Technical and Professional Education

Curriculum Content Frameworks for Navy JROTC

Curriculum Content Frameworks for
Navy JROTC
Developed by the
Department of Workforce Education

State of Arkansas
Department of Workforce Education

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Preface

The Technical & Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as all aspects of the NJROTC program as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical & Professional Education programs can be accessed through the Department of Workforce Education Web site.

Forward

The curriculum content framework for Naval Junior Reserve Officer Training Corps supports the course that prepares students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the protective services industry.

- Career Family: Military
- Career Area: Naval Service
- Career Role CIP Code: 28.0401
- Naval Enlisted Service
- Naval Officer Corps

• Acknowledgments

The Naval Junior Reserve Officers Training Corps curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. A panel of experts in the field of Navy JROTC reviewed the framework. The format and content of the framework reflect the specific training needs within the state of Arkansas. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas State's Department of Workforce Education access to their instructional frameworks.

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Introduction

About the Program

NJROTC familiarizes students with all areas of Naval Service. The course sequence focuses on duties and tasks performed by professionals in the United States Navy as well as pre-employment and employment skills.

About the Document

- Section 1 contains a master duty/task list for the NJROTC program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of NJROTC program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the NJROTC program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by NJROTC.

Course Descriptions

The NJROTC Program goals are to provide an opportunity for secondary school students to learn about the basic elements and requirements for national security and their personal obligations as American citizens to contribute toward national security.

Master Duty/Tasks Listing
Navy JROTC

National and state experts in the occupational field of Medical Professional Education have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty/task statement*, which describes what the student is to do

DUTY A: **The Navy Junior ROTC organization and requirements**
Task:
A001: History and Background of the NJROTC Program
A002: Mission, Goals and Policies of the NJROTC Program
A003: NJROTC Unit Activities
DUTY B: **Basic Naval Leadership & Followership traits & Principles**
Task:
B001: Followership
B002: Leadership
B003: Leadership Opportunities in NJROTC
B004: Relationships
DUTY C: **Navy ships, their construction, terminology, operations & use**
Task:
C001: The Mission of Navy Ships
C002: Ship Terminology
C003: Navy Ships

DUTY D: **Navy aircraft, their construction, operation, & use**
Task:
D001: Background of Naval Aviation
D002: Naval Aircraft and Missions
DUTY E: **Navy Junior ROTC Uniform**
Task:
E001: NJROTC Uniform Regulations (The Uniform)
DUTY F: **Navy Ranks & Rates**
Task:
F001: NJROTC Rates/Ranks and U.S. Navy Rates/Ranks
DUTY G: **Naval Customs & Courtesies**
Task:
G001: Military Customs, Courtesies, Etiquette and Ceremonies
DUTY H: **Military Drill**
Task:
H001: Introduction to Military Drill
DUTY I: **Military Drill Movements & Commands**
Task:
I001: Drill Without Arms
DUTY J: **Naval History From WWII to Present**
Task:
J001: World War II: The Atlantic War, 1941-1945
J002: World War II: Pacific War, 1941-1945

J003: The Cold War Era, 1945-1991
J004: The 1990s and Beyond
DUTY K: **Maritime Geography**
Task:
K001: Maritime Geography
K002: Maritime Geography of the Eastern Seas
DUTY L: **Oceanography**
Task:
L001: Undersea Landscapes
L002: Seawater: Its Makeup and Movements
L003: Life in the Seas
DUTY M: **Naval Knowledge**
Task:
M001: The Importance of Sea Power
M002: Naval Operations
DUTY N: **Naval Skills**
Task:
N001: Ship Construction, and Damage Control
N002: Marine Navigation
N003: An Introduction to Naval Weapons
DUTY O: **Leadership**
Task:
O001: Develop a better understanding of leadership traits and principles and be afforded the opportunity to apply those traits and principles in leadership situations within the NJROTC unit.

O002: Understand that effective leadership uses the arts of communication and supervision to get the job done, and that effective leadership is an ongoing, growing, and learning process - - not a finished product.
O003: Understand that a leader knows where it is going and how to get there, is willing to let his subordinates in on the ultimate goal, proximate goals, and the path(s) thereto, and to enlist their support.
O004: Understand that within the triad of responsibility, accountability, and authority, the officers corps has an ethical code that ensures that officers always do what is right and always use authority properly.
O005: Understand that one of the foremost responsibilities of a leader is to serve as the example or model for his or her followers in everything that he or she does or is.

Task Definitions

National and state experts in the occupational field of Navy JROTC have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

DUTY A:
The Navy Junior ROTC organization and requirements

Task:

A001: History and Background of the NJROTC Program

Definition: Process should include the following:

- Cite the public law that established the Junior ROTC program.
- Cite under whose guidance the NJROTC program is administered.
- Describe the team members/instructors teaching the NJROTC program.

Process/Skill Questions

A002: Mission, Goals and Policies of the NJROTC Program

Definition: Process should include the following:

- Cite the mission and goals the NJROTC program expects to achieve.
- Cite the policies a student must meet in order to enroll in the NJROTC unit.
- Cite the Navy's core values and explain what it means for everyone to be committed to their fellow cadets in the NJROTC program.

Process/Skill Questions

A003: NJROTC Unit Activities

Definition: Process should include the following:

- Explain the purpose of having all students participate in learning the basics of military drill.
- Discuss the types of community activities cadets can expect to engage in during the school year.
- Discuss the opportunity to take orientation trips during the school year, and what it does for cadet leadership training.

