

# ACAP

Austin Competency Analysis Profile

## Automation, Robotics, and Controls/Instrumentation

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# Preface

Austin Community College would like to express our sincere appreciation to our business, industry, labor, and community partners who donated their time and expertise toward the identification and validation of competencies in the following Austin Competency Analysis Profile.

# Introduction

The ACAP (Austin Competency Analysis Profile) initiative comes out of the Curriculum Development Office of Instructional Technology and Distributed Learning at Austin Community College. This initiative is ACC's primary source for Competency-Based Curriculum development, providing a connection between our academic and workforce programs and the needs of business and industry.

The ACAP is a process for analyzing an occupation to develop curriculum. The product is a competency list, employability skills, and academic skill levels that have been developed and validated by subject matter experts who perform the occupation. This list will be used to develop programs that address the needs of business and industry by equipping our students with the entry skills required in a workplace environment.

# **A** CAP Process Overview .....

## *What are Austin Competency Analysis Profiles (ACAPs)?*

Austin Competency Analysis Profiles (ACAPs) are competency lists for academic and workforce programs verified by expert workers, or Subject Matter Experts. These lists 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—only the concept of advancing items will be introduced to students. Advancing items are those needed beyond entry level in a given occupation, and are designated as “Advanced.” If core competencies or competency builders are present in an “Advanced” unit, then they are designated as “Core.”

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: Automation, Robotics, and  
Controls/Instrumentation**

Automated Manufacturing Technician

Controls Systems Technician

Industrial Controls Technician

Final Test Technician

Test Technician

Instrumentation and Controls Technician

Maintenance Technician

Equipment Technician

Facilities Maintenance Technician

Controls Technician

# Occupational Competencies

The following Occupational Competencies have been identified and verified by a panel of subject matter experts currently employed in the field of Automation, Robotics, and Controls/Instrumentation. This panel of experts has determined that these skills will adequately prepare students for *entry level* positions in this field. The *Competencies* are grouped into units. *Competency Builders* are included to help identify the knowledge, skills and attitudes students need to perform each competency. These *Competencies* and *Competency Builders* are designed to be the basis for curriculum development to ensure business and industry input that is relative and meaningful to the workplace. These *Competencies* are intended to include all basic, necessary skills for this occupational area, but may be supplemented with additional competencies as faculty and advisory committee members see the need to do so.

## **Key Terms:**

*Competency*—an observable and measurable behavior that has a definite beginning and end; can be performed within a limited amount of time; consists of two or more competency builders; and leads to a product, service, or decision.

*Competency Builders*—the skills, knowledge, and attitudes (written in measurable terms) needed to perform a given competency.

*Entry Level*—position of employment that requires no previous experience, but may require some training and/or specific skills, knowledge, or attitudes.

# ACAP: Automation, Robotics, and Controls/Instrumentation

Unit 1	Fundamental Functions
Unit 2	Field Device Functions
Unit 3	Industrial Networks
Unit 4	Maintenance/Troubleshooting Functions
Unit 5	Programming Functions
Unit 6	Communications Functions
Unit 7	Project Development/Implementation Functions

## Sources:

**British Columbia Institute of Technology.** <http://programs.bcit.ca/7350DIPLT>

**FANUC Robotics.** FANUC Robotics North America, Inc.  
<http://www.fanurobotics.com/Training/CourseDescription.asp#robotoperation>

**IL State Curriculum Center.** DACUM, “Automated Manufacturing Technician”. Dr. Ken Kyre, State Board for Technical & Comprehensive Education, Facilitator. 1986

**Texas State Technical College Waco.** DACUM, “Robotics Systems Technology (ROB): Computerized Controls Systems Technician”. 01/23-24/2003.  
<http://waco.tstc.edu/industry/dacums/ROBO3.HTM>

**Valentine Robotics-Curriculum Development.**  
<http://www.valentinerobotics.com/curriculumdevelopment.html>

## Unit 1 Fundamental Functions

### Competency 1.1 Differentiate/Distinguish electrical and electronic circuitry

#### *Competency Builders:*

- 1.1.1 Identify components of DC circuits
- 1.1.2 Identify components of AC circuits
- 1.1.3 Identify components of solid state devices and circuits that utilize them
- 1.1.4 Apply operation amplifiers and common applications
- 1.1.5 Apply digital devices and circuits that utilize them
- 1.1.6 Analyze circuits and components using multi-meters, power supplies, oscilloscopes and function generators
- 1.1.7 Troubleshoot circuits involving the mentioned devices
- 1.1.8 Connect a logic circuit to control a power circuit that drives various loads such as AC motors
- 1.1.9 Connect a logic circuit to control various loads such as fans, lights, and motors using a variety of relays

