ACAP~~
Austin Competency Analysis Profile

Biotechnology

Conducted November 11 and 12, 1998
Austin Community College
Austin, Texas

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What's Inside~~

ACAP Process Overview

What are Austin Competency Analysis Profiles (ACAPs)?

Austin Competency Analysis Profiles (ACAPs) are competency lists that are verified by expert workers called Subject Matter Experts or SMEs, that evolve from a well-established job analysis process involving business, industry, labor, and community agency representatives from throughout the Austin area.

How is an Austin Competency Analysis Profile used?

Each ACAP identifies the occupational, academic, and employability skills (or competencies) needed to enter a given occupation or occupational area. The ACAP not only lists the competencies but also clusters those competencies into broader units and details the knowledge, skills, and attitudes (competency builders) needed to perform each competency.

Within the competency list are two levels of items: core and advancing. Core items, which are essential for entry-level employment, are required to be taught. Advancing items are those needed to advance in a given occupation, and are designated by a superscripted "a". If core competencies or competency builders are present in "advancing" unit, then they are designated with a superscripted "c".

Educational institutions may add as many units, competencies, and/or competency builders as desired to reflect local employment needs, trends, and specialties. Local advisory committees are actively involved in the identification and verification of additional items.   Faculty members formulate their courses of study using the varied contents of the ACAP. Faculty also monitor gains using many forms of assessment.

ACAP Working Outline

November 11 and 12, 1998

Tuesday, November 11

Welcome and Introductions

Brainstorm: *What do people need to know and be able to do as an entry-ready employee in this occupation?*

Process Overview:
> **Purpose~Why are we here?**
> **Review definitions**
> **Identify outcomes**

Verify Units

~Lunch Break~

Verify Competencies

Verify Competency Builders

Wednesday, November 12

Continue Verifying Competency Builders

Determine Core and Advancing Units, Competencies, and Competency Builders

~Lunch Break~

Develop Work Keys Occupational Profile

Review and Wrap Up

Occupational Competencies

Unit 1: **Communication**

Unit 2: **Safety**

Unit 3: **Basic Lab Skills**

Unit 4: **Regulatory Compliance**

Unit 5: **Specific Lab Skills**

Unit 6: **Quality Assurance/ Control**

Unit 7: **Facility and Equipment**

Unit 8: **Care and Use of Research Test Animals**

Unit 9: **Care and Use of Research Test Plants**

Unit 1:   **Communication**

Competency 1.1   **Communicate in a professional manner**

Competency Builders:

1.1.1   Interact with vendors, colleagues, and clients
1.1.2   Notify appropriate persons about problems and observations
1.1.3   Coordinate tasks with coworkers
1.1.4   Make oral and written presentations
1.1.5   Apply strategies for interacting with different personalities

Competency 1.2:   **Follow, analyze protocol and keep accurate records**

Competency builders:

1.2.1   Comprehend and use a technical vocabulary
1.2.2   Document results at the time of performance

Competency 1.3:   **Write or update manuals, SOP's, Protocols, reports, and technical summaries**

Competency builders:

1.3.1   Take notes on procedures being done
1.3.2   Prepare, identify and apply changes to control procedures
1.3.3   Employ scientific writing techniques

Competency 1.4:   **Locate and review reference materials**

Competency builders:

1.4.1   Perform computerized research
1.4.2   Read technical literature
1.4.3   Evaluate for comparison
1.4.4   Identify basic reference resources in biotechnology

Competency 1.5:   **Demonstrate computer skills**

Competency builders:

1.5.1   Develop computer proficiency in PC and Mac for marketability
1.5.2   Navigate Internet
1.5.3   Perform applications in word processing, spreadsheets, databases, presentations, and project management

Competency 1.6:   **Practice ethical issues in biotechnology**

Competency builders:

1.6.1   Practice confidentiality
1.6.2   Practice scientific accountability

Unit 2:   Safety

Competency 2.1:   **Maintain safe work area**

Competency builders:

2.1.1   Identify first aid supplies, personnel, co-worker contact, medical information, emergency protection and evacuation plan
2.1.2   Follow appropriate safety procedures, guidelines, and chemical hygiene plan
2.1.3   Maintain required safety training to include location and understanding of MSDS
2.1.4   Observe rules of electric and equipment safety
2.1.5   Comprehend and obey safety symbols/signs
2.1.6   Keep work areas free from clutter
2.1.7   Recognize common lab hazards and observe procedures for the safe use of instruments, gas cylinders, and chemicals
2.1.8   Maintain and utilize safety equipment and personal protection equipment. (PPES)

Competency 2.2:   **Handle Store and dispose of hazardous materials per MSDS, other safety guidelines, worker protection Standards (WPS)**

Competency builders:

2.2.1   Check expiration dates, lot numbers, and label for hazard information
2.2.2   Monitor usage and exposure of radioisotopes and biohazards
2.2.3   Follow universal precautions for biological pathogens
2.2.4   Store chemicals, according to storage guidelines

Unit 3:   **Basic Lab Skills**

Competency 3.1:   Obtain and read protocol, test procedure, standard operating procedures (SOPs) and proper forms

Competency builders:

3.1.1   Apply scientific method
3.1.2   Recognize and follow documentation requirements
3.1.3   Design and troubleshoot procedure/test
3.1.4   Prioritize and perform multiple tasks in a timely manner

Competency 3.2:   Maintain laboratory testing

Competency builders:

3.2.1   Check and maintain equipment
3.2.2   Maintain equipment logs on usage and maintenance
3.2.3   Perform preventive maintenance according to schedule
3.2.4   Clean, organize, and sterilize material when necessary
3.2.5   Order inventory of laboratory supplies and reagents
3.2.6   Date and label reagents