Process/Skill Questions

DUTY B: **Basic Naval Leadership & Followership traits & Principles**
Task:
B001: Followership *Definition:* Process should include the following: • Define followership. • Describe the different types of followers. • Describe the qualities of a good follower, and the importance of obedience in a military organization. • Describe the duties of a good follower. Process/Skill Questions
B002: Leadership *Definition:* Process should include the following: • Define Leadership • Cite the traits of an effective leader. • Cite the personal qualities of an effective leader. • Discuss the range of leadership styles and strategies of successful leaders, from the very autocratic to the very democratic. Process/Skill Questions
B003: Leadership Opportunities in NJROTC *Definition:* Process should include the following: • Discuss the typical NJROTC unit organizational chart. • Describe the leadership positions found in the unit. Process/Skill Questions
B004: Relationships *Definition:* Process should include the following: • Discuss senior and subordinate relationships in a typical military situation. • Cite three reasons for the chain-of-command. • Discuss how frustration, anger, sexual harassment, being picked-on, and unfair situations cause conflicts in human relationships. • Discuss what the individual can do to learn about solving conflicts. Process/Skill Questions

DUTY C:
Navy ships, their construction, terminology, operation & use.

Task:

C001: The Mission of Navy Ships

Definition: Process should include the following:

- Describe the mission of the Nay as it relates to carrying out the military strategy of the United States.
- Discuss the objective of strategic deterrence in the Navy's mission.
- Discuss the Navy's ability to control the use of the seas.

Process/Skill Questions

C002: Ship Terminology

Definition: Process should include the following:

- Discuss the differences between civilian and Navy language when referring to various parts and locations aboard ship.
- Cite ship terminology related to directions on a ship.
- Cite ship terminology related to ship structure, floors of a ship, ship doors, ship hatches, and ship size.
- Discuss how ships are identified by name and designation.
- Cite ship terminology related to ship armament and ship armor.
- Discuss how the speed of a ship is stated in terms of nautical miles per hour over water, and how this compares to statute miles per hour over land.

Process/Skill Questions

C003: Navy Ships

Definition: Process should include the following:

- Discuss Navy ships in terms of type, size, displacement, length, beam and missions performed.
- Describe how the ships of the United States Navy are divided into two categories: combatant ships and auxiliary ships.
- Describe the purpose of combatant ships in enemy warfare.
- Cite the five types of combatant ships that are classified as "warships."
- Cite the two types of combatant ships that are classified as "other combatants."
- Cite the two types of submarines deployed by the Navy.
- Cite the other combatant ships that are classified as "mine warfare ships" and "amphibious ships."
- Discuss the purpose of the auxiliary ships as the lifelines to the combatant force.

Process/Skill Questions

DUTY D:
Navy aircraft, their construction, operation & use.

Task:

D001: Background of Naval Aviation

Definition: Process should include the following:

- Discuss the beginning of naval aviation and the four approaches used to integrate aircraft with the fleet.
- Discuss the Navy's first aircraft carriers and the major improvements made in carrier aviation since the early efforts.

Process/Skill Questions

D002: Naval Aircraft and Missions

Definition: Process should include the following:

- Discuss how naval aircraft of the same type are organized into squadrons for the purpose of training maintenance and administration.
- Discuss the variety of Navy aircraft available in each of its striking forces, and the missions they perform.

Process/Skill Questions

DUTY E:
Navy Junior ROTC Uniform

Task:

E001: NJROTC Uniform Regulations (The Uniform)

Definition: Process should include the following:

- Explain that the uniform is an important element in the morale, pride, discipline, and effectiveness of the NJROTC program.
- Demonstrate how the wearing of the NJROTC uniform reflects upon your NJROTC unit, your school, the U.S. Navy, your community and your country.
- Demonstrate the wearing of the NJROTC uniform and the uniform standards described in the cadet field manual.
- Explain the importance of proper appearance and grooming standards for wearing an NJROTC uniform.
- Demonstrate the correct uniform composition.

Process/Skill Questions

DUTY F:
Navy Ranks & Rates

Task:

F001: NJROTC Rates/Ranks and U.S. Navy Rates/Ranks

Definition: Process should include the following:

- Explain and recognize the various NJROTC rates and ranks and be able to understand assignments associated with each billet.
- Describe and recognize the rates and ranks of active duty Navy personnel.

Process/Skill Questions

DUTY G:
Naval Customs & Courtesies

Task:

G001: Military Customs, Courtesies, Etiquette and Ceremonies

Definition: Process should include the following:

- Explain the types of military customs to include their purposes and when courtesies are rendered.
- Describe the flag of the United States as a standard of honor.
- Explain the procedures in pledging allegiance to the flag.

Process/Skill Questions

DUTY H:
Military Drill

Task:

H001: Introduction to Military Drill

Definition: Process should include the following:

- Explain the purposes of military drill.
- Define the terms used in military drill.
- Explain the different types of commands.
- Demonstrate the proper techniques for giving commands.
- Describe the general rules for drill.

Process/Skill Questions

DUTY I:
Military Drill Movements & Commands

Task:

I001: Drill Without Arms

Definition: Process should include the following:

- Describe the positions and instructions for basic drill without arms.
- Demonstrate the correct formations and instructions for basic drill without arms.
- Demonstrate the correct marching steps for basic drill without arms.

- Demonstrate the command for changing direction for basic drill without arms.

Process/Skill Questions

DUTY J:
Naval History From WWII to Present

Task:

J001: World War II: The Atlantic War, 1941-1945

Definition: Process should include the following:

- Explain the events that took place in Europe in 1939-1940
- Explain the importance of the Battle of the Atlantic.
- Describe the first Allied offensive operation.
- Explain why successful Allied air attacks in Operation Overlord were essential to the success of the invasion of Normandy.
- Describe the major events of D-Day in Normandy.

Process/Skill Questions

J002: World War II: Pacific War, 1941-1945

Definition: Process should include the following:

- Describe the spread of Japanese control.
- Cite two reasons the Battle of the Coral Sea was important.
- Explain the significance of the Battle of Midway.
- Explain the strategy of 1943: Continuous Pressure.
- Explain the submarine war in the Pacific.