### Competency 1.2 Recognize control applications

#### *Competency Builders:*

- 1.2.1 Identify analog input/output devices
- 1.2.2 Identify discrete input/output devices
- 1.2.3 Identify smart devices (addressable or programmable)
- 1.2.4 Identify requirements and limitations
- 1.2.5 Identify different control architecture

### Competency 1.3 Follow safety procedures

#### *Competency Builders:*

- 1.3.1 Read safety documentation
- 1.3.2 Attend safety classes
- 1.3.3 Wear personal protective equipment (PPE) Maintain safety devices
- 1.3.4 Maintain safety devices
- 1.3.5 Report unsafe work situations
- 1.3.6 Perform lockout/tagout
- 1.3.7 Maintain safe work area
- 1.3.8 Implement safety procedures
- 1.3.9 Perform first aid and CPR
- 1.3.10 Follow OSHA guidelines

## Unit 2 Field Device Functions

### Competency 2.1 Utilize input devices

#### *Competency Builders:*

- 2.1.1 Identify/apply discrete sensors (such as proximity sensors, photo sensors and ultrasonic sensors, etc.)
- 2.1.2 Identify/apply analog sensors (thermal, PH, pressure, speed, flow, etc.)
- 2.1.3 Identify/apply other sensors (such as RF, bar code, vision, etc.)

### Competency 2.2 Utilize output devices

#### *Competency Builders:*

- 2.2.1 Identify/apply discrete devices (such as lights, solenoids, motors, relay, annunciators, valves, etc.)
- 2.2.2 Identify/apply analog devices (heaters, chemical metering, control valves, meters, drives, position sensors, etc.)
- 2.2.3 Identify/apply other output devices (such as printers, displays, electronic operator interfaces, LCD, pagers, etc.)

### Competency 2.3 Implement electric motors

#### *Competency Builders:*

- 2.3.1 Identify the differences between AC, DC, stepper, vector AC drives (constant torque) and servo motors
- 2.3.2 Apply appropriate methods to control a power circuit that powers an AC motor (i.e. direct control, transformer control, separate control)
- 2.3.3 Apply AC (VFD) drives, DC drives, stepper motor drives, vector AC drives (constant torque) and Servo drives

## Unit 3 Industrial Networks (ProfiBus, DeviceNet, Ethernet IP, etc.)

### Competency 3.1 Identify the attributes of various industrial networks (number of nodes, baud rates, cable lengths, protocol, etc.)

#### *Competency Builders:*

- 3.1.1 Determine the allowable number of nodes
- 3.1.2 Determine available baud rates
- 3.1.3 Configure cable length topology
- 3.1.4 Define protocol limitations and determinism
- 3.1.5 Choose appropriate hardware connections

### **Competency 3.2      Configure the network/devices**

#### *Competency Builders:*

- 3.2.1      Commission node address and baud rate
- 3.2.2      Configure parameters if not automatic
- 3.2.3      Discern the differences between a smart device and distributed I/O

### **Competency 3.3      Test/diagnose the network**

#### *Competency Builders:*

- 3.3.1      Install network drivers
- 3.3.2      Apply dedicated test device if available
- 3.3.3      Utilize diagnostic software if available
- 3.3.4      Identify the EDS (electronic data sheet) parameters

## **Unit 4 Maintenance/Troubleshooting Functions**

### **Competency 4.1      Troubleshoot control system problems**

#### *Competency Builders:*

- 4.1.1      Identify the problem/symptoms
- 4.1.2      Make initial determination of probable cause of problem
- 4.1.3      Perform diagnostic tests on hardware and software systems
- 4.1.4      Interpret diagnostic results
- 4.1.5      Make recommendations to solve the immediate problem and root cause

### **Competency 4.2      Fix the problem**

#### *Competency Builders:*

- 4.2.1      Test solutions
- 4.2.2      Implement solutions
- 4.2.3      Monitor solutions
- 4.2.4      Document the corrections made (if needed)

### **Competency 4.3      Carry out delegated preventative maintenance and routine maintenance procedures**

#### *Competency Builders:*

- 4.3.1      Account for parts and inventory
- 4.3.2      Assist in tailoring manufacturers' recommended PM or routine maintenance to local environment
- 4.3.3      Replace equipment as scheduled
- 4.3.4      Maintain action/work log