Competency 3.3:   Prepare solutions and reagents for laboratory use

Competency builders:

3.3.1   Practice aseptic techniques when necessary
3.3.2   Use titration and pipetting techniques
3.3.3   Measure volumes
3.3.4   Measure weights
3.3.5   Perform basic calculations and statistical analysis
3.3.6   Prepare and dispense stock reagents, buffers, media and solutions
3.3.7   Maintain reagent integrity (store properly, avoid cross-contamination, use at proper temperature, etc.)
3.3.8   Calculate and prepare dilutions series
3.3.9   Sterilize reagents, buffers, media and solutions when appropriate
3.3.10   Monitor physical properties of reagents, buffers, media and solution Determine acceptability and optimum conditions of reagents for tests

Competency 3.4:   **Set up clinical laboratory tests**

Competency builders:

3.4.1   Request and review procedures and match request to test sample
3.4.2   Prepare test subject (mentally and physically) for sampling
3.4.3   Obtain and label sample/specimen
3.4.4   Assess acceptability/ appropriateness of specimen
3.4.5   Prepare sample for testing
3.4.6   Perform tests/ assays: chemical, biological, clinical, environmental, robotic and mechanical
3.4.7   Return, archive, or dispose of samples appropriately

Competency 3.5:   **Set up general laboratory tests**

Competency builders:

3.5.1   Obtain and review appropriate procedures and test forms
3.5.2   Collect and set-up samples
3.5.3   Set-up equipment
3.5.4   Perform and document tests and results
3.5.5   Return archive or depose of samples appropriately

Competency 3.6:   **Operate the following equipment:**

Competency builders:

3.6.1   Thermocycler[a]
3.6.2   Microscope
3.6.3   Fluorimeter[a]
3.6.4   Hoods
3.6.5   Centrifuge
3.6.6   Polarimeter
3.6.7   pH meter
3.6.8   Chart recorder
3.6.9   Stirrers
3.6.10   Balance
3.6.11   Conductivity meter
3.6.12   Mixers
3.6.13   Autoclave
3.6.14   Power supply
3.6.15   Shakers
3.6.16   Dry heat oven
3.6.17   Incubators
3.6.18   Bunsen Burner

3.6.19   Scintillation counter[a]
3.6.20   High pressure liquid chromatography[a]
3.6.21   Geiger counter
3.6.22   Gas chromatography/ mass spectrometry[a]

Unit 4:   Regulatory Compliance

Competency 4.1:   Accept federal regulations

Competency builders:

4.1.1   Follow U.S. Food and Drug Administration (FDA)
4.1.2   Follow U.S. Occupational Safety and Health Administration (OSHA)
4.1.3   Follow U.S. Department of Agriculture (USDA)
4.1.4   Follow National Institutes of Health(NIH)
4.1.5   Follow National Research Council (NR)
4.1.6   Follow Department of Transportation (DOT)
4.1.7   Follow U.S. Environmental Protection Agency (EPA)
4.1.8   Follow Centers for Disease Control and Prevention (CDC)
4.1.9   Follow Nuclear Regulatory Commission (NRC)
4.1.10   Follow clinical lab improvement (CLIA, 88, Amendment of 1988 Protein tech skills)
4.1.11   Follow Drug Enforcement Administration Regulations(DEA)

Competency 4.2:   Follow state, local, and industry regulations

Competency builders:

4.2.1   Follow and observe TDH Regulations
4.2.2   Follow and observe Hazmat Guidelines
4.2.3   Follow and observe the elements of ISO 9000
4.2.4   Perform manufacturing using current good manufacturing practices (GMP)

Unit 5: Specific Lab Skills[a]

Competency 5.1:   **Perform Microbiology Skills**

Competency builders:

5.1.1   Identify and quantify microorganisms and cells
5.1.2   Isolate, maintain and store pure cultures
5.1.3   Prepare seed inoculum
5.1.4   Maintain and monitor fermentation equipment and materials
5.1.5   Harvest cells
5.1.6   Recover effluent products
5.1.7   Transform hosts
5.1.8   Perform bioassays
5.1.9   Decontaminate and/or dispose of equipment, glassware and biologics
5.1.10   Execute plating techniques
5.1.11   Identify microorganisms using manual and automated systems. (bacterial, fungus, mold, yeast)

Competency 5.2:   **Applies Cell Biology Techniques**

Competency builders:

5.2.1   Isolate and characterize cell lines
5.2.2   Propagate plant and animal tissue
5.2.3   Practice cryogenic techniques
5.2.4   Propagate and harvest viruses
5.2.5   Practice transfection techniques

Competency 5.3:   **Perform Immunological Techniques**

Competency builders:

5.3.1   Utilize monoclonal and polyclonal antibodies
5.3.2   Perform hemaglutination/ hemadsorption techniques
5.3.3   Perform enzyme-linked immunoabsorbent assays ELISA

Competency 5.4:   **Perform Genetic Engineering and Molecule Biology Techniques**

Competency builders:

5.4.1   Probe and analyze DNA library
5.4.2   Construct recombinant vectors
5.4.3   Perform transformation techniques
5.4.4   Perform polymerase chain reaction
5.4.5   Perform translation assays
5.4.6   Isolate and Analyze Nucleic Acid Isolation
5.4.7   Transcribe DNA
5.4.8   Perform electrophoresis on RNA, DNA and proteins
5.4.9   Perform nucleic acid hybridization
5.4.10   Perform autoradiography
5.4.11   Perform non-isotopic techniques

Competency 5.5:   **Separate proteins, isolate or characterize proteins**

Competency builders:

