Common Employability Skills for the Energy Industry
Equal Opportunity Employer/ Program
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OVERVIEW

In a recent CEWD poll of its member companies, nearly 83% of the respondents replied that high school and community college graduates are not prepared for energy careers. The lack of preparation falls into two main categories: employability and technical skills.

There is significant consensus on where potential employees can gain technical skills, including short-term bootcamps, certificate programs, company technical training, or formal education. On the employability front, however, it’s a different story. Many believe these skills are not “teachable” but, rather, gained through experience and work history. It doesn’t seem to make sense that the same skills that keep applicants from gaining a job are primarily learned on the job.

The National Network of Business and Industry Associations (NNBIA) has created a Common Employability Skills (CES) Framework that establishes a vivid, unifying description of the requisite Applied Knowledge along with Personal, People, and Workplace Skills needed to gain employment. CEWD is a sponsor of the CES, along with other leading industries including Manufacturing, Retail, IT, and Transportation. These skills directly align to the Energy Industry Competency Model. There are a few industry-specific areas, such as engineering and technology, hand and power tools, and some more advance math concepts, which are part of the CEWD version of the Model.

One of the goals of the CES model is that educators and other learning providers will have an industry-defined roadmap for what foundational skills to teach, providing individuals the added benefit of being able to evaluate educational programs to ensure they will in fact learn skills that employers value. This booklet provides guidance on how to “teach” some of the employability skills in the context of the real world of work. By contextualizing through industry-specific problem-solving and scenarios, students will better understand why they need to learn these skills and how they will use them in the future.

Common Employability Skills and Contextualized Learning

Contextualized learning is not something new. Back in 2001, the United States Department of Education Office of Vocational and Adult Education characterized CTL as a “conception of teaching and learning that helps teachers relate subject matter content to real world situations.” These instructional strategies are designed to more seamlessly link the learning of foundational skills and academic or occupational content by focusing teaching and learning squarely on concrete applications in a specific context that is of interest to the student.
## CES AT A GLANCE

### PERSONAL SKILLS
- Integrity
- Initiative
- Dependability & Reliability
- Adaptability/Flexibility
- Professionalism

**Energy Specific Skills**
- Reputation
- Ability to Learn
- Self-Development

### PEOPLE SKILLS
- Teamwork
- Communication
- Respect

### APPLIED KNOWLEDGE
- Reading
- Writing
- Mathematics
- Science
- Information Technology
- Critical Thinking

**Energy Specific Skills**
- Engineering

### WORKPLACE SKILLS
- Planning/Organizing/Scheduling
- Problem Solving
- Decision Making
- Business Fundamentals
- Customer Focus
- Working with Tools & Technology

**Energy Specific Skills**
- Ethics
- Following Directions
PERSONAL AND PEOPLE SKILLS

CES Personal Skills

INTEGRITY:
Treating others with honesty, fairness, and respect
  • Demonstrate respect for company’s time and property
  • Accept responsibility for one’s decisions and actions
  • Report unethical behavior demonstrated by others

INITIATIVE:
Demonstrating a willingness to work and seek out new work challenges
  • Take initiative in seeking out new responsibilities and work challenges, increasing the variety and scope of one’s job
  • Pursue work with energy, drive, and effort to accomplish tasks
  • Establish and maintain personally challenging, but realistic, work goals
  • Strive to exceed standards and expectations

DEPENDABILITY & RELIABILITY:
Displaying responsible behaviors at work
  • Behave consistently, predictably, and reliably
  • Fulfill obligations, complete assignments, and meet deadlines
  • Follow written and verbal directions
  • Comply with organization’s rules, policies, and procedures
  • Demonstrate regular and punctual attendance
  • Do not attend to personal business while on the job
  • Ensure the job is done safely, accurately, and completely

ADAPTABILITY/FLEXIBILITY:
Displaying the capability to adapt to new, different, or changing requirements
  • Be open to learning and considering new ways of doing things
  • Actively seek out and carefully consider the merits of new approaches to work
  • Embrace new approaches when appropriate and discard approaches that are no longer working
  • Effectively change plans, goals, actions, or priorities to deal with changing situations
  • Identify logical stopping points in work
  • Quickly learn new assignments and refocus attention

Note: Items in italics are energy-specific.
PROFESSIONALISM:
Maintaining a professional demeanor at work
• Demonstrate self-control by maintaining composure and keeping emotions in check, even in difficult situations
• Maintain a professional appearance by dressing appropriately for the job and maintaining personal hygiene
• Use professional language when speaking with supervisors, coworkers, and customers
• Maintain a positive attitude
• Take ownership of one’s work