## Unit 5 Programming Functions

### Competency 5.1 Develop control schema

#### *Competency Builders:*

- 5.1.1 Manipulate external system data (bar code, RFID, printer, etc)
- 5.1.2 Manipulate logic using timers, counters, math instructions, logic instructions, and more advanced instruction sets
- 5.1.3 Write analog control algorithm (and PID)
- 5.1.4 Write Boolean control algorithm
- 5.1.5 Develop feedback loops for automated control

### Competency 5.2 Apply a variety of system controller program functions

#### *Competency Builders:*

- 5.2.1 Program in Ladder Logic
- 5.2.2 Program in structured text
- 5.2.3 Program using sequential function charts
- 5.2.4 Program using function blocks
- 5.2.5 Program using graphical programming language
- 5.2.6 Incorporate various HMI software functions
- 5.2.7 Program a microprocessor that runs a robot to perform different tasks
- 5.2.8 Recognize CNC capabilities

### Competency 5.3 Implement control system software to interface with hardware

#### *Competency Builders:*

- 5.3.1 Configure and program controller software to work on a network, if appropriate (Ethernet, DeviceNet, proprietary, ControlNet)
- 5.3.2 Apply software packages to implement the logic (PLCs, DCS, PC-based, robotics)
- 5.3.3 Design and develop HMI (human-machine-interface) software to monitor and control (text displays, dedicated graphic interfaces, PC-based)
- 5.3.4 Link multiple electrical and/or mechanical systems
- 5.3.5 Determine master/slave relationships
- 5.3.6 Upload/download programs

### Competency 5.4 Program drives to run the corresponding motors to achieve specialized and accurate motion movements

#### *Competency Builders:*

- 5.4.1 Program AC/DC drives
- 5.4.2 Program stepper motor drives
- 5.4.3 Program servo drives

## **Competency 5.5      Acquire data using a personal computer**

### *Competency Builders:*

- 5.5.1      Apply data acquisition and instrumentation for critical system parameters
- 5.5.2      Design and implement a data acquisition system that controls multiple inputs and outputs using different data acquisition software and hardware
- 5.5.3      Choose a data acquisition system based on appropriate relative advantages and disadvantages for the job

## **Unit 6 Communication Functions**

## **Competency 6.1      Read and interpret schematics and technical documents**

### *Competency Builders:*

- 6.1.1      Identify the symbols on a schematic
- 6.1.2      Interpret 3D drawings (CAD)
- 6.1.3      Apply a schematic with pneumatic devices
- 6.1.4      Apply a schematic to electrical devices
- 6.1.5      Apply a process and instrumentation diagram

## **Competency 6.2      Make clear and concise reports (written or oral)**

### *Competency Builders:*

- 6.2.1      Create effective visual presentations using various software packages such as PowerPoint and Word
- 6.2.2      Write appropriate documentation

## **Competency 6.3      Communicate job status**

### *Competency Builders:*

- 6.3.1      Provide user training
- 6.3.2      Communicate with others both in writing and verbally
- 6.3.3      Manage correspondence

## **Unit 7 Project Development/Implementation Functions**

## **Competency 7.1      Evaluate and contribute to the design of system architecture**

### *Competency Builders:*

- 7.1.1      Determine objectives
- 7.1.2      Research solutions
- 7.1.3      Develop hardware/software solutions
- 7.1.4      Evaluate design
- 7.1.5      Create control program
- 7.1.6      Develop HMI software

## **Competency 7.2      Provide technical input to project development**

### *Competency Builders:*

- 7.2.1      Identify important statistics for controlling and improving processes
- 7.2.2      Utilize different types of statistical methods to control processes
- 7.2.3      Utilize quality control processes such as TQM
- 7.2.4      Analyze Statistical Process Control (SPC) charts

## **Competency 7.3      Assist with continuous process improvement**

### *Competency Builders:*

- 7.3.1      Analyze maintenance reports
- 7.3.2      Perform operational data analyses
- 7.3.3      Make predictive recommendations
- 7.3.4      Escalate maintenance issues
- 7.3.5      Fine tune control programs
- 7.3.6      Adjust operational parameters
- 7.3.7      Optimize control loop response
- 7.3.8      Optimize motion efficiency
- 7.3.9      Upgrade equipment
- 7.3.10     Implement new technologies

# **E**mployability Competencies .....

Employability Competencies are underlying skills, including work habits and ethics, essential to the workplace and personal growth. SCANS (Secretary's Commission on Achieving Necessary Skills) are the basis for these competencies and are included in all programs based on an ACAP (Austin Competency Analysis Profile). These skills are taught with the intention of providing the student with a well-rounded understanding of workplace expectations in areas not specific to a particular occupation, in an attempt to develop a valuable employee.

