explore the following questions with them:

- What do these manuals communicate and how?
- What is the author's purpose for writing?
- What is our purpose for reading?
- What are the limitations of manuals? Are there ever mistakes?

- b. As a follow up activity, ask students to read an excerpt of a manual with some mistakes in it (created by you) and ask them to find the errors. What contextual clues tell them there are mistakes?
- c. Another related activity is to have students read a portion of a 19th century instruction manual and compare it to a 21st century manual. How do the two manuals present information differently? What impact does this have on your ability to comprehend?

### 3. Reading comprehension and safety

This scenario calls on the importance not only of comprehending text but also understanding visual and other types of media. A relevant example is the ability to decipher safety decals in order to prevent injury or mishaps at the workplace.

Use safety decals from a [CNC](http://www.haascnc.com/doclib/manual/mill_safety.pdf) manual (such as [http://www.haascnc.com/doclib/manual/mill\\_safety.pdf](http://www.haascnc.com/doclib/manual/mill_safety.pdf)) to familiarize students with the kinds of hazards associated with operating a [CNC](http://www.haascnc.com/doclib/manual/mill_safety.pdf) machine. Use a conceal/reveal type activity with flashcards, or create a game where students compete against each other to identify the hazard depicted in various safety decals.

Alternately, have students create a fake news show highlighting workplace accidents, demonstrating the importance of paying attention to safety information.

### 4. Liberal Arts Connection

Support students in their general reading comprehension practice as well as in making the connection between themes from this scenario and related literature, poetry, songs, or films (or excerpts of these). For example, you might assign one of more of the following to discuss in class:

- Woody Guthrie, folk songs related to workers rights
- Charles Dickens, *Oliver Twist*
- Kurt Vonnegut, *Player Piano*
- Robert Pirsig, *Zen and the Art of Motorcycle Maintenance*
- Garth Stein, *Art of Racing in the Rain* (highlights the theme of work ethic/responsibility, very accessible language)
- Film: *Modern Times* (Charlie Chaplain)
- Poetry: <http://www.poetryfoundation.org/poem/177261>
- TEDTalk: <http://blog.ted.com/2012/09/12/meet-two-chinese-factory-workers-lu-qingmin-and-wu-chunming/>

### Contextualized test items

Choose a selection of safety decals from pages 6-8 in [http://www.haascnc.com/doclib/manual/mill\\_safety.pdf](http://www.haascnc.com/doclib/manual/mill_safety.pdf). Create a multiple choice or matching test item in which students must identify the meaning of the decals.

### Contextualized project

#### *Making connections with every day life*

1. Have students choose an everyday object that is created through a manufacturing process and research how it is made.

Resources that could support this project include:

- "Who Made That?" column in the New York Times Magazine (for example, "[Who Made That Sippy Cup?](#)" or "[Who Made That Super Soaker?](#)")
- [PBS Connections video series](#) (scroll down on the site for more recent episodes)

As an alternative activity, have students research an emerging manufacturing process/technology and create a presentation to share with the class. For ideas, see, for example, the recent [Scientific American issue](#) devoted to the future of manufacturing.

## 2. Understanding and evaluating content presented in diverse media

[CNC](#) operators need to be able to interpret and understand a variety of media including text, charts, and other visual information to use a machine to create a specific part or product. To support the development of this skill, have students identify a "do it yourself" project (such as fixing a car, painting a room or repairing an appliance) that they might undertake in their own lives. Then have them locate resources to guide them in completing the project, requiring them to use at least two different types of media.

Sites students may wish to use for this activity include <http://www.ifixit.com>, <http://www.diynetwork.com/> or <http://www.thisoldhouse.com/toh/tv/ask-toh/>.

Students can then present the outcome both of their research and the project itself to their classmates, again using two or more types of media to share what they did and what they learned.

## Additional or extension activities, multimedia, readings and/or resources

Job description: <http://hiring.monster.com/hr/hr-best-practices/recruiting-hiring-advice/job-descriptions/cnc-operator-machinist-job-description-sample.aspx>

The growth of manufacturing, Michigan Historical Museum:

<http://www.hal.state.mi.us/mhc/museum/explore/museums/hismus/prehist/manufac/>

Jim Burke's Academic Vocabulary List

<http://www.englishcompanion.com/pdfDocs/acvocabulary2.pdf>

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