ACAP

Austin Competency Analysis Profile

Programming/
Software Engineering

Conducted
  August 15, 2002

Validation Panel

Dylan Smith, Co-op/Student
   IBM, Austin, Texas

Dennis A. Burt, System Analyst IV
   Texas Department of Health, Austin, Texas

Tom Ballard, Staff Software Engineer
   IBM/Trivoli Systems, Austin, Texas

Robert Sartin, Principle Engineer
   Sartin Consulting, Austin, Texas

Martin Chilvers, Senior Software Developer
   Tonic Software, Austin, Texas

David Sams, Senior Consultant
   Techsys Advanced Resources, Dallas, Texas

Christie Mitschke, Systems Analyst V
   Texas Department of Protective and Regulatory Services,
   Austin, Texas

Facilitated by:
   Lynn Schmitz and Teresa S. Moore
      Curriculum Development Specialists/Job Profilers
      Austin Community College, Austin, Texas

AUSTIN COMMUNITY COLLEGE

ACC Programming/Software Engineering
ACAP
Final Draft 9/2002

What's Inside?

......

Preface
......

Austin Community College's Workforce Education Office of Curriculum and Competency-Based Instruction 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 Workforce Education Office of Curriculum and Competency-Based Instruction of Austin Community College. This initiative is ACC's primary source for Competency-Based Curriculum development, providing a connection between our 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 our Workforce Education programs to address the needs of business and industry by equipping our students with skills required in a workplace environment.

ACAP Process Overview
• • • • • •

What are Austin Competency Analysis Profiles (ACAPs)?

Austin Competency Analysis Profiles (ACAPs) are competency lists for workforce education 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.   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 an "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.

Target Job Titles

ACAP: Programming/Software Engineering

Associate Software Engineer

Engineer

Junior Developer

Junior Programmer

Member Tech Staff

Programmer

Software Engineer

Systems Analyst

Systems Engineer

O ccupational Competencies

The following Occupational Competencies have been identified and verified by a panel of subject matter experts currently employed in the field of Programming/Software Engineering. 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: Programming/Software Engineering

Unit 1	Perform Analysis
Unit 2	Develop Architecture
Unit 3	Design/Develop Program
Unit 4	Implement Program
Unit 5	Test Program
Unit 6	Validate Program
Unit 7	Release Product

Sources: *Building a Foundation for Tomorrow: Skill Standards for Information Technology*. The Millennium Edition. National Workforce Center for Emerging Technologies, through Bellevue Community College. Bellevue, WA: Bellevue Community College Printing Services, 1999.

Competency 1.1   Gather data to identify customer requirements

Competency Builders:
1.1.1   Identify affordable, relevant sources and methods for gathering requirements
1.1.2   Ensure sources of requirements are reliable and current
1.1.3   Gather information that is accurate and complete
1.1.4   Gather information through interviews that follow appropriate company practices and uses open ended questions
1.1.5   Gather information continuously in a cost-effective manner
1.1.6   Include information that addresses the customer needs for the future
1.1.7   Document customer requirements such as timeline, platform, etc.

Competency 1.2   Define scope of work

Competency Builders:
1.2.1   Identify project objectives
1.2.2   Secure agreement regarding project requirements
1.2.3   Identify major project tasks and interdependencies
1.2.4   Prepare project plan based on customer requirements
1.2.5   Estimate time, materials and capabilities needed, to meet customer requirements
1.2.6   Present estimate of time, materials and capabilities needed clearly and concisely
1.2.7   Estimate life cycle of product or application consistent with comparable products and customer expectations
1.2.8   Define time, technology and resource constraints
1.2.9   Present alternatives
1.2.10   Develop risk analysis and contingency plans
1.2.11   Interpret requirements properly
1.2.12   Evaluate requirements properly
1.2.13   Identify and resolve conflicting requirements
1.2.14   Document scope of work

Competency 1.3   Define system requirements

Competency Builders:
1.3.1   Ensure all hardware and software are compatible
1.3.2   Consider the licenses, patents and other legal restrictions
1.3.3   Ensure system requirements are in accordance with overall project requirements
1.3.4   Assess technical specifications for feasibility
1.3.5   Document system requirements

Competency 1.4   Establish measurable performance requirements

Competency Builders:
1.4.1   Define criteria for adequate system performance level (service level agreement)
1.4.2   Define criteria for customer satisfaction and acceptance
1.4.3   Document performance requirements

Competency 1.5   Develop test requirements

Competency Builders:
1.5.1   Identify appropriate internal and external test participants
1.5.2   Select testing methods and processes
1.5.3   Identify scope of testing
1.5.4   Identify success criteria

Competency 1.6   Compile data on development standards

Competency Builders:
1.6.1   Gather information continuously in a cost-effective manner
1.6.2   Ensure sources and methods for gathering standards are affordable and relevant
1.6.3   Follow appropriate company standards and practices for information gathering interviews
1.6.4   Ensure reliability and currency of sources of standards