## **ACAP: Automation, Robotics, and Controls/Instrumentation**

Unit 1:	Resources
Unit 2:	Interpersonal
Unit 3:	Information
Unit 4:	Systems
Unit 5:	Technology
Unit 6:	Basic Skills
Unit 7:	Thinking Skills
Unit 8:	Personal Qualities

## Unit 1: Resources

### Competency 1.1 Manage time effectively

#### *Competency Builders:*

- 1.1.1 Select relevant, goal-related activities.
- 1.1.2 Rank activities in order of importance.
- 1.1.3 Allocate time to activities
- 1.1.4 Identify tasks to be completed
- 1.1.5 Develop and follow an effective, workable schedule based on accurate estimates of such things as importance of tasks, time to complete tasks, time available for completion, and task deadlines, without wasting time
- 1.1.6 Identify possible impact of schedules on other activities
- 1.1.7 Evaluate and adjust a schedule

### Competency 1.2 Manage money effectively

#### *Competency Builders:*

- 1.2.1 Prepare or use budgets including making cost and revenue forecasts
- 1.2.2 Record details to track budget performance.
- 1.2.3 Adjust budget appropriately when needed.
- 1.2.4 Allocate money to include accurately preparing and using a budget according to a consistent and orderly accounting method
- 1.2.5 Calculate future budgetary needs based on projected costs and revenues
- 1.2.6 Track the extent to which actual costs and revenues differ from the estimated budget, and take appropriate and effective action

### Competency 1.3 Manage material and facility resources effectively

#### *Competency Builders:*

- 1.3.1 Store resources such as materials, supplies, parts, equipment, space or final products in an order that makes the best use of them
- 1.3.2 Allocate materials and facility resources to include carefully planning the steps involved in the acquisition, storage, and distribution of resources
- 1.3.3 Acquire, transport, and store material and facility resources safely and efficiently
- 1.3.4 Maintain material and facility resources in good condition
- 1.3.5 Distribute material and resources to the end user

### Competency 1.4 Manage human resources efficiently

#### *Competency Builders:*

- 1.4.1 Assess people's knowledge, skills and potential
- 1.4.2 Identify present and future work load
- 1.4.3 Match individual talents and workload effectively
- 1.4.4 Monitor performance and provide feedback actively

## Unit 2: Interpersonal Skills

### Competency 2.1 Participate as a member of a team

#### *Competency Builders:*

- 2.1.1 Work cooperatively with others
- 2.1.2 Contribute to group with ideas, suggestions, and efforts
- 2.1.3 Complete personal share of tasks necessary to complete a project
- 2.1.4 Encourage team members by listening and responding appropriately to their contributions
- 2.1.5 Build on individual team members' strengths
- 2.1.6 Resolve differences for the benefit of the team
- 2.1.7 Take personal responsibility for accomplishing goals
- 2.1.8 Challenge existing procedures, policies, or authorities responsibly

### Competency 2.2 Teach others

#### *Competency Builders:*

- 2.2.1 Coach or otherwise teach others to apply related concepts and theories to tasks
- 2.2.2 Convey job information to allow others to see its applicability and relevance to tasks
- 2.2.3 Identify training needs of others
- 2.2.4 Assess performance of others
- 2.2.3 Provide feedback on others' performance in a constructive manner
- 2.2.4 Provide solutions to observed problems.