Process/Skill Questions

J003: The Cold War Era, 1945-1991

Definition: Process should include the following:

- Describe naval contributions in the Korean War.
- Describe the events involved with Operation Chromite: Inchon.
- Describe the Navy's movement into the nuclear age.
- Describe major events in the Cuban missile crisis.
- Describe the U.S. involvement in the Tonkin Gulf incident in August of 1964.
- Describe the major events that led to the end of the Vietnam War.
- Describe the rise of terrorism worldwide with events in the Middle East during the 1980's.Describe the great changes experienced by the Soviet Union since 1985 and the rapid rise of the democratic movement within the Soviet Union after the demolition of the Berlin Wall.

Process/Skill Questions

J004: The 1990s and Beyond

Definition: Process should include the following:

- Describe the major events that occurred during both operations Desert Shield and Desert Storm.
- Describe other problems that took place in the late 1990s concerning India, Pakistan, and China.
- Describe international terrorist events that occurred in the late 1990s and September 11, 2001.

Process/Skill Questions

DUTY K:
Maritime Geography

Task:

K001: Maritime Geography of the Western Seas

Definition: Process should include the following:

- Describe the subdivisions of the World Ocean
- Cite the importance of geography in military planning and operations.
- Describe the Atlantic Ocean in terms of its economic and strategic importance to the United States and its allies.
- Explain the importance of the Caribbean Sea and Gulf of Mexico to the United States.
- Describe the Artic Ocean in terms of its economic and strategic importance to the United States and its allies.
- Describe the Mediterranean Sea in terms of its economic and strategic importance to the United States and its allies.

Process/Skill Questions

K002: Maritime Geography of the Eastern Seas

Definition: Process should include the following:

- Cite the importance of the Red Sea and the Gulf of Aden to American interest.
- Explain the role of the united States and its allies in the Persian Gulf and the Gulf of Oman.
- Describe the Indian Ocean in terms of its economic and strategic value to the United States and its allies.
- Describe the value of the Pacific Ocean to the United States and its allies.
- Describe the special features of the Antarctic Ocean

Process/Skill Questions

DUTY L:
Oceanography

Task:

L001: Undersea Landscapes

Definition: Process should include the following:

- Explain methods used to explore the ocean floor.
- Describe the benefits of the continental shelf
- Describe the make-up of the continental slope.
- Explain the features of the deep ocean basin.
- Describe the sediments found on the ocean floor.

Process/Skill Questions

L002: Seawater: Its Makeup and Movements

Definition: Process should include the following:

- Describe the causes of waves.
- Describe the effects of wave power.
- Describe the current movement in the Pacific Ocean
- Explain the effects of the moon on our tides.

Process/Skill Questions

L003: Life in the Seas

Definition: Process should include the following:

- Describe how microscopic plant life is involved in the ecological system of the oceans.
- Cite the chain of natural events that occur in the food cycle in the seas.
- Describe life-sustaining characteristics of marine life at the edge of the sea.
- Describe the abundance of life in the shallow sea.
- Describe the two major divisions of marine animals and their characteristics.
- Describe the biological phenomenon of sea noises created by marine animals and its effect on antisubmarine operations.
- Describe four categories of harmful marine animals that pose a threat to man.

Process/Skill Questions

DUTY M:
Naval Knowledge

Task:

M001: The Importance of Sea Power

Definition: Process should include the following:

- Define the importance of sea power as it relates to America
- Describe four major developments since World War II that have increased the importance of the oceans of the world.
- Describe the strategic ocean areas.

- Describe the fourfold mobility we gain from the sea.
- Describe the purpose and function of the United States Merchant Marine and the relationship between maritime commerce and the economy of the United States.
- Describe the importance of a sound national security program.
- Describe the U.S. Navy's mission and national strategy.

Process/Skill Questions

M002: Naval Operations

Definition: Process should include the following:

- Explain the capabilities of the U.S. Naval Forces.
- Describe the purpose of air warfare.
- Describe the purpose of submarine warfare.
- Describe the purpose of undersea warfare.
- Cite the importance the U.S. Navy places on amphibious warfare and operations.

Process/Skill Questions

DUTY N:
Naval Skills

Task:

N001: Ship Construction, and Damage Control

Definition: Process should include the following:

- Identify nautical terms used in the U.S. Navy
- Describe those terms that describe a ship's structure.
- List the classifications and designations of U.S. Navy ships.
- Describe the services provided by damage control.
- List the three physical requirements for a fire to occur and the four classes of fires.
- Describe the procedures for fighting fires.

Process/Skill Questions

N002: Marine Navigation

Definition: Process should include the following:

- Define navigation
- Explain how latitude and longitude are used to locate places on a map
- Describe true and relative bearing
- Explain how time is indicated in the Navy.
- Describe the importance of Greenwich time for navigational purposes.

Process/Skill Questions

N003: An Introduction to Naval Weapons

Definition: Process should include the following:

- Discuss basic weapon terminology as it applies to the Navy.
- Describe the major characteristics and nomenclature of naval guns.
- Describe the types of naval aircraft.
- Describe the general types of guided missiles.
- Describe the types and usage of guided missiles used in the Navy.
- Describe the four systems of mine classification.
- Explain what conventional weapons are.
- Explain chemical warfare and describe the common types of CW agents found in the weapons stockpiles of most major nations today.
- Explain biological warfare.
- Explain nuclear warfare and describe the possible effects of a nuclear warhead explosion.

Process/Skill Questions

DUTY O:
Leadership

Task:

O001: Develop a better understanding of leadership traits and principles and be afforded the opportunity to apply those traits and principles in leadership situations within the NJROTC unit.

Definition: Process should include the following:

- Discuss the basis for effective leadership.
- Explain the essential qualities of good leadership.
- Know what leadership techniques are available and which of them to employ in a specific situation.
- Identify the communication skills needed for effective leadership.
- Discuss the leadership relationship between a senior and his/her subordinate.

Process/Skill Questions

O002: Understand that effective leadership uses the arts of communication and supervision to get the job done, and that effective leadership is an ongoing, growing, and learning process - - not a finished product.

Definition: Process should include the following:

- Describe which arts are used in practicing effective leadership.
- Explain why it is important to communicate well.
- Describe the three characteristics of effective leadership.
- Define the traits of an effective leader.
- Discuss what is involved in sharing and teamwork.
- Describe the basic rules that effective leaders follow.