REPUTATION:
Maintaining a high degree of personal ethics and behavior
• Is free from substance abuse
• Demonstrate financial responsibility
• Maintain an acceptable grade point average if in school
• Has not embarrassed oneself through Internet postings
• Maintain a good driving record

ABILITY TO LEARN:
Incorporating classroom and on-the-job training into work performance
• Understand and use material taught in the classroom and on-the-job training in work situations
• Apply information provided in training to work tasks
• Demonstrate and show willingness to learn new assignments, procedures, and technologies

SELF-DEVELOPMENT:
Demonstrating a commitment to self-development and improvement
• Identify goals and career interests
• Seek opportunities to learn new skills and tasks and to refine current skills
• Develop personal career plan that includes goals, objectives, and strategies
• Identify industry credentialing requirements
• Maintain career portfolio to document knowledge, skills, and experience
• Evaluate and compare employment opportunities that match career goals
• Identify and exhibit traits for retaining employment
• Identify opportunities and research requirements for career advancement
• Research the benefits of ongoing personal development
CES People Skills

TEAMWORK:
Demonstrating the ability to work effectively with others
• Establish a high degree of trust and credibility with others
• Interact professionally and respectfully with supervisors and coworkers
• Develop constructive working relationships and maintain them over time
• Use appropriate strategies and solutions for dealing with conflicts and differences to maintain a smooth workflow

COMMUNICATION:
Maintaining open lines of communication with others
• Demonstrate sensitivity and empathy
• Listen to and consider others’ viewpoints
• Recognize and interpret the verbal and nonverbal behavior of others
• Speak clearly, in precise language, and in a logical, organized, and coherent manner

RESPECT:
Working effectively with those who have diverse backgrounds
• Demonstrate sensitivity and respect for the opinions, perspectives, customs, and individual differences of others
• Be flexible and open-minded when dealing with a wide range of people
• Value diversity of approaches and ideas
Contextualized Activities for Personal and People Skills

Hands-on activities and scenario exercises are ideal ways for students to practice Personal and People Skills. CEWD has created a set of materials for teachers to use, all contextualized to the energy industry. While the materials don’t cover all of the personal and people skills included in the CES document, they do cover a wide array of learning objectives, including:

- Identify key elements of the energy industry
- Explain the importance of first impressions
- Select characteristics of a positive image
- Identify behavior desired in the workplace (habits that supervisors and coworkers like)
- Identify cooperative behaviors
- Engage in team-building and negotiating
- Demonstrate effective communication with others
- Practice active listening
- Identify personal conflicts that arise in the workplace
- Identify communication strengths and weaknesses
- Identify safety requirements in the workplace
- Know the importance of compliance with standards, regulations, and established procedures to ensure a safe and healthy work environment
- Know basic regulatory requirements that promote safe and effective operations for the protection of people, data, property, and institutions
- Know the roles and responsibilities of employers and employees in creating and maintaining a workplace safety culture

Below is a sample module from this curriculum. The full workshop guides are available to CEWD Members at [http://www.cewd.org/toolkits/workplaceskills.php](http://www.cewd.org/toolkits/workplaceskills.php).
Sample Module

Listening Assessment Instructions
Direct students to the Listening Assessment in their learner guides; allow enough time for the students to complete the assessment. After they have completed the assessment, have them study the Analysis of Results. Ask questions to get discussions started about any surprises discovered and any areas identified that need work. Advise students to take a few moments to write some tasks in their action plan.

Listening Assessment
Read each statement, decide how that statement describes your behavior, and place a check mark in the appropriate column.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I think about why I'm listening.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I maintain eye contact with the speaker.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I concentrate on the message.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I listen without judging or criticizing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I try to summarize the information.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I give verbal and nonverbal indications that I am listening.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I set a purpose for listening.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I block out thoughts of personal problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I try to predict what will come next.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I take notes when needed to help remember.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I ignore external distractions such as loud noises and other workers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I try to determine the speaker's purpose.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I think about questions I may need to ask for clarification.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I restate (paraphrase) messages to confirm my understanding.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I let the speaker finish and do not interrupt.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL CHECK MARKS
Listening Assessment Analysis of Results

Tally the three columns. Then refer to the interpretations below.

14-15 Checks for Always
You are probably a fantastic listener, both at work and among your friends. Keep up the good work.

12-13 Checks for Always
You are a good listener, but you need to fine-tune a few of your listening skills. Choose behaviors to modify that you feel will easily improve your listening.

10-11 Checks for Always
You need to change some behaviors so that you will get more out of instructions at work. To improve your listening behaviors, you should start with any item that you checked as Never. Then move to the Sometimes column.