5.5.1   Disrupt cells
5.5.2   Run protein gels
5.5.3   Perform Western blotting
5.5.4   Denature/ renature proteins
5.5.5   Precipitate solubilize proteins
5.5.6   Chromatograph proteins
5.5.7   Concentrate (filter and dialyze) proteins
5.5.8   Quantitative proteins (e.g. IEF)
5.5.9   Perform enzyme activity assays
5.5.10   Monitor protein stability

Competency 5.6:   **Perform Chemical Assays**

Competency builders:

5.6.1   Perform quantitative analysis
5.6.2   Perform distillation techniques
5.6.3   Perform titration techniques (manual and Automatic)
5.6.4   Employ dyes and indicators[c]
5.6.5   Perform lypholization[c]
5.6.6   Perform organic chemistry techniques
5.6.7   Perform extractions
5.6.8   Measure turbidity, viscosity, and density[c]
5.6.9   Perform lab investigation per FDA guidelines

Unit 6: Quality Assurance/ Control[a]

Competency 6.1: **Inspect and verify integrity of the product, procedure, and specimen**

Competency builders:

6.1.1   Perform quality tests
6.1.2   Document results of quality testing
6.1.3   Verify test standards
6.1.4   Maintain QA records
6.1.5   Archive samples and documents
6.1.6   Release final product
6.1.7   Perform trend analysis

Competency 6.2: Address customer complaints

Competency builders:

6.2.1   Investigate customer complaints
6.2.2   Take corrective action according to SOP or as directed
6.2.3   Document actions and outcomes
6.2.4   Perform trend analysis

Unit 7: Facility and Equipment

Competency 7.1: **Monitor/ record the environmental conditions of the facility (growth chamber, greenhouse, seed storage room, animal room, or manufacturing suite)**

Competency builders:

7.1.1   Sample environment
7.1.2   Clean work area according to SOPs
7.1.3   Document clean room integrity
7.1.4   Notify appropriate personal if sampling shows problems

Competency 7.2:   **Validate or confirm equipment**

Competency builders:

7.2.1   Label equipment
7.2.2   Check calibration
7.2.3   Perform systems diagnostics
7.2.4   Perform or schedule preventive maintenance
7.2.5   Trouble shoot and repair equipment (work order)
7.2.6   Maintain equipment logs

Unit 8:   Care and use of Research/Test Animals

Competency 8.1:   **Care for Research/test animals**

Competency builders:

8.1.1   Receive and transport animals
8.1.2   Maintain separate in-process, quarantine, and release areas
8.1.3   Prepare food and prescription diets
8.1.4   Feed, water and monitor animals
8.1.5   Clean housing and sterilize cages
8.1.6   Monitor health and maintain health records
8.1.7   Follow USDA/IACUC guidelines for animal care and use

Competency 8.2:   **Utilize Research/Test animals**

Competency builders:

8.2.1   Restrain and handle animals
8.2.2   Collect and process specimens
8.2.3   Inoculate animals for testing
8.2.4   Monitor health and collect data
8.2.5   Document results

Unit 9:   Care and use of Research/Test plants

Competency 9.1:   **Care for plants for optimal experimental test use**

Competency builders:

9.1.1   Maintain plants for optimal growth
9.1.2   Apply agrochemical safely
9.1.3   Maintain and monitor insect populations
9.1.4   Maintain growth media
9.1.5   Pot and repot plants
9.1.6   Monitor growth and development of plants

Competency 9.2:   **Utilize Research/Test plants**

Competency builders:

9.2.1   Inoculate plants and/or soil with biological materials
9.2.2   Gather pollen and bundle pollinate
9.2.3   Apply plant pests safely
9.2.4   Collect biological data
9.2.5   Perform bioassays
9.2.6   Document results

ACAP: Biotechnology~~

Employability Competencies

Unit 1:   **Career Development**

Unit 2:   **Decision Making and Problem Solving**

Unit 3:   **Work Ethic**

Unit 4:   **Job-Seeking Skills**

Unit 5:   **Job Retention and Career Advancement Skills**

Unit 6:   **Technology in the Workplace**

Unit 7:   **Lifelong Learning**

Unit 8:   **Economic Education**

Unit 9:   **Balancing Work and Family**

Unit 10:   **Citizenship in the Workplace**

Unit 11:   **Leadership**

Unit 12:   **Entrepreneurship**

Unit 1:   Career Development

Competency 1.1:   **Investigate career options**

Competency Builders:

1.1.1   Determine interests and aptitudes
1.1.2   Identify career options
1.1.3   Research interests, knowledge, abilities, and skills needed in an occupation
1.1.4   Select careers that best match interests and aptitudes
1.1.5   Identify advantages and disadvantages of career options, including self-employment and nontraditional careers

Competency 1.2:   **Utilize career information**

Competency Builders:

1.2.1   Identify a range of career information resources
1.2.2   Use a range of resources to obtain career information (e.g., handbooks, career materials, labor market information, and computerized career-information delivery systems)
1.2.3   Demonstrate knowledge of various classification systems that categorize occupations and industries (e.g., *Dictionary of Occupational Titles*)
1.2.4   Describe the educational requirements of various occupations
1.2.5   Identify individuals in selected occupations as possible information resources, role models, or mentors
1.2.6   Describe the impact of factors such as population, climate, employment trends, and geographic location on occupational opportunities
1.2.7   Assess differences in the wages, benefits, annual incomes, cost of living, and job opportunities associated with selected career options
1.2.8   Determine labor market projections for selected career options

Competency 1.3:   **Participate in a career exploration activity**

Competency Builders:

1.3.1   Identify career exploration activities (e.g., job shadowing, mentoring, volunteer experiences, part-time employment, and cooperative education)
1.3.2   Compare traits, skills, and characteristics required for specific career choices with individual's traits, skills, and characteristics
1.3.3   Recognize potential conflicts between personal characteristics and career choice areas
1.3.4   Describe the impact of exploration activities on current choices