Process/Skill Questions

O003: Understand that a leader knows where it is going and how to get there, is willing to let his subordinates in on the ultimate goal, proximate goals, and the path(s) thereto, and to enlist their support.

Definition: Process should include the following:

- Know the difference between a leader and a manager.
- Describe what is a leader's "service reputation."
- Describe what ability an individual must have in order to be effective and successful in the Navy.
- Discuss how behavior is a basic element of "setting the example."

Process/Skill Questions

O004: Understand that within the triad of responsibility, accountability, and authority, the officers corps has an ethical code that ensures that officers always do what is right and always us authority properly.

Definition: Process should include the following:

- Explain one of the keys to effective leadership as regards to authority
- Describe the difference between positive and negative exercise of authority.

Process/Skill Questions

O005: Understand that one of the foremost responsibilities of a leader is to serve as the example or model for his or her followers in everything that he or she does or is.

Definition: Process should include the following:

- Discuss the concept of setting the example as one of the foremost responsibilities of a leader.
- Identify what great leaders like Winston Churchill, Franklin Roosevelt, General MacArthur and Admirals Nimitz and Halsey have in common.
- Discuss how a leader sets the moral tone for subordinates.

Process/Skill Questions

SkillsUSA

DUTY A: **Self - Improvement**
Task:
A001: Complete a self-assessment and identify individual learning styles *Definition:* Process should include the following: • Identify and list individual strengths. • Identify and list areas in need of improvement. Process/Skill Questions
A002: Discover self-motivation techniques and establish short-term goals *Definition:* Process should include the following: • Develop a list of short-term goals. • Discuss ways to change or improve lifestyle appearance and behavior. Process/Skill Questions
A003: Determine individual time-management skills *Definition:* Process should include the following: • Prepare and keep a time journal. • Discuss ways to improve time management skills. Process/Skill Questions
A004: Define future occupations *Definition:* Process should include the following: • Search internet for career opportunities within specified fields of study. • Prepare presentation on a specified career area. Process/Skill Questions
A005: Develop awareness of cultural diversity and equity issues *Definition:* Process should include the following: • Research a tradition modeled by individual's family. • Develop personal philosophy statements regarding gender equity. Process/Skill Questions

A006: Define the customer

Definition: Process should include the following:

- Differentiate between External and Internal customers
- Discuss factors which contribute to poor customer relationships.

Process/Skill Questions

A007: Recognize benefits of doing a community service project

Definition: Process should include the following:

- Discuss and list ways to become involved in the community
- Develop a community service project.

Process/Skill Questions

A008: Demonstrate effective communication with others

Definition: Process should include the following:

- Identify and list personal barriers to listening.
- Develop personal plan to overcome barriers to listening.

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize experience of job shadowing activity.

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

- Identify parts of a portfolio
- Design a personal employment portfolio

Process/Skill Questions

A011: List proficiency in program competencies

Definition: Process should include the following:

- Complete an interpersonal competency assessment.

Process/Skill Questions

DUTY B:
Civic, Social and Business Awareness

Task:

B001: Measure/modify short-term goals

Definition: Process should include the following:

- Discuss steps to pursue short-term goal(s)

Process/Skill Questions

B002: Identify stress sources

Definition: Process should include the following:

- List personal sources of stress.
- Discuss techniques to cope with individual sources of stress.

Process/Skill Questions

B003: Select characteristics of a positive image

Definition: Process should include the following:

- Discuss actions and traits that lead to a positive image.
- Discuss actions and traits that lead to a negative image.

Process/Skill Questions

B004: Demonstrate awareness of government, professional organizations and trade unions

Definition: Process should include the following:

- Identify state governor, legislators, and senators.
- Identify professional organizations pertaining to specific career areas.

Process/Skill Questions

B005: Apply team skills to a group project

Definition: Process should include the following:

- Form a team to develop a class project.

Process/Skill Questions

B006: Observe and critique a meeting

Definition: Process should include the following:

- Attend a formal meeting held within the community
- Critique the attended meeting.

Process/Skill Questions

B007: Demonstrate business meeting skills

Definition: Process should include the following:

- List and discuss the basic rules to ensure an orderly and business-like meeting

- Role-play appropriate meeting skills

Process/Skill Questions

B008: Demonstrate social etiquette

Definition: Process should include the following:
- Role-play appropriate social behavior
- Differentiate between good and bad manners.

Process/Skill Questions

B009: Complete survey for employment opportunities

Definition: Process should include the following:
- Gather information on a particular employment opportunity of interest.
- Conduct internet search of a specific career area.

Process/Skill Questions

B010: Review a professional journal and develop a 3 to 5 minute presentation

Definition: Process should include the following:
- Develop a presentation on the content, purpose, and distribution of a particular professional journal

Process/Skill Questions

B011: Identify customer expectations

Definition: Process should include the following:
- List and discuss customer expectations.
- Discuss consequences of unmet customer expectations.

Process/Skill Questions

B012: Complete a job application

Definition: Process should include the following:
- Obtain a job application from various businesses in the community
- Conduct a mock job interview.

Process/Skill Questions

B013: Identify a mentor

Definition: Process should include the following:
- Define mentor.
- Discuss ways in which a mentor can help an individual meet career goals.

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop employment portfolio

Process/Skill Questions

B015: Explore supervisory and management roles in an organization

Definition: Process should include the following:

- Examine an organizational chart
- Discuss responsibilities of managers and supervisors

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

B017: Evaluate your proficiency in program competencies

Definition: Process should include the following:

- Define task and competency
- List competencies associated with a specified career area.

Process/Skill Questions

Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general "literacy."

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new

hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which vocational-technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most vocational-technical programs.

Using The Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
    - must be easy to implement
    - must stand alone
    - do not need to be taught in a particular order
    - must be open-ended enough to be useful for any technical/vocational program.

- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and vocational instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- "*Need-to-know" assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform ____ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.
- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at www.dol.gov.
- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit www.osha.gov.
- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see www.mavcc.org.

ACADEMIC STANDARDS FOR READING AND WRITING

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	Classroom Applications to Industry
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding reading and writing.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
Answer **simple comprehension or recall questions from a lecture or from written material.**	Provide 2 examples of workplace materials* on students' reading level. With the first, allow students to read information and then answer brief recall questions. With the second example, read aloud the material but do not give a handout. Ask brief recall questions. Compare the differences…how do students retain information better—orally or visually? Discuss learning styles and impact on the job.
Follow, *Give* **oral instructions.**	Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.

Follow, *Give* **written instructions.**	Using a short list of instructions for a hands-on task, have students give written instructions to a partner or group. Rate the effectiveness of the speaker.
Show **the difference between relevant and irrelevant details.**	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
Sort **objects based on x number of criteria.**	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
Recognize, *Identify* **technical vocabulary.**	Using workplace materials*, highlight technical vocabulary terms. Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
Read **aloud.**	Read aloud from workplace materials* in groups or individually.
Identify, *Explain* **symbols, abbreviations and acronyms relevant to subject area.**	Using workplace materials*, highlight symbols, abbreviations, and acronyms. Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, *Use* **rules of grammar, usage, spelling, punctuation.**	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*. Correct the mistakes.
Discuss **uses and purposes of a variety of workplace communication tools.**	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
Duplicate **process demo by instructor**	Using a workplace process, demonstrate steps

	to complete and have students perform individually or in groups.
Notice, *Apply* **word analysis techniques.**	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) [1]
Match **parts from photographs or diagrams to actual objects.**	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
Read **for main ideas and for details.**	Use a graphic organizer[1] to show main ideas and supporting details.
Distinguish **between fact, opinion, and inference.**	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
Distinguish **between rows and columns;** *identify* **a cell as a block where a row and column intersect.**	Using charts or tables from workplace materials*, discuss the reasons for this format. Identify the quantity in a particular cell.
Select, *Use* **appropriate resources and reference tools.**	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia. List reasons for choosing one reference tool over another. Use reference tools to answer questions related to industry or current events.
Paraphrase **written or oral material into summary form.**	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson. Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

Interpret, *Fill out/complete* **forms and records.**	Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory). Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner. Create a form or document to be used in a workplace process.
Use, *Develop* **a process for remembering details.**	Use pneumatic devices to organize and remember details. Pneumatic devices[1] include Semantic Maps, Thought Webs, and other creative tools to organize thinking.
Proofread, *Correct* **mistakes in written drafts.**	Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage. Correct mistakes in written drafts.
Examine **different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).**	Gather samples of workplace materials*. Identify each by type. Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.
Understand **the writing process.**	In order to apply the writing process, create a workplace communication tool to be used for a specific purpose. Prewrite: Brainstorm, gather facts, or do research to create a <u>business letter, memo, report, brochure, proposal, schematic, map, or diagram</u>. Identify the audience.

	Determine the purpose of the document. Write: Create a first draft. Revise and Edit: Make changes to ensure accuracy. Look at the writing from a different point of view. Shorten or make more concise where possible. Use white space, bold print and other formatting details to make the document easy-to-read. Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.) Publish the final draft.

Identify, *Create* **sentences of different types.**	Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses). Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).
Identify, *Use* **contractions correctly.**	Using workplace materials*, locate contractions (e.g., isn't, I'll). Identify misuses of contractions. Write a short list of directions relating to an industry process and use as many contractions as possible.
Identify, *Use correctly* **commonly misspelled words.**	Using a list of commonly misspelled words[1], locate errors in the media (newspaper articles, Internet sites, magazines.) Ask each student to identify his problem words from the list. Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions). Give short weekly quizzes focusing on 5 words per week. Award bonus points.
Identify, *Use* **correctly the English irregular verbs.**	From a list of irregular verbs, review the uses of each. Ask each student to identify his problem irregular verbs from the list. Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.
Identify, *Use* **Signal Words and other cues to improve writing.**	Use a list of Signal Words[1] and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention.)

	Examples: Signal Words sowing emphasis: Most of all, It should be noted, Of course Signal Words showing a conclusion: Lastly, In summary, Finally Identify common signal words in workplace writing, especially in sequenced lists. Write a list of work instructions using signal words.
Identify **components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.**	Label the parts of a workplace document.
Place **steps in proper sequence.**	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
Analyze **cause and effect.**	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
Determine **missing information.**	Locate the information that is missing from a problem and explain why the problem cannot be solved without it. To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.
Differentiate **between tools used for a job.**	Given a list of tools and a list of functions, identify the most efficient tool for each task.
Assemble **or disassemble objects.**	From a list of oral or written instructions, assemble an object or complete a process. Students write the instructions for disassembly.
Cross-reference **materials to compare information.**	Using more than one source document, compare the information given.

Interpret **reasoning behind rules or regulations.**	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
Show contrasts **between approaches.**	Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.) Compare and contrast each approach from the perspective of a worker, manager, supervisor.
Organize **data in a new format.**	Using workplace materials*, organize the information into a new format.
Prove **a rule or method's sufficiency.**	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
Show **relationships between two or more systems.**	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
Given examples of emergency situations, *identify* **real world course of action.**	Using an emergency situation common to your industry, outline a step-by-step plan for action.
Identify **variables that affect the outcome of a process.**	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
Infer **situations that meet guidelines when complete information is not available.**	Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy. Discuss or debate the issues.
Compare **finished products to a set of guidelines.**	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).

	List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
Identify **preventative measures for maintenance of a system.**	List the needed routine maintenance to keep a system working properly.
Predict **new standards or rules that may become necessary in the future.**	Identify recent areas of change or development in your industry. Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).
Improve **a process by streamlining (locating waste) or decreasing lost time.**	Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient. Isolate the cause of failure in a process by performing an experiment.
Prepare **a model explaining a concept.**	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

[1] Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists,* 4th ed. ISBN 0-13-028185-9.