9 or Less Checks for Always OR 7 or More Checks for Never
You need to master listening skills for work success. It will be difficult to find a situation in which you will not need to use listening skills. Check with your local library for information on improving listening skills. An internet search on “listening skills” yields a number of articles, such as these at www.about.com and www.livestrong.com:
http://careerplanning.about.com/cs/miscskills/a/listening_skill.htm
http://www.livestrong.com/article/14657-improving-listening-skills/

Adapted from Elmhurst College's Listening Behaviors Survey.
APPLIED KNOWLEDGE

CES Applied Knowledge

READING:
Understanding written sentences and paragraphs in work-related documents
• Read and comprehend work-related instructions, policies, memos, bulletins, notices, letters, policy manuals, and governmental regulations
• Read and comprehend documents ranging from simple and straightforward to more complex and detailed
• Attain meaning and comprehend core ideas from written materials
• Integrate what is learned from written materials with prior knowledge
• Apply what is learned from written materials to work situations
• Sort through distracting information

WRITING:
Using Standard English to clearly communicate thoughts, ideas, and information in written form
• Prepare written materials that are easy to understand using correct wording
• Communicate thoughts, ideas, information, messages, and other information conveyed in written form in a logical, organized, and coherent manner
• Use correct grammar, spelling, punctuation, and capitalization
• Write in a factual manner in a tone appropriate for the target audience in multiple formats, clearly developing ideas and elaborating on them with relevant supporting examples and specific details

MATHEMATICS:
Using mathematics to solve problems
• Add, subtract, multiply, and divide whole numbers, fractions, decimals, and percents
• Convert decimals to fractions; convert fractions to percents
• Calculate averages, ratios, proportions, and rates
• Take measurement of time, temperature, distance, length, width, height, and weight; convert one measurement to another
• Translate practical problems into useful mathematical expressions
• Able to determine slope, midpoint, and distance
• Calculate perimeters, areas, and volumes of basic shapes and solids
• Read, track, and calculate gauge measurements
• Solve simple algebraic equations
SCIENCE:
Knowing and applying scientific principles and methods to solve problems
- Understand basic scientific principles
- Understand the scientific method (i.e., identify problem, collect information, form opinion, and draw conclusion)
- Apply basic scientific principles and technology to solve problems and complete tasks
- Discuss the role of creativity in constructing scientific questions, methods, and explanations
- Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings
- Identify physical principles such as force, friction, and energy
- Determine weight and mass and how it relates to rigging, wind, and structure supports
- Identify and evaluate the characteristics and hazards of electricity
- Recognize and explain the interactions of compatible and incompatible substances

INFORMATION TECHNOLOGY:
Demonstrating IT skills for workplace efficiency and work flow
- Navigation and File Management
  - Understand common computer terminology
  - Use scroll bars, a mouse, and dialog boxes to work within the computer's operating system
  - Access and switch between applications and files of interest
  - Adhere to standard conventions for safeguarding privacy and security
- Internet and Email
  - Navigate the Internet to find information
  - Open and configure standard browsers
  - Use searches, hypertext references, and transfer protocols (enter URLs)
  - Send and retrieve electronic mail (email)
- Use Personal Information management applications to increase workplace efficiency
- Use basic computer technology to receive work orders, report progress, and maintain records
- Employ technological tools to expedite workflow, including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and Internet applications
- Employ computer operations applications to access, create, manage, integrate, and store information
- Employ collaborative/groupware applications to facilitate group work
CRITICAL THINKING:
Using logical thought processes to analyze and draw conclusions
• Identify inconsistent or missing information
• Critically review, analyze, synthesize, compare, and interpret information
• Draw conclusions from relevant and/or missing information
• Test possible hypotheses to ensure the problem is correctly diagnosed and the best solution is found

ENGINEERING:
Possessing an appropriate mastery of knowledge, techniques, skills, modern tools, and advanced technology
• Apply basic engineering principles
• Apply the appropriate technical solution
• Apply principles of engineering science and technology, techniques, procedures, and equipment to the design and production of various goods and services
• Apply the basics of electricity
• Solve problems where a variety of mechanical, electrical, thermal, or fluid faults could be the reason for the problem
Contextualized Activities for Applied Knowledge

Reading and Science

Reading is a part of our everyday life at home, school, and work. By providing students the opportunity to read content related to the energy industry, their learning becomes contextualized. If students are enrolled in an energy career academy, this will happen naturally. However, all students can become immersed in contextualized reading through publicly available materials on the CEWD curriculum site in the program titled Energy Industry Fundamentals. There are numerous modules organized by grade level that teachers are encouraged to use. The student guides contain reading material designed in a similar manner as a textbook. Teachers are welcome to just use what fits with their students and are not obligated to even cover full modules. A lesson here and there with a reading assignment works perfectly.