Competency 1.4:   **Assess the relationship between educational achievement and career planning**

Competency Builders:

1.4.1   Describe how skills developed in academic and vocational programs relate to career goals
1.4.2   Describe how education relates to the selection of a college major, further training, and/or entry into the job market
1.4.3   Identify skills that can apply to a variety of occupational requirements
1.4.4   Explain the importance of possessing learning skills in the workplace

Competency 1.5:   **Develop an individual career plan**

Competency Builders:

1.5.1   Identify career goal(s)
1.5.2   Identify worker conditions, education, training, and employment opportunities related to selected career goal(s)
1.5.3   Describe school and community resources available to help achieve career goal(s)
1.5.4   Identify career ladders possible within selected career goal(s)*
1.5.5   Identify additional experiences needed to move up identified career ladders*
1.5.6   Recognize that changes may require retraining and upgrading of employees' skills

Competency 1.6:   **Annually review/revise the individual career plan**

Competency Builders:

1.6.1   Identify experiences that have reinforced selection of the specific career goal(s) listed on the individual career plan
1.6.2   Identify experiences that have changed the specific career goals(s) listed on the individual career plan
1.6.3   Modify the career goal(s) and educational plans on the individual career plan
1.6.4   Ensure that parents or guardians provide input into the individual career plan process
1.6.5   Identify the correlation between the individual career plan and the actual courses to be taken in high school
1.6.6   Identify the correlation between the individual career plan and postsecondary training, adult education, or employment

Unit 2: Decision Making and Problem Solving

Competency 2.1: **Apply decision-making techniques in the workplace**

Competency Builders:

2.1.1 Identify the decision to be made
2.1.2 Compare alternatives
2.1.3 Determine the consequences of each alternative
2.1.4 Make decisions based on values and goals
2.1.5 Evaluate the decision made

Competency 2.2: **Apply problem-solving techniques in the workplace**

Competency Builders:

2.2.1 Diagnose the problem, its urgency, and its causes
2.2.2 Identify alternatives and their consequences in relation to the problem
2.2.3 Recognize multicultural and nonsexist dimensions of problem solving
2.2.4 Explore possible solutions to the problem using a variety of resources
2.2.5 Compare/contrast the advantages and disadvantages of each solution
2.2.6 Determine appropriate action
2.2.7 Implement action
2.2.8 Evaluate results of action implemented

Unit 3: Work Ethic

Competency 3.1: **Evaluate the relationship of self-esteem to work ethic**

Competency Builders:

3.1.1 Identify special characteristics and abilities in self and others
3.1.2 Identify internal and external factors that affect self-esteem
3.1.3 Identify how individual characteristics relate to achieving personal, social, educational, and career goals
3.1.4 Identify the relationship between personal behavior and self-concept

Competency 3.2:   **Analyze the relationship of personal values and goals to work ethic both in and out of the workplace**

Competency Builders:

3.2.1 Distinguish between values and goals
3.2.2 Determine the importance of values and goals
3.2.3 Evaluate how one's values affect one's goals
3.2.4 Identify own short- and long-term goals
3.2.5 Prioritize own short- and long-term goals
3.2.6 Identify how one's values are reflected in one's work ethic
3.2.7 Identify how interactions in the workplace affect one's work ethic
3.2.8 Identify how life changes affect one's work ethic

Competency 3.3:   **Demonstrate work ethic**

Competency Builders:

3.3.1 Examine factors that influence work ethic
3.3.2 Display initiative
3.3.3 Demonstrate dependable attendance and punctuality
3.3.4 Demonstrate organizational skills
3.3.5 Adhere to schedules and deadlines
3.3.6 Demonstrate a willingness to learn
3.3.7 Demonstrate a willingness to accept feedback and evaluation
3.3.8 Demonstrate interpersonal skills required for working with and for others
3.3.9 Describe appropriate employer-employee interactions for various situations
3.3.10 Express feelings and ideas in an appropriate manner for the workplace

Competency 3.4:   **Demonstrate safety skills**

Competency Builders:

3.4.1 Practice safe work habits
3.4.2 Identify safety hazards
3.4.3 Employ preventative safety measures
3.4.4 Demonstrate appropriate care and use of equipment and facilities to ensure safety
3.4.5 Comply with safety and emergency procedures

Unit 4: Job-Seeking Skills

Competency 4.1: **Prepare for employment**

Competency Builders:

4.1.1   Identify traditional and nontraditional employment sources
4.1.2   Utilize employment sources
4.1.3   Research job opportunities, including nontraditional careers
4.1.4   Interpret equal employment opportunity laws
4.1.5   Explain the critical importance of personal appearance, hygiene, and demeanor throughout the employment process
4.1.6   Prepare for generic employment tests and those specific to an occupation/organization

Competency 4.2: **Develop a resume**

Competency Builders:

4.2.1   Identify personal strengths and weaknesses
4.2.2   List skills and/or abilities, career objective(s), accomplishments, educational background, work experience, volunteer/community contributions, and organizational memberships
4.2.3   Select an acceptable resume format
4.2.4   Use correct grammar and spelling and concise wording
4.2.5   Secure references
4.2.6   Complete the resume

Competency 4.3: **Complete the job application process**

Competency Builders;

4.3.1   Explain the importance of an application form
4.3.2   Obtain job application forms
4.3.3   Demonstrate behaviors (e.g., personal appearance, hygiene, and demeanor) for obtaining job application forms in person
4.3.4   Describe methods for handling illegal questions on job application forms
4.3.5   Demonstrate legible written communication skills using correct grammar and spelling and concise wording
4.3.6   Return application to appropriate person
4.3.7   Request interview
4.3.8   Follow up on application status