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing
Problem Solving
Operations and Calculations
Applications
Data Analysis and Display

Objectives	**Classroom Applications to Industry**
Present *Review and Discuss* *Master* **the list of skills employers want for the workplace regarding mathematics.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
PROBLEM SOLVING	
Examine ***Apply*** **problem**-solving process.	Define the problem What is being asked? Decide on a type of solution Multi-step or single-step question? Try any of these: Estimate an answer Draw a diagram Find a pattern

	Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation Locate information you need Do you have all the components? Get missing information May need to perform some other calculations Calculate Look at the answer. How should the remainder be expressed? Check the solution Is it reasonable?
OPERATIONS AND CALCULATIONS	
Read, write, **and** *count* **numbers.**	Read and write numbers (especially focus on very large and very small numbers where mistakes are common). Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 > or < Put these in order from smallest to largest: 0.66, 0.677, 0.67
Round **numbers.**	Discuss your industry's use of decimals. Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.

	Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.
Estimate **numbers.**	The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations where estimation is used. Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills. Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)
Compute **averages.**	Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples. Using workplace materials*, calculate a series of averages. For example: • Take 10 different measurements of a piece of pipe using a micrometer. • Compare the measurements. • Find the average of all the measurements. • Compare the average to the smallest and largest measurement. • Discuss the effects on quality…when is an average an acceptable benchmark measurement?
Calculate **with whole numbers: perform one-step problems with basic operations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.
Perform **problems that require an**	Using workplace materials*, make a list of

understanding of the order of operations.	situations or problems that need more than one step to perform them. If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved. If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition. Rework the problem using addition first. Compare the answers. Discuss the importance of reasoning skills to verify that an answer makes sense.
Understand **the relationship between decimals, fractions and percents.**	Make a table comparing fractions, decimals, and percents.
Compute **with fractions, decimals, and percents, and show understanding of the relationship between them.**	Create sample problems using fractions that relate to everyday situations. ▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8 10+2+8 = 20 (recognize denominator value) $\frac{10}{20}$ Pizza $\frac{2}{20}$ Salad $\frac{8}{20}$ BBQ ▪ Add the fractions. $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$ ▪ Convert fraction to whole number. (Total answers equal 1 class's worth of answers.)

	$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ ▪ Convert fractions to percents. $\frac{10}{20}$ means 10 divided by 20 = 0.50 Move decimal 2 places right. 0.50 = 50% $\frac{2}{20}$ means 2 divided by 20 = 0.10 0.10 = 10% $\frac{8}{20}$ means 8 divided by 20 = 0.40 0.40 = 40% 50% + 10% + 40% = 100% Notice the totals add to 100%. So, $\frac{20}{20} = 1 = 100\%$ Using workplace materials*, calculate work-related questions using fractions, decimals, and percents. Calculate shipping costs for internet purchases (such as music from amazon.com).
Solve **formulas and equations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations. ▪ Work left to right ▪ Use order of operations ▪ Place numbers on one side, variables on the other side
Obtain **squares and square roots.**	Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples. Compare the difference between the 2 common answers to 3^2 (answer = 9, not 6).

	How would an incorrect value affect the work on the job?
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for length.**	Discuss industry measures and terms relating to length.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for mass/weight.**	Discuss industry measures and terms relating to mass/weight.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for volume.**	Discuss industry measures and terms relating to volume.
Measure **with a certain degree of accuracy.**	Estimate measurements. Using workplace materials* and tools, take measurements of work-related and classroom items. Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.
APPLICATIONS	
Solve **word problems.**	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
Select/apply **mathematical formula.**	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
Understand **the importance of time in the workplace.**	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.
Recognize **components of time systems (clocks and calendars).**	AM and PM Leap Year Military time

Discuss, *Identify,* *Understand* **terms relating to measuring time.**	Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.
Understand **that time can be expressed in terms of equivalencies.**	Show the time equivalencies using fractions. For example: 1 ½ days = ___ hours 1 day = 24 hours + ½ day = +12 hours 1 ½ days = 36 hours
Compute **time conversions.**	Make a table that shows the equivalencies of time units. Compute conversion problems at the appropriate level of difficulty. Examples include: • Convert minutes to hours • Convert hours to days • Convert seconds to years.
Calculate **ratio and proportion.**	Review fractions when discussing ratio and proportion. Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch). Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)
Apply **geometry principles: Use formulas for measuring shapes of 2 dimensions.**	Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc. Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter? Find the area of the tiles on the floor. Find the area of the classroom.

	Review that all areas are expressed in terms of square units (square inches, square miles, etc)
Apply **geometry principles: Use formulas for measuring shapes of 3 dimensions.**	Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units. Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.
Define **terms relating to money.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money. For more advanced students, include terms and principles of economics, finance, or statistics.
Perform **one-step problems involving money.**	Make change. Count up (rather than backwards) to make change.
Perform **multiple-step problems using money.**	Calculate gross and net earnings. Calculate ▪ Interest ▪ Sales tax ▪ Percent off ▪ Sale price ▪ Profit percentages Perform banking transactions.
Perform **business-related financial activities.**	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
Use **a calculator to perform computations.**	Identify appropriate activities that can be performed using a calculator (calculators

	allow students to concentrate on problem-solving strategies. Award prizes for weekly activities or competitions.
Calculate **measurements taken from measuring devices.**	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
Perform/prepare **an inventory.**	Use a sample group of items to prepare an inventory. Review inventory vocabulary terms. Discuss the math processes that would apply to the inventory process.
DATA ANALYSIS AND DISPLAY	
Recognize **types of visual representations.**	Charts Graphs Tables
Interpret **charts, graphs and tables.**	Answer simple questions about charts, graphs and tables. *Solve* multi-step problems involving the correlation of graphs and tables.
Collect/record **data.**	As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details. Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers. Find the range of answers (maximum and minimum). Find the average. Discuss an acceptable range of answers (±), and graph the results showing the number that fell inside and outside the acceptable range.