### Competency 2.3 Serve clients/customers

#### *Competency Builders:*

- 2.3.1 Identify customers/clients expectations through surveys, questions, body language, or expressions.
- 2.3.2 Communicate and work with clients/customers to satisfy their expectations
- 2.3.3 Listen actively to customers to avoid misunderstanding and to identify needs
- 2.3.4 Provide alternatives to clients/customers to satisfy their expectations.
- 2.3.5 Provide services and goods in a timely, positive manner
- 2.3.6 Obtain additional resources to satisfy client needs efficiently

### Competency 2.4 Exercise leadership

#### *Competency Builders:*

- 2.4.1 Communicate thoughts, feelings, and ideas to justify a position
- 2.4.2 Motivate and/or convince individuals or groups through encouragement or persuasion

- 2.4.3 Challenge existing procedures, policies or authorities responsibly.
- 2.4.4 Use rules/values followed by others
- 2.4.5 Justify a position logically and appropriately
- 2.4.6 Consider minority viewpoints in making decisions or taking action

### **Competency 2.5 Negotiate to arrive at a decision**

#### *Competency Builders:*

- 2.5.1 Achieve agreement through exchanging specific resources or resolving divergent interests
- 2.5.2 Research opposition and the history of the conflict
- 2.5.3 Set realistic, obtainable goals
- 2.5.4 Present facts and arguments
- 2.5.5 Listen to and reflect upon what has been said
- 2.5.6 Clarify problems and resolve conflicts
- 2.5.7 Propose and examine possible options
- 2.5.8 Make reasonable compromises

### **Competency 2.6 Work with cultural diversity**

#### *Competency Builders:*

- 2.6.1 Work with men and women, and a variety of ethnic, social and educational backgrounds
- 2.6.2 Compare one's own culture and that of others
- 2.6.3 Respect the rights of others while helping them make cultural adjustments when necessary
- 2.6.4 Base impression upon individual performance, not stereotypes
- 2.6.5 Understand concerns of members of other ethnic and gender groups

## **Unit 3: Information**

### **Competency 3.1 Acquire and evaluate information**

#### *Competency Builders:*

- 3.1.1 Pose analytic questions to determine specific information needs
- 3.1.2 Select appropriate information sources
- 3.1.3 Determine when new information must be created and do so
- 3.1.4 Evaluate data for relevance and accuracy

### **Competency 3.2 Organize and maintain information**

#### *Competency Builders:*

- 3.2.1 Organize a variety of information forms or sources in a systemic fashion
- 3.2.2 Maintain written or other forms of information to keep up-to-date information available in a systemic fashion

- 3.2.3 Organize information from computer, visual, oral and physical sources in readily accessible formats, such as computerized data bases, spreadsheets, microfiche, video disks, paper files, etc.
- 3.2.4 Transform data into different formats in order to organize them by the application of various methods such as sorting, classifying, or more formal methods

### **Competency 3.3 Interpret and communicate information**

*Competency Builders:*

- 3.3.1 Select information to be communicated
- 3.3.2 Identify best methods to present information (e.g., overheads, handouts, etc.)
- 3.3.3 Communicate results to others in desired format
- 3.3.4 Convey information to others through a variety of means including oral, written, graphic, pictorial or multi-media methods

### **Competency 3.4 Process information using computer**

*Competency Builders:*

- 3.4.1 Acquire information from the internet and other computer based resources
- 3.4.2 Organize information, using spreadsheets, word processor, and data bases effectively
- 3.4.3 Analyze information to identify trends, make projections, etc.
- 3.4.4 Enter, modify, retrieve, store and verify data and other information in a computer
- 3.4.5 Choose format for display (e.g., line graphs, bar graphs, tables, pie charts, narrative)
- 3.4.6 Convey information into the chosen format
- 3.4.7 Communicate information using e-mail, list serves, word processor, or other computer based communication functions

## **Unit 4: Systems**

### **Competency 4.1 Apply appropriate techniques to function within social, organizational, and technological systems to attain goals effectively and ethically**

*Competency Builders:*

- 4.1.1 Identify dynamics and components of social, organizational and technological systems
- 4.1.2 Recognize acceptable behavior and attitudes within social, organizational and technological systems
- 4.1.3 Communicate through acceptable methods to interact with social, organizational, and technological systems effectively, efficiently, and ethically
- 4.1.4 Recognize how a system's structures relate to goals
- 4.1.5 Recognize the right of people to ask for information and where to get resources

## **Competency 4.2      Monitor and correct performance of a system**

### *Competency Builders:*

- 4.2.1      Distinguish trends
- 4.2.2      Predict impact of actions on system operations
- 4.2.3      Diagnose deviations in the function of a system/organization
- 4.2.4      Correct performance through necessary action
- 4.2.5      Detect deviations from systems intended purpose
- 4.2.6      Troubleshoot the system
- 4.2.7      Make changes to the system to rectify system function and to ensure quality of product

## **Competency 4.3      Improve and design systems**

### *Competency Builders:*

- 4.3.1      Make suggestions to modify or improve existing products or services
- 4.3.2      Implement approved improvements in systems
- 4.3.3      Evaluate the benefits of the improvements
- 4.3.4      Develop/recommend new or alternative system designs based on relevant feedback
- 4.3.5      Communicate the results of the evaluations

## **Unit 5:      Technology**

## **Competency 5.1      Select appropriate technology**

### *Competency Builders:*

- 5.1.1      Determine the desired results or outcomes and applicable restraints
- 5.1.2      Visualize the necessary methods and applicable technology
- 5.1.3      Evaluate specifications
- 5.1.2      Judge which procedures, tools, machines or programs will produce the desired results.