In addition, some of the same lessons can be used for contextualizing science. For example, there are lessons on how electricity is generated and even some science experiments. A sample of the material is included below.

Energy Generation

The generators in a modern power plant produce alternating current (AC), which is a flow of electrons that constantly changes in magnitude and periodically reverses direction. Direct current (DC) flows in the direction determined by the polarity of the applied voltage. Although the first commercial source of electricity was DC, its use for power transmission and distribution was very limited. Why? Alternating current is preferred for the following reasons:

1.) AC generators produce more power than DC generators. DC generator voltage and current levels are limited to approximately 750 volts and 800 amps, while AC generators commonly generate voltages from 13 kV to 25 kV. Generating AC is more practical.
2.) AC voltage and current can be stepped up or down with transformers. Transformers are relatively simple and efficient devices. Transformers don’t work for DC. Changing voltage levels of direct current requires the use of more complicated switching circuits.
3.) The combination of AC generators and transformers make it possible to produce electrical energy in generating stations long distances from where it will be used and then deliver it efficiently and economically, while DC generators are generally located at the site where the DC power will be used.
In a turbine generator under load, the effects can be very dramatic. To clearly understand what happens, let us review:

• Direct current is introduced into the windings of the rotor and produces a magnetic field that passes through the pole faces, across the air gap, through the stator, and back to the opposite pole face.
• The rotor is turned by action of the turbine, thereby causing the magnetic field to move relative to the armature windings of the stator.
• An electromotive force or voltage is set up across the armature windings, which results in the movement of electrons or current when these conductors in the stator are connected to an external load.

**Electric Power Generation: Coal**

Fossil-fueled electric generation processes and systems are fundamentally very similar. In coal-fueled electric generation power plants, heat created by burning coal converts water in a **boiler** into high-pressure steam. To safely contain steam pressure, the vessel must have its structural integrity assured in the construction stage and maintained by proper usage.

The steam rotates the turbine shaft at high speed, driving the shaft of a generator. The main function of a generator is to convert the heat energy of steam into more easily used electrical energy. It does this in two steps: first, the **thermal energy** of the steam is transformed into mechanical torque in the turbine; and second, this mechanical torque is converted into electrical energy in the generator because the turbine shaft rotation moves the magnetic field over the coils of the generator, producing electrical current.
After the steam leaves the turbine it is usually condensed back to water and pumped back into the boiler for the process to begin again. Since the condensing is usually accomplished using makeup water, power generating plants are commonly located along large bodies of water.

Electric Power Generation: Natural Gas

As mentioned earlier, fossil-fueled electric generation processes and systems are fundamentally very similar. Natural gas is typically used in two ways for electric power generation. The first method is through steam turbine generation by burning natural gas to provide heat to create steam similar to the way coal is used to create steam in coal-fired plants.

The second method of using natural gas as a fuel source is through gas turbine generation, by the use of the hot gases produced by the combustion of natural gas. In this case, natural gas is combusted and the hot combustion gases, instead of steam, turn turbines.

A third method called combined cycle technology consists of the combination of the above mentioned processes.

A Closer Look at Gas Turbine Generation

A gas turbine is a combustion turbine, a rotary engine that gets energy from the flow of hot, compressed combustion gas. Gas turbines are normally fueled with natural gas, although low-sulfur fuel oil can also be used as needed.

The turbines operate like a jet engine: they draw in air at the front of the unit, compress it, mix it with fuel, and ignite it. In the combustor, fuel is mixed with air and ignited under high pressure. The high-pressure environment increases the temperature of the combustion, making it more efficient.

The products of the combustion, most importantly high velocity gases, are forced into a turbine, which spins the turbine’s blades and drives their mechanical output. Similar to other power generators, the turbine blades are connected to a generator to produce electricity.
Combined cycle technology boosts power plant efficiency by essentially utilizing the same fuel to generate electricity twice. Natural gas power plants can reach a much higher efficiency level, around 60%, when a combined cycle configuration is used.

In combined cycle generation that utilizes gas turbines, the hot gases of combustion are used to turn the turbine as well as to provide a heat source for a boiler which produces steam for a steam generator. Electricity is produced as a result of the hot gas combustion energy and through steam energy.

Gas turbine plants are considered among the most expensive to operate, but they are the most flexible in the control of power output. Combustion turbines are designed to start quickly in addition to having operational flexibility in adjusting power output levels. These characteristics make gas turbine plants useful for peak load demand where quick startup or short use periods are needed. Peak load demand and other power demand concepts will be discussed further later in this module.