Review ***and*** *apply* **principles of probability.**	Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")
Use probability models to *predict* **chance events.**	Calculate theoretical probability of an event (e.g., the probability of rolling a 5 on a die is 1/6). Find empirical probability of an event by performing repeated experiments. Compare the 2 probabilities.
Calculate ***and*** *interpret* **statistics.**	Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see? For a humorous look at statistics, see *How to Lie with Statistics* by Huff and Geis.
Interpret **plans/blueprints.**	Review vocabulary and terms for plans, blueprints and schematics. Build a plan or blueprint one layer at a time, starting with the basic identifying information. Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually, or the entire drawing as a whole.
Construct **charts and tables.**	Discuss chart types and chart vocabulary. Using workplace or sample data from the class, construct tables and charts.

	For a daily example, consult *USA Today* online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data. Challenge students to bring in examples of charts and graphs containing errors.

ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing

General Science-	topics not specific to a content area
Physical Science-	Mechanics and Physics
	Energy and Waves
	Thermodynamics
	Electromagnetism
	Chemistry
	Optics
Life Science-	Cell biology
	Evolution
	Genetics and Heredity
	Human and Animal Development
Anatomy	Ecology
	Viruses
	Bacteria
	Plants
Earth Science-	Earth in space
	Solar System/Astronomy
	Atmosphere and weather
	Oceans and water
	Earth resources

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	Classroom Applications to Industry
GENERAL SCIENCE	
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding science skills.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers • Researching the topic of adult literacy
Perform **computations as required to solve problems.**	Use the metric system to convert units of measure. Round numbers to correct number of significant figures. Determine percentage of error. Understand validity, reliability, accuracy, and precision.
Apply **scientific method of inquiry.**	Identify the steps of the scientific method. Conduct experiments. Understand the following terminology: Conclusions vs inferences Variables Replications Samples/sample size

Investigate **science history as it applies to industry.**	In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group. Present findings in report format, or in oral presentations. Investigate science ethics. Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm [Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]
Use **scientific instruments to *measure* aspects of the environment.**	Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.
Demonstrate **an understanding of data.**	List the processes involved in gathering data. Suggest ways that data can be grouped or organized. Collect specimens. Show how data can be represented (graphically, charts and diagrams, etc) Construct a model to depict a basic concept.
Identify **the seven basic S I (Systeme International) units.**	Length- meter- m Mass- kilogram- kg Time- second- s Electric current- ampere- A

	Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd Dictionary of units- see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
Identify **S I (Systeme International) Derived units.**	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc). Create a picture dictionary demonstrating the concepts.
Review **relevant theories, laws and models**.	As relating to your industry, discuss important theories, laws and models.
Use **reference tools to solve problems.**	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
Practice **safe lab procedures.**	Handle equipment with care. Demonstrate safety and first aid procedures. Identify harmful substances.
PHYSICAL SCIENCE	
Understand **the cyclical nature of systems.**	Show, demonstrate, model, track the cycles of any of the following systems: Growth and decay Food webs Weather Water
Analyze/classify **matter according to type.**	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
Explain **the concepts of work and power.**	Identify machines used in industry. Identify how energy levels change when work or power is increased/decreased. Identify fuel sources used in your industry. Discuss internal and external combustion.

	Create a model demonstrating the uses of levers and pulleys.
Be familiar **with concepts of motion.**	Measure acceleration and deceleration Understand the relationship between speed and velocity by performing experiments. Recognize waves and vibrations as a type of motion. Understand action and reaction. Review laws pertaining to motion.
Understand **concepts related to force**.	Show the need for balance of forces acting on an object. Observe centrifugal and centripetal forces in action. Show how friction is created and must be accounted for in using and preserving equipment. Create a chart showing types of lubricants needed in a factory and schedule of maintenance. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia. Show the relationship between pressure, mass, and weight.
Understand and *apply* **principles relating to the atom.**	Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.) Identify ions.
Investigate **forms of and changes in energy.**	Discuss how energy is measured. Observe changes in energy relationships. Identify catalysts and reactants.

	Identify sources of kinetic and potential energy in your industry.
Discuss, apply **principles of electricity and electric currents.**	Identify types of circuits and switches. Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each. Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.) Identify good conductors and insulators, and how to choose them. Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity. Show the uses of a vacuum tube by building a model. Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry. As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.
Be familiar **with sound waves.**	Compare how sound waves travel between liquids, solids, and air. Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.

	Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms): Amplification Audible range Frequency Acoustics Resonance Speed
Be familiar **with principles of heat.**	Differentiate between the 3 types of heat transfer (conduction, convection, radiation). Understand that substances expand and contract due to heating and cooling Identify purpose and types of insulations used. Differentiate between heat and temperature.
Investigate **and** *apply* **concepts relating to temperature.**	Use the temperature scales; convert between Celsius and Fahrenheit.
Explain **the concepts of magnetism.**	Understand that currents create magnetic fields. Identify materials that are good conductors, and the properties that make them such. Understand electromagnetic forces present in earth.
Investigate/apply **chemical properties.**	Differentiate between acids and bases. Find pH for substances used in industry. Identify substances used in your industry and classify them by type. Name the major drugs, fertilizers, or additives used in your industry. Define and state examples of chemical reactions. Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble.

	Explain solute and solvent.
Investigate **forms of and changes in matter.**	Compare and contrast physical and chemical changes. Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.
Understand **and apply concepts relating to the elements.**	Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)). Element Groups: Alkali Metals Alkaline Earth Metals Transition Metals Other Metals Metalloids Non-Metals Halogens Noble Gases Rare Earth Elements
Be familiar **with principles of light.**	Discuss light as a form of energy. Describe types of lighting systems. Examine the light spectrum and note the relative smallness of visible light. Define reflection and refraction. Explain how light carries information (by lasers) and show examples of the impact on technology/industry. Identify types of lenses.
Be familiar **with principles of color.**	Diagram the main parts of the eye involved in seeing color (rods, cones). Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?