Competency 4.4:   **Demonstrate interviewing skills**

Competency Builders:

4.4.1   Investigate interview procedures
4.4.2   Demonstrate appropriate behaviors (e.g., appearance, hygiene, and demeanor)
         for the interview
4.4.3   Demonstrate question-and-answer techniques
4.4.4   Demonstrate methods for handling difficult and/or illegal interview questions
4.4.5   Use correct grammar and concise wording

Competency 4.5:   **Secure employment**

Competency Builders:

4.5.1   Identify present and future employment opportunities within an
         occupation/organization
4.5.2   Research the organization/company
4.5.3   Use follow-up techniques to enhance employment potential
4.5.4   Evaluate job offer(s)
4.5.5   Respond to job offer(s)

Unit 5:   Job Retention and Career Advancement Skills

Competency 5.1:   **Analyze the organizational structure of the workplace**

Competency Builders:

5.1.1   Identify employer expectations regarding job performance, work habits,
         attitudes, personal appearance, and hygiene
5.1.2   Comply with company policies and procedures
5.1.3   Examine the role/relationship between employee and employer
5.1.4   Recognize opportunities for advancement and reasons for termination
5.1.5   Recognize the organization's ethics

Competency 5.2:   **Maintain positive relations with others**

Competency Builders:

5.2.1   Exhibit appropriate work habits and attitudes
5.2.2   Identify behaviors for establishing successful working relationships
5.2.3   Cooperate through teamwork and group participation
5.2.4   Demonstrate a willingness to compromise
5.2.5   Identify methods for dealing with harassment, bias, and discrimination based on race, color, national origin, gender, religion, disability, or age
5.2.6   Cooperate with authority
5.2.7   Accept supervision

Competency 5.3:   **Demonstrate accepted social and work behaviors**

Competency Builders:

5.3.1   Demonstrate a positive attitude
5.3.2   Demonstrate accepted conversation skills
5.3.3   Use good manners
5.3.4   Accept responsibility for assigned tasks
5.3.5   Demonstrate personal hygiene
5.3.6   Demonstrate knowledge of a position
5.3.7   Perform quality work

Competency 5.4:   **Analyze opportunities for personal and career growth***

Competency Builders:

5.4.1   Demonstrate opportunities within chosen occupation/organization*
5.4.2   Determine other career opportunities outside chosen occupation/organization*
5.4.3   Evaluate the factors involved in considering a new position within or outside an occupation/organization*
5.4.4   Exhibit characteristics needed for advancement*

Unit 6: Technology in the Workplace

Competency 6.1: **Demonstrate knowledge of technology issues**

Competency Builders:

6.1.1   Demonstrate knowledge of the characteristics of technology
6.1.2   Demonstrate knowledge of how technology systems are applied
6.1.3   Assess the impact of technology on the individual, society, and environment
6.1.4   Demonstrate knowledge of the evolution of technology
6.1.5   Identify how people, information, tools and machine, energy, capital, physical space, and time influence the selection and use of technology
6.1.6   Identify legal and ethical issues related to technology (e.g., confidentiality, information sharing, copyright protection)

Competency 6.2: **Demonstrate skills related to technology issues**

Competency Builders:

6.2.1   Exhibit willingness to adapt to technological change
6.2.2   Utilize technological systems
6.2.3   Utilize a variety of resources and processes to solve technological problems
6.2.4   Employ higher-order thinking skills for solving technological problems
6.2.5   Work as a team member in solving technological problems
6.2.6   Use technology in a safe and responsible manner
6.2.7   Apply science, mathematics, communication, and social studies concepts to solve technological problems
6.2.8   Demonstrate ingenuity and creativity in the use of technology*
6.2.9   Utilize a formal method (systems approach) in solving technological problems*

Unit 7:   Lifelong Learning

Competency 7.1:   **Apply lifelong learning practices to individual situations**

Competency Builders:

7.1.1   Define lifelong learning
7.1.2   Identify factors that cause the need for lifelong learning
7.1.3   Identify changes that may require the retraining and upgrading of employee's skills
7.1.4   Identify avenues for lifelong learning
7.1.5   Participate in lifelong learning activities

Competency 7.2:   **Adapt to change**

Competency Builders:

7.2.1   Analyze the causes and effect of change
7.2.2   Identify the effect of change on goals
7.2.3   Identify the importance of flexibility when reevaluating goals
7.2.4   Evaluate the need for lifelong learning experiences in adapting to change

Unit 8:   Economic Education

Competency 8.1:   **Analyze how an economy functions as a whole**

Competency Builders:

8.1.1   Describe how individuals and societies make choices to satisfy needs and wants with limited resources
8.1.2   Identify how production factors (land, labor, capital, and entrepreneurship) are used to produce goods and services
8.1.3   Illustrate how individuals and households exchange their resources for the income they use to buy goods and services
8.1.4   Explain how individuals and business firms use resources to produce goods and services to generate income
8.1.5   Identify characteristics of command, market, and traditional economics*
8.1.6   Describe how all levels of government assess taxes in order to provide services

Competency 8.2:   **Analyze how an economic system is a framework within which decisions are made by individuals and groups**

Competency Builders:

8.2.1   List several individuals and groups that make economic decisions at the local, state, and national levels
8.2.2   Identify the important roles that local, state, and national governments play in a market economy
8.2.3   List examples of how government decisions affect individuals
8.2.4   Identify how geographic locations affect the political and economic systems of the world
8.2.5   Evaluate how markets allocate goods and services
8.2.6   Explain how resources, goods, and services are exchanged in markets
8.2.7   Explain competition and its effect on the market

Competency 8.3:   **Analyze the importance of making informed personal financial decisions**