**ACTIVITY: Natural Gas Fuel Cells**

Research and discuss these questions as a class.

- What is natural gas fuel cell technology?
- What are the implications (financial, environmental, other) of using natural gas as a fuel source without using combustion methods to generate electricity?

**Electric Power Generation: Nuclear**

Nuclear energy has been proposed as an alternative to fossil fuels. Nuclear power is created by controlled nuclear reactions. The **nucleus** of an atom contains energy. In a nuclear power plant, the energy contained in a **radioactive** atom such as uranium (U) is released by splitting or breaking down the nuclei. This process is called nuclear fission, and it creates large amounts of heat.
Nuclear fission takes place inside the reactor of a nuclear power plant. A concrete and steel enclosure called the containment building is constructed around a nuclear reactor to confine fission products that otherwise might be released into the atmosphere.

At the center of the reactor is the core which contains the uranium fuel source. The uranium fuel source within the core is composed of multiple fuel rods.

Typically, fuel rods are operational inside the reactor for about six years. Once the fuel rods reach the end of their usefulness, they must be stored with special procedures within special facilities such as spent fuel pools, closed storage, or reprocessing.

During nuclear fission of uranium, small particles called neutrons hit the uranium atom and split it. This splitting or “fission” releases a large amount of energy in the form of heat and radiation.

In nuclear power plants, the heat given off by the nuclear reaction is used to change water into steam. Similar to the other power generation systems covered so far, the steam passes through a turbine, rotating the turbine at high speeds, which in turn moves the magnetic field over the coils of the generator, producing electrical current. After the steam leaves the turbine it is usually condensed back to water and pumped back into the nuclear-fueled boiler for the process to begin again.

The water that circulates through the reactor (reactor coolant system) serves two important functions. First, as mentioned above, the water is the source of steam that turns the turbines to generate electricity; and second, it controls the fission process by serving as a moderator through the change in water temperature, either slowing or speeding up the process.

An additional source of control of the fission process is the control rods. Control rods are composed of special chemicals elements that can be used to control the rate of nuclear fission in the reactor. The control rod assembly position is manipulated up or down so that less or more of the assembly is exposed to the reactor core to moderate the fission reaction.
A steady rate of self-sustaining fission *chain reactions* are necessary for stable power generation output. This steady rate or "equilibrium" of self-sustaining nuclear fission reactions is known as *critical mass.*

**Types of Plants**

There are several types of nuclear power reactors. Only **Boiling Water Reactors** (BWRs) and **Pressurized Water Reactors** (PWRs) are in commercial operation in the United States.

**Boiling Water Reactors**

A boiling water reactor functions in the following way: The uranium core inside the reactor *vessel* creates heat. A steam-water mixture is produced when reactor coolant water moves through the core, absorbing heat.

The steam-water mixture leaves the top of the core and enters two stages of moisture separation where water droplets are removed before steam enters the steam line. Steam is directed through a steam line to a turbine, causing it to turn the turbine generator, which produces electricity.

Unused steam is returned to the condenser where it condensed into water. That water is pumped out of the condenser, reheated, and pumped back to the reactor vessel. Boiling water reactors contain between 370–800 *fuel assemblies.*
Pressurized Water Reactors

The majority of nuclear power plants in the United States are pressurized water reactors. Pressurized water reactors are different than boiling water reactors in that the steam that moves the turbine is created by a steam generator.

A pressurized water reactor functions in the following way: The uranium core inside the reactor vessel creates heat. Pressurized water carries the heat to a steam generator. Inside the steam generator, steam is directed through a steam line to a turbine, causing it to turn the turbine generator, which produces electricity.

Unused steam is returned to the condenser where it is condensed into water. That water is pumped out of the condenser, reheated and pumped back to the reactor vessel. Pressurized-water reactors contain between 150 and 200 fuel assemblies.

A full set of materials are available on the CEWD Energy Industry Curriculum Site at: 
http://www.cewd.org/curriculum/eif-downloads.php
Contextualized Activities for Applied Knowledge

Math

How many of us sat in high school algebra wondering, “Why do I need to know this? I’ll never use it in real life.” In most cases, we’re not provided any type of context or real-world application. Research in education supports the fact that students understand math better when it is contextualized. It motivates and increases the students’ willingness to engage (Tabach & Friedlander, 2008) and provides concrete meaning to the math (Heid et al, 1995). CEWD has created math modules that align to the Applied Knowledge Math concepts in the CES. The problems are sorted by topic area as well as job category. The job categories are four of the five CEWD has focused on since its inception—Lineworker, Technician, Power Plant Operator, and Pipefitter/Pipelayer/Welder.