	Define situations in which colorblindness impacts a worker's ability to do his job.
LIFE SCIENCE	
Explain **the presence of cells as the identifier of all living organisms.**	Examine the cells of organic material used in your industry, using books, the internet, or a microscope. Recognize that cells divide or replicate to promote growth of an organism. Examine the parts of a cell. Compare the cell to a machine…how do the parts function and rely on each other? Give example of one-celled and multiple-celled organisms. Review the classification system of all organisms (Kingdom, Phylum, etc). Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms: Bacteria Fungi Viruses Insects Plants Vertebrates Invertebrates Compare some of the cell processes (active and passive transport) to the processes in your industry.
Understand **the progress of evolution of organisms.**	Recognize how a species will adapt to better fit in its environment over time.
Explain **the role of genetics in human development.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including: • Half of an individual's genes are contributed by each parent • Traits that are inherited are either dominant or recessive from the parent(s)

	• Cell division by mitosis versus meiosis • Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
Investigate/apply **principles of human development.**	Describe the life cycle of humans and other animals. Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.
Explore **additional concepts pertaining to humans and other animals.**	Give examples of ways organisms adapt to their environment. As relating to industry, review the concepts of: Aging Immune system Skin and Tissues Blood and hemoglobin Disease
Compare/contrast **the differences between sexual and asexual reproduction.**	Determine instances when understanding the concepts of sexual reproduction are important for your industry. Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.
Show **a general understanding of the importance of health.**	Explore the cost of lost wages and worker's compensation in the past year due to health problems. Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)
Investigate **the food cycle.**	Identify food chains, food webs, food pyramids. Show how changes to the food cycle affect the

	environment and affect man. Name the food groups.
Understand **nutrition and the body's need for a diet that provides vitamins and minerals.**	Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry. Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)
Observe **health code/sanitation requirements.**	Research the development of health code and sanitation requirements, including OSHA. Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety. Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts). Discuss potential effects of ignoring health requirements. After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each. To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc. Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded. Explore proactive measures students can take to extend their health. Understand the importance of mental health in

	addition to physical health.
Investigate/apply **principles of anatomy and physiology.**	As relating to your industry, explore issues relating to anatomy and physiology. Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome. Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.
Understand **basic principles of Ecology.**	Define ecology. Identify 5 major ways in which man interacts with the environment, especially as relating to your industry. Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues. Identify any areas of concern regarding waste/waste management in your industry. Show the difference between a niche, community, habitat, and ecosystem. Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group? Understand predators' effects on food chains. Identify predators of industry. Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?
State **the differences between viruses and bacteria.**	Define viruses and bacteria. Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated? State the benefits of viruses and bacteria.

	Explain the recent increased resistance to drugs and antibiotics.
Understand **basic concepts relating to plants.**	Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide. As relating to industry, review the concepts of: Fertilization Parts of plant, and functions of each Effects of temperature on plants Need for water and light Photosynthesis
EARTH SCIENCE	
Recognize **earth's position in the universe.**	As relating to your industry, identify relevant topics regarding Asteroids Comets Stars Galaxies Identify planets in the solar system. Compare and contrast earth to other planets. Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ___ so the sun should be the size of ___). How do the phases of the moon and sun affect the hemispheres?
Investigate **history of the earth.**	Identify geological, chemical and other methods of determining the age of an object. Demonstrate that fossils and rocks are indicators of previous eras. As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each. Make sure the timeline is drawn to scale.

	Assign each Age to a group and research the following: Weather Major events at beginning and end of age Organisms living during this time Factors that made the Age unique
Investigate **physical characteristics of the earth.**	Label/model the components of the earth. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity. Solve problems of longitude, latitude and time zones. Create a model of the ratio of land and water on earth.
Investigate **physical forces acting on the earth.**	Examine erosion and depletion of nonrenewable resources. Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).
Explain **the basic components of earth's rotation.**	Understand that the earth spins on its axis at an angle of 23 ½ degrees Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons. Discuss time zones.
Identify **the earth's atmosphere and its components.**	Identify the main elements in the earth's atmosphere (nitrogen and oxygen). Identify layers of the atmosphere, and the ozone layer.

	Explain concepts of air pressure.
Understand **basic principles of the solar system.**	Demonstrate how the sun strikes the earth at different angles depending on location.
Demonstrate **the relationship between climate and weather.**	Identify the factors that create weather. Show how landscape features are affected by changes in climate or weather. Identify the greenhouse effect. How does industry contribute to it? Describe the relationship between altitude and weather. Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream. Identify types of precipitation. Differentiate between types of clouds. Understand the effect of winds, wind speeds, and impacts on vegetation.
Learn **and** *apply* **concepts relating to the oceans.**	Label the major oceans and seas. Determine the elements in ocean water (nearly all elements are present). Identify or draw the structural components of the ocean floor. Explain the relationship between the moon and the tides. Explore ways the ocean is used for power and business.
Investigate **principles of water.**	Identify the parts of the water cycle and the effects of the processes involved. Define water's chemical properties water is the universal solvent water has a neutral ph of 7

	chemically, water is one atom of oxygen bound to two atoms of hydrogen) Measure salinity. Which industries rely heavily on water? Define water's physical properties water is the only natural substance that exists as solid, liquid, and gas water's surface has a high density water has a high tolerance for heat (heat index) water's weight water as a coolant specific gravity
Investigate **conservation of physical and natural resources.**	As relating to your industry, discuss or debate the issues of Allocation of resources Recovering resources Best/worst methods of using resources Compare/contrast renewable and nonrenewable resources. Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation. Discuss alternative sources of energy as relating to your industry.
Investigate **issues regarding scientific technology.**	As relating to your industry, discuss the uses of technology. What are the newest developments? What effects does the technology have on our society? Political system? Discuss the role of economics on technology.
Apply **science principles/laws to environmental issues.**	Discuss how mankind alters the earth and environment through use of resources and technology, pollution.

Arkansas's All Aspects of Industry

Defining "All Aspects"

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.

Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology. Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior
- Communicating safety regulations and plans to employees

Working with selected community groups to implement safety programs.