Competency Builders:

8.3.1   Describe the need for personal management records
8.3.2   Create a personal budget
8.3.3   Create a budget for a family of four for one month
8.3.4   Explain how credit affects personal/family finances
8.3.5   Identify steps to avoid credit problems
8.3.6   Make informed consumer choices in response to personal needs and wants
8.3.7   Identify factors that influence consumer decisions (e.g., advertisements, peer groups, price, and location)
8.3.8   Explain the cost and benefits for individuals of various types of taxation at the local, state, and federal levels

Unit 9:   Balancing Work and Family

Competency 9.1:   Analyze the effects of family on work

Competency Builders:

9.1.1   Recognize how family values, goals, and priorities are reflected in the workplace
9.1.2   Identify present and future family structures and responsibilities
9.1.3   Describe personal and family roles
9.1.4   Analyze concerns of working parent(s)
9.1.5   Examine how family responsibilities can conflict with work
9.1.6   Identify ways to resolve family-related conflicts
9.1.7   Explain how to use support systems/community resources to help resolve family-related conflicts

Competency 9.2:   Analyze the effects of work on family

Competency Builders:

9.2.1   Identify responsibilities associated with paid and nonpaid work
9.2.2   Compare the advantages and disadvantages of multiple incomes
9.2.3   Explain how work can conflict with family responsibilities
9.2.4   Explain how work-related stress can affect families
9.2.5   Identify family support systems and resources

Unit 10:   Citizenship in the Workplace

Competency 10.1:   Exercise the rights and responsibilities of citizenship in the workplace

Competency Builders:

10.1.1   Identify the basic rights and responsibilities of citizenship in the workplace
10.1.2   Identify situations in which compromise is necessary
10.1.3   Examine how individuals from various backgrounds contribute to the workplace
10.1.4   Demonstrate initiative to facilitate cooperation
10.1.5   Give/receive constructive criticism to enhance cooperation

Competency 10.2   **Prepare to work in a multicultural society**

Competency Builders:

10.2.1   Identify ways to live in a multicultural society with mutual respect and
         appreciation for others
10.2.2   Examine how culture and experience create differences in people
10.2.3   Demonstrate respect for the contributions made by all people
10.2.4   Investigate personal cultural background as a means of developing self-respect
10.2.5   Make personal choices that reduce discrimination, isolation, and prejudice
10.2.6   Work effectively with people irrespective of their race, gender, religion,
         ethnicity, disability, age, or cultural background

Unit 11:   Leadership

Competency 11.1:   **Evaluate leadership styles appropriate for the
                              workplace**

Competency Builders:

11.1.1   Identify characteristics of effective leaders
11.1.2   Compare leadership styles
11.1.3   Demonstrate effective delegation skills
11.1.4   Investigate empowerment concepts
11.1.5   Identify opportunities to lead in the workplace

Competency 11.2   **Demonstrate effective teamwork skills**

Competency Builders:

11.2.1   Identify the characteristics of a valuable team member
11.2.2   Identify methods of involving each team member
11.2.3   Contribute to team efficiency and success
11.2.4   Determine ways to motivate team members

Competency 11.3: **Utilize effective communication skills**

Competency Builders:

11.3.1 Identify the importance of listening
11.3.2 Demonstrate effective listening skills
11.3.3 Demonstrate assertive communication techniques
11.3.4 Recognize the importance of verbal and nonverbal cues and messages
11.3.5 Prepare written material
11.3.6 Analyze written material
11.3.7 Give-receive feedback
11.3.8 Communicate thoughts
11.3.9 Use appropriate language
11.3.10 Follow oral and written instructions
11.3.11 Demonstrate effective telephone techniques
11.3.12 Identify technology in communications

Unit 12: Entrepreneurship

Competency 12.1: **Evaluate the role of small business**

Competency Builders:

12.1.1 Identify the impact of small business on local economy
12.1.2 Examine the relationship of small business to a national (USA) and global economy
12.1.3 Identify factors that contribute to the success of small business
12.1.4 Identify factors that contribute to the failure of small business
12.1.5 Identify the components of a business plan

Competency 12.2: **Examine entrepreneurship as a personal career option**

Competency Builders:

12.2.1 Evaluate personal interests and skills
12.2.2 Compare personal interests and skills with those necessary for entrepreneurship
12.2.3 Determine motives for becoming an entrepreneur
12.2.4 Identify the advantages and disadvantages of owning a small business
12.2.5 Compare business ownership to working for others

ACT Work Keys Skill Levels

Skill Area	Entry Level	Performance Level
1) Applied Mathematics	6	6
2) Applied Technology	-	-
3) Listening	-	-
4) Locating Information	4	5
5) Observation	4	4
6) Reading for Information	5	5
7) Teamwork	-	-
8) Writing	-	-

Levels of Work Keys Defined

The skills needed to achieve each level for each of the seven Work Keys* academic skills are as follows.

Applied Mathematics

Applied Mathematics measures skill in applying mathematical reasoning to work-related problems. There are five levels of complexity, 3 through 7, with Level 3 being the least complex and Level 7 the most complex. The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

*Perform basic mathematical operations (addition, subtraction, multiplication, and division) and conversions from one form to another, using whole numbers, fractions, decimals, or percentages.
*Translate simple verbal problems into mathematical equations.
*Directly apply logical information provided to solve problems, including those with measurements and dollars and cents.

Level 4

*Perform one or two mathematical operations (such as addition, subtraction, or multiplication) on several positive or negative numbers. (Division of negative numbers is not covered until Level 5.)
*Add commonly known fractions, decimals, or percentages (e.g., ½, .75, 25%) or add three fractions that share a common denominator.
*Calculate averages, simple ratios, proportions, and rates, using whole numbers and decimals.
*Reorder verbal information before performing calculations.
*Read simple charts or graphs to obtain information needed to solve a problem.