It is important to note that students need to engage in three steps BEFORE providing any type of contextualized math problems:
1. Develop a conceptual understanding
2. Make connections to why they need to know the content
3. Be fluent in the procedures of how to do the math problems

If math concepts are taught in context first, students have difficulty using the math outside of the specific contexts presented. So the energy industry contextualized math problems should be used after students have gone through steps one through three for each topic.

The concepts that are covered include:
• Basic Operations
• Forms of Fractions
• Operations with Fractions
• Converting Fractions to Percentages
• Rations and Proportions
• Conversions (English & Metric)
• Use of Formulas

Some sample pages are included below.

A full set of materials are publicly available on the CEWD Energy Industry Curriculum Site at: http://cewd.org/curriculum/contextualized-math.php
Forms of Fractions (Plant Operator)

Scenario

“Where are we at with the coal usage for the day?” asked Byron, a new plant operator, as he began his shift.

“We have used all of Silo #1, which holds 200,000 cubic feet of coal,” Cassandra, the current plant operator, responds. “And it looks like we have 25,000 cubic feet of coal remaining in Silo #2, which holds 250,000 cubic feet.”

What fraction of Silo #2 is full?

A. 1/8 full – Correct Answer
B. 1/10 full
C. 2/5 full
D. 1/4 full

Problems

Identifying and Writing Fractions

Cassandra, a plant operator, has inspected 3 of the total 4 boilers in the plant. What fraction of the boilers has she inspected?

A. 4/3 of the boilers
B. 3/4 of the boilers – Correct Answer
C. 75% of the boilers
D. 67% of the boilers
Devon, a plant operator, reduced plant power to 400 MW due to decreased demand. If the maximum rated power for the power plant is 500 MW, at what fraction of maximum power is the plant operating?

A. 4/5 of maximum power – Correct Answer
B. 4/9 of maximum power
C. 2/5 of maximum power
D. 100 MW

**Changing Improper Fractions to Mixed Numbers**

While compiling the weekly usage reports, Devon noted that 2/3 gallons of the chemical water additive had been added twice. Besides saying that 4/3 of a gallon had been used, which of the following could Devon also accurately say had been used?

A. 3/4 gallon
B. 1 1/3 gallons – Correct Answer
C. 2 1/3 gallons
D. 4 1/3 gallons

Cassandra, a plant operator, noted that the coal usage for the past 24 hours was 5/8 of Silo #2 and 7/8 of Silo #4. Besides recording that 12/8 of the total silo volume was used, which of the following could she say was used during the 24-hour period?

A. 2/8 of the total silo volume
B. 1 3/8 of the total silo volume
C. 1 1/2 of the total silo volume – Correct Answer
D. 1 2/8 of the total silo volume
Changing Mixed Numbers to Improper Fractions

Devon was getting ready to order grease for the equipment maintenance shop. He noted that during the first quarter, 1/2 of a barrel of grease was used, and during the second quarter, 3/4 of a barrel of grease was used. Instead of saying 1 1/4 barrels of grease was used, which of the following could he also say was used?

A. 11/4 barrels
B. 5/4 barrels – Correct Answer
C. 5/2 barrels
D. 4/8 barrels

While overhauling the plant’s three boilers, insulation tiles were replaced. Boiler #1 took 3/4 pallet of tiles, Boiler #2 took 5/8 pallet, and Boiler #3 took 1/2 pallet of tiles. If 1 7/8 pallets of tiles were used, how else could the used amount be recorded?

A. 9/14 pallets of tile
B. 17/8 pallets of tile
C. 6/8 pallets of tile
D. 15/8 pallets of tile – Correct Answer

Renaming Fractions to Lowest Terms

Devon, a plant operator, is currently using 2 of the plant’s 4 generators for power production. What fraction of the plant’s generators is being used?

A. 3/8 of the plant’s generators
B. 1/3 of the plant’s generators
C. 2/6 of the plant’s generators
D. 1/2 of the plant’s generators – Correct Answer
Cassandra, taking logs on the plant’s water purification system, recorded that 24 of the 32 reverse osmosis cylinders were in use and 8 were undergoing a regeneration soak. What fraction, in lowest terms, of the osmosis cylinders were in use?

A. 8/32 cylinders
B. 3/4 cylinders – Correct Answer
C. 24/32 cylinders
D. 1/4 cylinders

The daily coal train delivery consists of 40 coal cars. If 25 coal cars have unloaded so far, what fraction, in lowest terms, of the coal cars remain to be unloaded?