## **Competency 5.2      Apply technology to task**

### *Competency Builders:*

- 5.2.1      Set up tools such as machines, computers, and programming systems, using proper procedures, to get desired results
- 5.2.2      Analyze how different parts of machines interact and how machines interact with broader production systems
- 5.2.3      Install machines including computers
- 5.2.4      Interpret machine output accurately
- 5.2.5      Detect errors from program output

### **Competency 5.3 Maintain and troubleshoot technology**

#### *Competency Builders:*

- 5.3.1 Prevent problems in machines, computers, and other technologies
- 5.3.2 Identify problems in machines, computers and other technologies
- 5.3.3 Perform routine maintenance and service of machines, computers, and other technologies
- 5.3.4 Detect more serious problems
- 5.3.5 Generate workable solutions to correct deviations
- 5.3.6 Recognize need for additional help

## **Unit 6: Basic Skills**

### **Competency 6.1 Read written information in prose and documents, such as manuals, graphs, and schedules with understanding**

#### *Competency Builders:*

- 6.1.1 Determine the main idea or essential message
- 6.1.2 Identify relevant details, facts, and specifications
- 6.1.3 Infer or locate the meaning of unknown or technical vocabulary
- 6.1.4 Judge the accuracy, appropriateness, style, and plausibility of reports, proposals, or theories of other writers

### **Competency 6.2 Communicate thoughts, ideas, information, and messages in writing**

#### *Competency Builders:*

- 6.2.1 Record information completely and accurately
- 6.2.2 Compose and create documents such as letters, directions, manuals, reports, proposals, graphs, and flow charts
- 6.2.3 Use language, style, organization and format appropriate to the subject matter, purpose, and audience
- 6.2.3 Include supporting documentation where appropriate
- 6.2.4 Attend to level of detail
- 6.2.5 Check, edit, and revise for correct information, appropriate emphasis, form, grammar, spelling, and punctuation

### **Competency 6.3 Perform arithmetic computations and concepts with appropriate technology and/or paper and pencil to solve simple work problems**

#### *Competency Builders:*

- 6.3.1 Perform basic computations
- 6.3.2 Use basic numerical concepts such as whole numbers and percentages in practical situations

- 6.3.3 Make reasonable estimates of arithmetic results without a calculator
- 6.3.4 Use tables, graphs, diagrams, and charts to obtain or convey quantitative information

**Competency 6.4 Perform mathematics in a variety of techniques to approach practical problems appropriately**

*Competency Builders:*

- 6.4.1 Choose appropriate technique to solve problem
- 6.4.2 Use quantitative data to construct logical explanations for real world situations
- 6.4.3 Express mathematical ideas and concepts orally and in writing
- 6.4.4 Predict an event considering the role of chance in the occurrence

**Competency 6.5 Listen and react appropriately to verbal messages**

*Competency Builders:*

- 6.5.1 Receive, attend to, interpret, and respond to verbal messages appropriately
- 6.5.2 Receive, attend to, interpret, and respond to other cues such as body language appropriately
- 6.5.3 Listen to comprehend, learn, critically evaluate, appreciate, or support the speaker

**Competency 6.6 Deliver oral messages appropriately to listeners**

*Competency Builders:*

- 6.6.1 Organize ideas and communicates orally as appropriate for the situation and listeners
- 6.6.2 Participate in conversation, discussion, and group presentations
- 6.6.3 Select an appropriate medium for conveying a message
- 6.6.4 Use verbal language and other cues, such as body language, in a way appropriate in style, tone, and level of complexity to the audience and the occasion
- 6.6.5 Speak clearly and communicate a message
- 6.6.6 Respond to listener feedback in a way that indicates understanding
- 6.6.7 Ask questions when needed