Competency 1.7   Determine security requirements

Competency Builders:
1.7.1   Identify types of risk exposure and specific risks
1.7.2   Identify external security requirements
1.7.3   Follow current security policies
1.7.4   Evaluate security options based on functionality, user convenience, risks, cost, etc.
1.7.5   Document security plan including privileges, roles and validation

Competency 1.8   Determine maintenance requirements

Competency Builders:
1.8.1   Identify maintenance requirements and resources
1.8.2   Communicate maintenance requirements to user and support groups
1.8.3   Ensure maintenance requirements are congruent with system and customer requirements
1.8.4   Identify potential add-ons and enhancements
1.8.5   Document maintenance requirements

Unit 2 Develop Architecture

Competency 2.1   Choose an architecture

Competency Builders:
2.1.1   Research main alternatives
2.1.2   Outline alternative technical and design scenarios
2.1.3   Present alternative technical and design scenarios
2.1.4   Complete analysis of tradeoffs, risks and limitations
2.1.5   Rate alternatives according to best match with current project (functionality, timeline, budget, etc.)
2.1.6   Review selected architecture with management and all appropriate audiences
2.1.7   Obtain approval for selected architecture
2.1.8   Document selected architecture

Competency 2.2   Identify major subsystems and interfaces

Competency Builders:
2.2.1   Delineate all major subsystems and interfaces clearly
2.2.2   Minimize overlap and coupling between major subsystems
2.2.3   Identify external subsystems for incorporation (build versus buy)
2.2.4   Document major subsystems and interfaces clearly

Competency 2.3   Develop models

Competency Builders:
2.3.1   Define scope and purpose of models (business, physical, interface, logical, data, class, object, sequence diagrams, etc.)
2.3.2   Develop models cost-effectively
2.3.3   Represent design and functionality in models
2.3.4   Document model development procedures, test results and recommendations

Competency 2.4   Validate architecture using models

Competency Builders:
2.4.1   Exercise models for performance
2.4.2   Test models for performance
2.4.3   Verify requirements are met by architecture
2.4.4   Document deficiencies

Competency 3.1   Assist with selecting design tools

Competency Builders:
3.1.1   Identify cost-effective design tools that are adequate for scope of work
3.1.2   Choose design tools appropriate for available level of expertise
3.1.3   Secure availability of necessary resources within the scope and budget of the project
3.1.4   Communicate recommendations regarding design tools to the appropriate personnel

Competency 3.2   Develop design and interface specifications

Competency Builders:
3.2.1   Create complete design and interface specifications
3.2.2   Identify and resolve conflicts in design and interface specifications
3.2.3   Assess design and interface specifications for ease and quality of implementation
3.2.4   Verify that interface is consistent with industry, company and product standards
3.2.5   Obtain approval by all relevant parties of design and interface specifications
3.2.6   Delineate components and dependencies
3.2.7   Delineate all components and interfaces to ensure a minimum of overlap and coupling between components of subsystems
3.2.8   Document design and interface specifications

Competency 3.3   Develop detailed data model

Competency Builders:
3.3.1   Create normalized data model
3.3.2   Verify requirements are fully represented by the data model
3.3.3   Verify data model meets performance criteria of architectural model

Competency 3.4   Prepare and conduct design review

Competency Builders:
3.4.1   Review design with appropriate personnel
3.4.2   Gather appropriate information from other parts of the system
3.4.3   Conduct review in accordance with company policy
3.4.4   Document design review

Competency 3.5   Create and test prototypes

Competency Builders:
3.5.1   Define scope and purpose of prototypes
3.5.2   Meet appropriate customer expectations for scope and purpose of prototypes
3.5.3   Create cost-effective prototypes
3.5.4   Test prototypes
3.5.5   Check performance of prototype against models
3.5.6   Check performance of prototype against specifications

3.5.7   Identify the impact on existing systems
3.5.8   Document prototype development procedure, test results and recommendations

Competency 3.6   Review and provide input to user documentation

Competency Builders:
3.6.1   Identify documentation needs and timelines
3.6.2   Communicate the major features of the product to the technical documentation group
3.6.3   Review user documentation for technical and logical accuracy

Competency 3.7   Incorporate security requirements into design

Competency Builders:
3.7.1   Identify security issues
3.7.2   Anticipate latent security risks
3.7.3   Present security matters to appropriate audience

Unit 4 Implement Program

Competency 4.1   Write code

Competency Builders:
4.1.1   Develop code using efficient software design processes
4.1.2   Employ reusable components whenever practical
4.1.3   Implement security measures
4.1.4   Document code so that it can be understood by other software engineers

Competency 4.2   Perform unit testing

Competency Builders:
4.2.1   Test units using standard and appropriate testing procedures
4.2.2   Analyze/Resolve errors correctly
4.2.3   Document defects and solutions

Competency 4.3   Integrate subsystems

Competency Builders:
4.3.1   Test subsystems for compatibility
4.3.2   Resolve conflicts
4.3.3   Integrate subsystems iteratively until integration is complete
4.3.4   Document conflicts and solutions

Competency 4.4   Lead and/or participate in peer code review

Competency Builders:
4.4.1   Conduct code reviews in accordance with company policy
4.4.2   Document feedback