A. 5/8 of the coal cars
B. 40/25 of the coal cars
C. 3/8 of the coal cars – Correct Answer
D. 25/40 of the coal cars
WORKPLACE SKILLS

CES Workplace Skills

PLANNING/ORGANIZING/SCHEDULING:
Planning and prioritizing work to manage time effectively and accomplish assigned tasks
• Able to plan and schedule tasks so that work is completed on time
• Able to prioritize various competing tasks
• Demonstrate the effective allocation of time and resources effectively
• Will take necessary corrective action when projects go off track
• Find new ways of organizing work area to accomplish tasks more efficiently
• Estimate resources needed for project completion
• Make arrangements that fulfill all requirements as efficiently and effectively as possible
• Respond to the schedules of others affected by arrangements; inform others of arrangements by giving them complete, accurate, and timely information
• Keep track of details to ensure work is performed accurately and completely
• Effectively coordinate the transition of employees at the beginning and end of each work shift: disseminate crucial information in an organized manner to rapidly bring employees up to speed at the start of their shifts

PROBLEM SOLVING:
Demonstrating the ability to apply critical-thinking skills to solve problems by generating, evaluating, and implementing solutions
• Able to identify and define the problem
• Communicate the problem to appropriate personnel
• Capable of generating possible solutions
• Able to choose and implement a solution

DECISION MAKING:
Applying critical-thinking skills to solve problems encountered in the workplace
• Identify and prioritize the key issues involved to facilitate the decision-making process
• Anticipate the consequences of decisions
• Involve people appropriately in decisions that may impact them
• Respond quickly and calmly
• Decisively choose the best solution in a timely manner after contemplating available approaches to the problem, even in highly ambiguous situations or without assistance, when needed
• Observe and evaluate the outcomes of implementing the solution to assess the need for alternative approaches and to identify lessons learned
BUSINESS FUNDAMENTALS:
Having fundamental knowledge of the organization and the industry
• Understand the importance of one’s role in the functioning of the company and the potential impact one’s performance can have on the success of the organization
• Recognize the importance of maintaining privacy and confidentiality of company information, as well as that of customers and coworkers, and comply with intellectual property laws
• Understand the significance of maintaining a healthful and safe environment and report any violations/discrepancies to appropriate personnel
• Able to articulate the organization’s mission, functions, and position in the marketplace
• Comply with applicable laws and rules governing work and report loss, waste, or theft of company property to the appropriate personnel
• Act in the best interest of the company, community, and environment

CUSTOMER FOCUS:
Actively looking for ways to identify market demands and meet customer or client needs
• Understand and anticipate customer needs
• Provide personalized service with prompt and efficient responses to meet the requirements, requests, and concerns of customers or clients
• Be pleasant, courteous, and professional when dealing with internal and external customers or clients
• Evaluate customer or client satisfaction

WORKING WITH TOOLS & TECHNOLOGY:
Selecting, using, and maintaining tools and technology to facilitate work activity
• Identify, select, and use appropriate tools and technological solutions to frequently encountered problems
• Carefully consider which tools or technological solutions are appropriate for a given job, and consistently choose the best tool or technological solution for the problem at hand
• Operate tools and equipment in accordance with established operating procedures and safety standards
• Seek out opportunities to improve knowledge of tools and technologies that may assist in streamlining work and improving productivity
• Know how to maintain and troubleshoot tools and technologies
ETHICS:
Describing the importance of personal ethics and legal responsibility
  • Anticipate or recognize the existence of a problem
  • Evaluate and justify decisions based on ethical reasoning
  • Evaluate alternative responses to workplace situations based on personal, professional, ethical, and legal responsibilities and employer policies
  • Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace
  • Interpret and explain written organizational policies and procedures

FOLLOWING DIRECTIONS:
Receiving, understanding, and carrying out assignments with minimal supervision
  • Receive, interpret, understand, and respond to verbal messages and other clues
  • Pick out important information in verbal messages
  • Interpret complex instructions and their relevance to the work assignment
  • Ask questions to clarify unclear directions
  • Act upon the instruction to complete the assignment
Contextualized Activities for Workplace Skills

As makes sense with the category title, Workplace Skills are best practiced in the workplace, since they tend to be industry- and company-specific. However, there are a few areas that are exceptions, such as problem-solving and decision-making. These skills are used by students on a daily basis in educational settings. Teachers can draw attention to how important these are in the workplace and provide examples. Even if they can use personal examples of how they use these skills as teachers, they can be effective.