**Unit 7: Thinking Skills**

**Competency 7.1 Generate new ideas using creative thinking**

*Competency Builders:*

- 7.1.1 Change or reshapes goals using nonlinear or unusual connections
- 7.1.2 Imagine new ideas by combining ideas or information in new ways
- 7.1.3 Connects seemingly unrelated ideas
- 7.1.4 Reshape goals in ways that reveal new possibilities

## **Competency 7.2      Make decisions**

### *Competency Builders:*

- 7.2.1      Specify goals and constraints
- 7.2.2      Generate alternatives
- 7.2.3      Consider risks
- 7.2.4      Evaluate and choose best alternatives
- 7.2.5      Analyze how personal, family, and social factors influence decisions, behaviors, and lifestyles
- 7.2.6      Utilize a decision-making process to develop future career goals

## **Competency 7.3      Apply problem solving skills appropriate to situation**

### *Competency Builders:*

- 7.3.1      Recognize a problem exists (i.e., that there is a discrepancy between what is and what should be)
- 7.3.2      Identify possible reasons for the problem
- 7.3.3      Devise and implement a plan of action to resolve the problem
- 7.3.4      Evaluate and monitor progress
- 7.3.5      Revise the plan as indicated by the findings
- 7.3.6      Communicate in both oral and written language while working with others to identify/resolve problems
- 7.3.7      Reason inductively and deductively to solve problems
- 7.3.8      Select and apply problem-solving methods

## **Competency 7.4      See things in the mind's eye**

### *Competency Builders:*

- 7.4.1      Organize and process symbols, pictures, graphs, objects or other information to visualize actual representation (such as a building from blueprints)
- 7.4.2      Visualize possible options
- 7.4.3      Communicate visualized options verbally

## **Competency 7.5      Apply learning strategies to support life-long learning**

### *Competency Builders:*

- 7.5.1      Apply and adapt existing and new knowledge and skills, using learning techniques, in both familiar and changing situations
- 7.5.2      Evaluate learning style (visual, aural, etc.) to make proper selection of learning techniques
- 7.5.3      Identify various learning techniques including formal learning strategies (note taking or clustering items that share some characteristics) and informal learning strategies (awareness of unidentified false assumptions that may lead to faulty conclusions)
- 7.5.4      Make decisions/plans concerning school to work training and future educational needs using relevant resources

## **Competency 7.6      Apply reasoning to finding solutions or draw conclusions**

### *Competency Builders:*

- 7.6.1      Discover a rule or principle underlying the relationship between two or more objects
- 7.6.2      Extract rules or principles from a set of objects or a written text
- 7.6.3      Apply principles to solve problems
- 7.6.4      Draw conclusion from available information using logic
- 7.6.5      Apply rules and principles to a new situation
- 7.6.6      Determine which conclusion is correct when given a set of facts and conclusions
- 7.6.7      Evaluate alternatives and assess consequences to achieve personal and social goals

## **Unit 8:      Personal Qualities**

## **Competency 8.1      Act responsibly**

### *Competency Builders:*

- 8.1.1      Persevere toward goal attainment with a high level of effort
- 8.1.2      Set high standards in order to become excellent at doing tasks by setting high standards, paying attention to details, working well and displaying a high level of concentration even when assigned an unpleasant task
- 8.1.3      Display a high standard of attendance, punctuality, enthusiasm, vitality, and optimism in approaching and completing tasks

## **Competency 8.2      Exhibit effective self-esteem**

### *Competency Builders:*

- 8.2.1      Maintain a positive view of self and believes in own self-worth
- 8.2.2      Identify own skill and abilities possessed
- 8.2.3      Recognize own emotional capacity and needs
- 8.2.4      Identify/Apply effective ways to handle emotional capacity and needs
- 8.2.5      Recognize own impression on others

## **Competency 8.3      Employ appropriate social skills**

### *Competency Builders:*

- 8.3.1      Demonstrate understanding, friendliness, adaptability, empathy and politeness in new and on-going group settings
- 8.3.2      Assert self in familiar and unfamiliar social situations
- 8.3.3      Relate well to others
- 8.3.4      Respond appropriately as the situation requires
- 8.3.5      Take an interest in what others say and do

## **Competency 8.4      Manage self**

### *Competency Builders:*

- 8.4.1      Assess own knowledge, skills, and abilities accurately
- 8.4.2      Set well-defined and realistic personal goals
- 8.4.3      Monitor progress toward goal attainment
- 8.4.4      Motivate self through goal achievement
- 8.4.5      Exhibit self-control and respond to feedback unemotionally and nondefensively
- 8.4.6      Initiate action