Level 5

*Look up and calculate single-step conversions within English or non-English measurement systems (e.g., converting ounces to pounds or centimeters to meters) or between measurement systems (e.g., converting centimeters to inches).
*Make calculations using mixed unit (e.g., hours and minutes).
*Determine what information, calculations, and unit conversions are needed to find a solution.

Level 6

*Set up problems and do several steps of calculations or conversions.
*Calculate using negative numbers, fractions, ratios, percentages, or mixed numbers (e.g., 12 1/8).
*Transpose a formula before calculating (e.g., $8X = 20 => X = 20/8$).
*Look up and use two formulas to change from one unit to another unit within the same system of measurement (e.g., 1 cup = 8 fl oz, 1 quart = 4 cups).
*Find mistakes in calculations, such as those required in lower levels.
*Determine the best deal and perform a further calculation with the result.

Level 7

*Solve problems requiring multiple steps of logic and calculation.
*Solve problems involving more than one unknown, nonlinear functions (e.g., rate of change), and applications of basic statistical concepts (e.g., error of measurement).
*Locate errors in multiple-step calculations.
*Solve problems with unusual content or format, or with incomplete or implicit information

Applied Technology

Applied Technology measures skill in solving problems of a technological nature, involving the basic principles of mechanics, electricity, fluid dynamics, and thermodynamics as they apply to machines and equipment found in the workplace. There are four levels of complexity, 3 through 6, with Level 3 being the least complex and Level 6 the most complex. Although Level 3 is the least complex, it still represents a level of applied technology skill well above "no skill at all." The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

*Apply the elementary physical principles underlying the operation of uncomplicated systems or tools.
*Recognize and identify relevant aspects of simple problems that involve one uncomplicated system or tool.
*Select appropriate methods or materials needed to solve problems.

Level 4

*Recognize, identify, and order relevant aspects of one moderately complex system or more than one uncomplicated system.
*Evaluate alternative solutions to determine the most appropriate one for the situation presented.

Level 5

*Solve problems based on one complex system, or one or more uncomplicated tools or systems.
*Understand and apply moderately difficult principles of mechanics, electricity, thermodynamics, and fluid dynamics, in addition to understanding, complex machines and systems.
*Recognize, identify, and order relevant aspects of a problem before reaching an appropriate solution.

Level 6

*Solve problems that do not contain all the information needed to solve them, and/or in which the information provided may be out of logical order.
*Solve problems that contain extraneous information.
*Solve problems involving one or more tools or systems having a wide range of complexity.
*Apply difficult physical principles.
*Understand and correctly interpret the interaction of several complex systems.

Listening

Listening measures skill in listening to and understanding work-related messages; receiving information from customers, coworkers, or suppliers; and then writing down the information to communicate it to someone else. Students demonstrate their ability to distinguish and communicate critical information. **Critical information** consists of those details that the recipient of the message must have in order to understand the message and act upon it (e.g., names, phone numbers, addresses, times). **Noncritical information** can improve a message by providing details that further explain the message or its tone, but the absence of this noncritical information does not interfere with the recipient's ability to understand and accurately act upon the message. Each *Listening* level describes the **content and quality** of messages students write to describe an audio message.

Level 0

*No meaningful information, or totally inaccurate information.

Level 1

*Minimal pertinent information; enough context to provide clues as to gist of situation or source of further information.

Level 2

*Some pertinent information; may have incorrect critical information, but sketch of the situation is correct.

Level 3

*All the critical information that is present is correct; may be missing a few pieces of critical information.

Level 4

*All critical information is given and is correct; may be missing subtle details or tone; may have incorrect noncritical information that does not interfere with central meaning.

Level 5

*All critical information is present and correct; response conveys insight into situation through tone and/or subtle details.

Locating Information

Locating Information measures skill in using information taken from workplace graphics such as diagrams, blueprints, floor plans, tables, forms, graphs, charts, and instrument gauges. There are four levels of complexity, 3 through 6, with Level 3 being the least complex and Level 6 the most complex. The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

*Find one or two pieces of information in elementary workplace graphics, such as simple order forms, bar graphs, tables, flowcharts, and floor plans.
*Fill in one or two pieces of information that are missing from elementary workplace graphics.

Level 4

*Find several pieces of information in these type of graphics.
*Summarize and/or compare information and trends in a single graphic.
*Summarize and/or compare information and trends among more than one workplace graphic, such as a bar chart and a table showing related information.

Level 5

*Summarize and/or compare information and trends in single graphic.
*Summarize and/or compare information and trends among more than one graphic, such as a bar chart and a table showing related information.

Level 6

*Make decisions, draw conclusions, and/or apply information to new situations using several related and complex workplace graphics that contain a great amount of information or have challenging presentations (e.g., very detailed graphs, charts, tables, forms, maps, blueprints, diagrams).

Observation

Observation measures the examinee's skill in paying attention to instructions and demonstrations, and in noticing details. There are four levels of complexity, with Level 3 being the least complex and Level 6 the most complex. Although Level 3 is the least complex, it still assesses a level of observation skill well above no skill at all. The levels build on each other, each incorporating the skills assessed at the preceding levels.