One area of Workplace Skills for which CEWD does have a wealth of resources is hand and power tools for use in the energy industry. This is part of the Energy Career Academy model and is available to education partners of CEWD members. See below for more information and a sample module.

Hand and Power Tools

Unique to the energy industry are CES that focus on hand and power tools used specifically for the broad area of utility technician, which includes job categories such as Lineworker and Natural Gas Technician. CEWD has created hands-on modules where students identify the tools and, where available and taking into account safety, they can practice using the tools.

Throughout the modules, students are asked to complete short activities, worksheets, and hands-on activities. They practice collecting data, recording answers to questions, and taking notes. Keeping documentation is a skill required in many jobs in the energy industry. These modules also require teamwork. The activities in this module are completed in small groups of two to four students. Below is a sample module.
# Unit M: Tool Demonstration Evaluation Form

<table>
<thead>
<tr>
<th>Student Name (printed)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluator Name (printed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Evaluator directions**
Evaluate the student’s ability to inspect and demonstrate use of tool selected.

<table>
<thead>
<tr>
<th>Task/Procedure</th>
<th>Criteria</th>
<th>Acceptable Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inspect the selected rotary drivers and screwdrivers for serviceability.</td>
<td>Check the power cord connection where it connects to the tool for loose connection, frays, or damage to the cord.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Check the plug end of the power cord for damage such as: crush plug, bent prongs, cut or missing ground prong.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Check that the chuck is tightly secured to the spindle.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Check that the auxiliary handles, if they are part of the tool, are securely installed.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Check the auxiliary handles for damage such as: cracks, burrs.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Check the body of the tool for cracks, chips, or broken plastic cover.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td>2. Demonstrate how to use the selected rotary drivers and screwdrivers in a utility.</td>
<td>Don the appropriate PPE.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Select the appropriate drill bit.</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td></td>
<td>Drill a hole in the concrete block.</td>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>
Unit M: Rotary Drivers and Screwdrivers

This unit introduces you to the various types of rotary drivers and screwdrivers.

Unit M: Rotary Drivers and Screwdrivers Do’s and Don’ts

Don’ts
• Never carry a tool by the cord or hose.
• Never yank the cord or hose to disconnect it from the receptacle.
• Do not use power tools in damp or wet sites.
• Do not energize the tool until just before use.
• Never get near the moving parts of an electrical tool unless the power is off.
• Never lay electrical cords over sharp edges or through doorways or holes in walls.
• Do not use an electric tool in an area where flammable gases or vapors may be present unless the tool is rated for that application.
• Do not use any tool that is sparking or appears to have an electrical short.
• Do not use any tool with a damaged cord or exposed wiring.
• Do not use excessive force on drills to drill through hard materials.
• Do not use the tool unless the bit is securely tightened.

Do’s
• Follow manufacturer’s instructions for lubrication and changing accessories.
• Disconnect tools when not in use.
• Disconnect tools from the power source before servicing, changing accessories, performing repairs, or adjustments are made.
• Keep all observers at a safe distance away from the work site.
• Use both hands to operate the tool; secure work with clamps or a vise.
• Keep finger off the “ON” switch button unless operating the tool.
• Keep good footing and maintain good balance when using a power tool.
• Wear proper clothing and PPE; avoid any clothing or accessory that could become caught in moving parts.
• Remove all damaged portable electric tools from use and tag “Do Not Use.”
• Keep cords and hoses away from heat, oil, and sharp edges.
• Tools must either have a 3-wire cord with ground and be grounded, be double insulated, or be powered by a low-voltage isolations transformer.
• Use a cord with a three-pronged plug and grounding pin.
• Ensure cords are not a tripping hazard.
• The tool is an approved double-insulated type.
• Powered tools shall be used only within their design and shall be operated in accordance with the instructions of the manufacturer.
• All tools shall be kept in good repair.

Unit M: Tool Inspection Checklist

• Check the power cord connection where it connects to the tool for loose connection, frays, or damage to the cord.
• Check the plug end of the power cord for damage such as: crushed plug, bent prongs, cut or missing ground prong.
• Check that the chuck is tightly secured to the spindle.
• Check that the auxiliary handles, if they are part of the tool, are securely installed.
• Check the auxiliary handles for damage such as cracks and burrs.
• Check the body of the tool for cracks, chips, or broken plastic cover.

Instructor and student guides are available to education partners of CEWD members at:
and
Formed in March 2006, the Center for Energy Workforce Development (CEWD) is a non-profit consortium of electric, natural gas and nuclear utilities and their associations - Edison Electric Institute, American Gas Association, American Public Power Association, Nuclear Energy Institute, and National Rural Electric Cooperative Association.