## **Competency 8.5      Apply integrity and honesty to all matters**

### *Competency Builders:*

- 8.5.1      Recognize situations when faced with making a decision or exhibiting behavior that may break with commonly held personal or societal values
- 8.5.2      Understand the impact of violating these beliefs and codes on an organization, self, and others
- 8.5.3      Choose an ethical course of action

# WorkKeys® 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.

**The WorkKeys** component, developed by ACT, measures students’ applied academic skills. These academic skills include Applied Mathematics, Locating Information, Reading for Information, Listening, Writing, Teamwork, Observation, and Applied Technology. It is determined during the profile which skills apply to the specific job or occupational area.

The ACAP (Austin Competency Analysis Profile) typically includes one or more of the skills described below. A fourth skill may be identified and included if the subject matter experts agree that it is necessary for entry into the position.

- *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 (includes charts, graphs, tables, forms, blueprints, maps, and instrument gauges).
- *Reading for Information* measures students’ ability to read and understand work-related reading materials (text only—does not including charts, graphs, tables, forms, blueprints, maps, or instrument gauges).

Each WorkKeys 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 as identified by subject matter experts.

# A CT WorkKeys® Skill Levels

<u>Skill Area</u> <u>Rank</u>	<u>Entry Level</u>	<u>Performance Level</u>
1) Locating Information	4-6	5-6
2) Applied Mathematics	5	6

## Entry Level

Refers to the requirements necessary for someone entering into the occupation (without previous on the job experience).

## Performance Level

Refers to the level at which an employee would need to function effectively having gained on-the-job knowledge.

## Skill Ranking

Refers to the criticality of the skill to the performance of the occupation with the most critical skill indicated with one (1) and higher numbers indicating lower criticality.

# **L**evels of WorkKeys® Defined .....

The skills needed to achieve each level for WorkKeys academic skills identified in this profile are as follows:

## **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).

## 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.,  $\frac{1}{2}$ , .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.,  $12 \frac{1}{8}$ ).
- Transpose a formula before calculating (e.g.,  $8X = 20 \Rightarrow X = 20/8$ ).
- 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

# **E**quipment .....

- 24 Volt Power roller conveyor
- ZPA conveyor controls
- Motorized conveyor pulley
- Integration of conveyor systems with other equipment
- Static Conductive conveyor belt system

# Glossary

**ACAP**–*Austin Competency Analysis Profile*–a well-established job analysis process unique to Austin Community College involving business, industry, labor, and community agency representatives from throughout the Austin area.

**Advanced Competencies**–The occupation and academic competencies needed to advance in a given occupation

**Competency**–an observable and measurable behavior that has a definite beginning and end; can be performed within a limited amount of time; consists of two or more competency builders; and leads to a product, service, or decision.

**Competency Builders**–The skills, knowledge, and attitudes (written in measurable terms) needed to perform a given competency.

**Core Competencies**–The essential occupational and academic competencies needed to enter and remain in a given occupation.

**Employability Competencies**–Underlying skills, abilities, and knowledge as they relate to work ethics, work habits, and personal growth and development.

**Entry Level**–refers to the requirements necessary for someone entering into the occupation (without previous on the job experience).

**Performance Level**–refers to the level at which an employee would need to function effectively having gained on-the-job knowledge.

**Skill Ranking**–Refers to the criticality of the WorkKeys skill to the performance of the occupation with one (1) indicating the most critical skill.

**SME**–*Subject Matter Expert*–incumbent worker in a given occupation that is knowledgeable about the job.

**Target Job Titles**–titles that may be assigned to the types of jobs aligned with an ACAP. Possible titles of jobs for which students would qualify with certificates or degrees in the programs based on an ACAP.

**WorkKeys Skills**–Eight skills, defined by ACT, referring to underlying, academic skills as they relate to the workplace. The skills include *Applied Mathematics, Applied Technology, Locating Information, Reading for Information, Observation, Teamwork, Listening, and Writing*. Each skill has a very specific definition and levels of each skill can be aligned with specific abilities defined at each level. WorkKeys skills are the basis for an occupational analysis system developed by ACT. The WorkKeys analysis is the final part of the overall ACAP report. All ACAPs include *Reading for Information, Locating Information, and Applied Mathematics*. A fourth skill may be included in the profile if the subject matter experts identify a need for it.