Level 3

*Pay attention
*Watch and listen to a strongly cued demonstration or set of instructions
*Recall a few strongly reinforced details of a process or procedure

Level 4

*Sustain focused attention on the demonstrated instructions, process, or procedure.
*Select and attend to important details
*Recall a few important, moderately reinforced details about the demonstrated process or procedure

Level 5

*Focus attention on and recall several important aspects of the information presented
*Ignore irrelevant background information through selective attention to important details
*Maintain attention to detail
*Recall several important details about unfamiliar material

Level 6

*Notice and remember several details that are relevant to the process or procedure being shown
*Take in and recall incoming sensory information so it can be used to make predictions, comparisons, or evaluations
*Visualize how a detail or task fits into the entire process or procedure demonstrated
*Interpret if-then and cause-effect relationships

Reading for Information

Reading for Information measures skill in reading and understanding work-related reading materials. There are five levels of complexity, 3 through 7, with Level 3 being the least complex and Level 7 the most complex. Although Level 3 is the least complex, it still represents a level of reading skill well above "no skill at all." The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

*Identify uncomplicated key concepts and simple details.
*Recognize the proper placement of a step in a sequence of events, or the proper time to perform a task.
*Identify the meaning of works that are defined with in a passage.
*Identify the meaning of simple words that are not defined within a passage.
*Recognize the application of instructions, from a passage to situations that are described in the passage.

Level 4

*Identify details that are more subtle than those in Level 3.
*Recognize the application of more complex instructions, some of which involve several steps, to described situations.
*Recognize cause-effect relationships.

Level 5

*Understand the paraphrased definition of specialized words or phrases (jargon or technical terms) defined in these reading materials
*Use jargon or technical terms appropriately in describing situations stated in these reading materials
*Understand the meaning of acronyms defined in these reading materials (an acronym is a work or collection of letters which stands for a longer phrase, such as HMO to mean Health Maintenance Organization).
*Figure out which definition of a word with multiple meanings is appropriate in the context of these reading materials.
*Apply information given in these reading materials to situations that are not directly described, but similar.
*Apply instructions or procedures with a number of steps to described situations. These instructions may include conditional (if X happens, then you should do Y).

Level 6

*Recognize the application of jargon or technical terms to new situations.
*Recognize the application of complex instructions to new situations.
*Recognize the less-common meaning of a word with multiple meanings from context.
*Generalize from a passage to situations not described in the passage.
*Identify implied details.
*Explain the rationale behind a procedure, policy, or communication.
*Generalize from a passage to a somewhat similar situation.

Level 7

*Recognize the definitions of difficult, uncommon jargon or technical terms from context.
*Generalize from a passage to situations neither described in nor completely similar to those in a passage.

Teamwork

Teamwork measures skill in choosing behaviors and/or actions that simultaneously support team interrelationships and lead toward the accomplishment of work tasks. There are four levels of complexity, 3 through 6, with Level 3 being the least complex and Level 6 the most complex. Although Level 3 is the least complex, it still represents a level of teamwork skill well above "no skill at all." The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

*Identify team goals and ways to work with other team members to accomplish those goals.
*Choose actions that support the ideas of other team members to accomplish team goals.
*Recognize that a team is having problems finishing a task and identify the cause of those problems.

Level 4

*Identify the organization of tasks and the time schedule that would help accomplish team goals efficiently and effectively.
*Select approaches that accept direction from other team members in order to accomplish tasks and to build and keep up good team relations.
*Identify behaviors that show appreciation for the personal and professional qualities of other team members and respect for their diversity.

Level 5

*Identify courses of action that give direction to other team members effectively.
*Choose approaches that encourage and support the efforts of other team members to further team relationships and/or task accomplishment.
*Consider the possible effects of alternative behaviors on both team relationships and team accomplishments and select the one that would best help the team meet its goals.

Level 6

*Identify the focus of team activity and select a new focus if that would help the team meet its goals more effectively.
*Select approaches that show the willingness to give and take direction as needed to further team goals (e.g., recognize the organization of team members' tasks that would best serve the larger goals of the team).
*Choose approaches that encourage a team to act as a unit and reach agreement when discussing specific issues.
*Identify actions that would help manage differences of opinion among team members, moving the team toward its goals while valuing and supporting individual diversity.

Writing

Writing measures skill at writing work-related messages; receiving information from customers, coworkers, or suppliers; and then writing down the information to communicate it to someone else. Each *Writing* level rates the **writing mechanics** (such as sentence structure and grammar) **and writing style** of messages students write to describe an audio message.

Level 0

*An attempt is made at the message, but the message is completely garbled with no recognizable sentence structure.

Level 1
*Message conveyed inadequately; overall lack of proper sentence structure.

Level 2

*Message conveyed inadequately; weak sentence structure; large number of mechanical errors.

Level 3

*Message conveyed clearly; most sentences complete; some mechanical errors.

Level 4

*Message conveyed clearly; all sentences are complete; may have a few minor mechanical errors; may have a choppy style.

Level 5

*Message conveyed clearly; good sentence structure; no mechanical errors; highly appropriate for business setting and situation; smooth, logical style.

Work Keys Process Overview

Developed by American College Testing (ACT), the purpose of the Job Profiling process is to identify the level of applied academic skills that, according to business and industry, students must master to qualify for and be successful in their occupation of choice. The results of Job Profile "leveling" can help teachers to better target instruction toward their students' needs.

Work Keys. The Work Keys component, developed by ACT, measures students" applied academic skills.

*Applied Mathematics measures students' ability to analyze, set-up, and solve math problems typically found in the workplace.
*Locating Information measures students' ability to use graphic documents to insert, extract, and apply information.

In addition, certain taxonomies will use the following Work Keys assessments:

*Reading for Information will be used by Business, Marketing, Home Economics, Health Education, and Cosmetology taxonomies.
*Applied Technology will be used by Trade and Industrial and Agricultural Education taxonomies.

Each Work Keys assessment is further broken down into four to five levels of achievement, with higher numbers indicating higher achievement in the assessed skill. For each academic skill, the Job Profiling process identifies the level required for successful entry into an occupational area.

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