Competency 4.5   Resolve defects and rework code

Competency Builders:
4.5.1   Document defect
4.5.2   Identify resources
4.5.3   Locate source of defect
4.5.4   Embed debugging hooks into system
4.5.5   Evaluate defects for impact on functionality
4.5.6   Formulate recommendations
4.5.7   Fix or log defects for input into next design iteration

Competency 4.6   Revise and adapt existing code

Competency Builders:
4.6.1   Resolve compatibility issues
4.6.2   Document solutions

Unit 5 Test Program

Competency 5.1   Develop test plan

Competency Builders:
5.1.1   Document test plan completely in accordance with accepted policies
5.1.2   Establish schedule for test
5.1.3   Verify test requirements are in compliance with legal requirements, policies, procedures, and customer requirements
5.1.4   Identify testing resources
5.1.5   Mimic external interfaces accurately with test system
5.1.6   Automate test scenarios where feasible
5.1.7   Develop comprehensive set of test cases and expected results

Competency 5.2   Develop test procedures

Competency Builders:
5.2.1   Verify specifications explicitly in test procedures
5.2.2   Define test conditions
5.2.3   Document test procedures in detail
5.2.4   Develop regression tests properly
5.2.5   Implement a systematic testing program to find hardware compatibility problems

Competency 5.3   Perform tests

Competency Builders:
5.3.1   Identify appropriate team members for test process
5.3.2   Test system according to plan and schedule
5.3.3   Identify critical error areas
5.3.4   Communicate test results as appropriate

5.3.5   Perform system integration testing and volume/performance testing when appropriate

5.3.6   Perform regression tests to thoroughly exercise the software according to plan and schedule

5.3.7   Document test results

Competency 5.4   Document test results and make recommendations

Competency Builders:

5.4.1   Document errors and preceding conditions

5.4.2   Include recommendations for modification in documentation

5.4.3   Identify problems

Unit 6   Validate Program

Competency 6.1   Perform user acceptance test

Competency Builders:

6.1.1   Prepare documented test procedure for user

6.1.2   Test system performance according to plan and schedule

6.1.3   Document test results

6.1.4   Communicate issues and recommendations to design team

Competency 6.2   Validate user documentation

Competency Builders:

6.2.1   Analyze user feedback

6.2.2   Document user feedback

6.2.3   Obtain approval according to policy

Competency 6.3   Validate user documentation

Competency Builders:

6.3.1   Test security measures in actual application

6.3.2   Grant/Deny access according to user role and company policies

6.3.3   Identify critical error areas

Unit 7   Release Product

Competency 7.1   Participate in development of release plan

Competency Builders:

7.1.1   Outline release plan in detail with necessary phases, timeline and decision points

7.1.2   Define release procedures and feedback processes as agreed upon by decision makers

7.1.3   Identify test groups relevant to the application

7.1.4   Follow release procedures

Competency 7.2   Train technical support staff

Competency Builders:
7.2.1   Develop training procedures
7.2.2   Document training procedures
7.2.3   Schedule training sessions according to policy
7.2.4   Conduct training sessions according to policy
7.2.5   Communicate feedback system from technical support staff to design group
7.2.6   Verify that technical staff is able to fully support the product

Competency 7.3   Participate in development of user training plan

Competency Builders:
7.3.1   Select training materials that are clear, effective and satisfy training objectives
7.3.2   Adjust training for learning needs

Competency 7.4   Transition to new system

Competency Builders:
7.4.1   Document transition plan in detail with necessary phases and timeline
7.4.2   Create contingency plan
7.4.3   Analyze impact on productivity
7.4.4   Communicate impact on productivity to appropriate personnel
7.4.5   Implement transition plan with minimal impact on overall productivity
7.4.6   Ensure that new system is fully operational

Competency 7.5   Evaluate, correct and document defects

Competency Builders:
7.5.1   Ensure feedback procedure is in place and adequate to meet user needs
7.5.2   Document defects
7.5.3   Communicate defects effectively to appropriate personnel
7.5.4   Evaluate defects for impact on customer
7.5.5   Formulate recommendations
7.5.6   Correct defects or log for input into next design iteration

Competency 7.6   Evaluate and document enhancements

Competency Builders:
7.6.1   Ensure that proposed enhancements are congruent with technical support and user
             feedback
7.6.2   Document recommendations for enhancements
7.6.3   Record user comments
7.6.4   Evaluate user comments
7.6.5   Prioritize user comments
7.6.6   Document recommendations for input into next design

Employability 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: Programming/Software Engineering

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

<div style="background-color:gray; text-align:center">

Unit 6:   Basic Skills

</div>

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

<div style="background:gray">

Unit 7:   Thinking Skills

</div>

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 won 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

W orkKeys 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) includes 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.

ACT WorkKeys Skill Levels

Skill Area	Entry Level	Performance Level and Rank
1) Locating Information	4	5-6
2) Applied Mathematics	3-6	6-7
3) Reading for Information	5	6-7

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.

Levels of WorkKeys Defined
•••••

The skills needed to achieve each level for WorkKeys academic skills identified in this profile 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

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).

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.

G••••••lossary

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.