THE SECRETARY'S COMMISSION ON ACHIEVING NECESSARY SKILLS

Identifying Necessary Job Skills:

A Review of Previous Approaches

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September 19, 1990

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EMPLOYMENT AND TRAINING ADMINISTRATION
U.S. DEPARTMENT OF LABOR

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Past efforts by industrial psychologists, business groups, and others to characterize "job requirements" provide a starting point in developing a SCANS approach to identifying the skills required by work. These past efforts have developed a structure for examining and communicating job requirements. An examination of these past efforts and the viewpoints they represent can help SCANS refine its own viewpoint and focus its efforts. We begin with a brief discussion of general approaches or perspectives on job requirements. This is followed by a compilation of "lists" of skill requirements with brief comments on each of the different organizing frameworks.

Fleishman & Quaintance (1984) have prepared a comprehensive examination of lists and taxonomies of human performance. Our examination presents a more focused sample of attempts at describing work skills in order to underscore the breadth of alternative approaches. We also include several lists developed by business organizations after the Fleishman & Quaintance review was completed.

Industrial Psychology Perspectives on Job Requirements

There is currently a very general debate among personnel psychologists concerning the extent to which different skills are required for different jobs. One view, based on research using an meta-analytic technique known as validity generalization (Schmidt & Hunter, 1977), holds that a single measure of general cognitive skill accounts for nearly all of the variation in

performance for virtually all jobs. From this perspective, job requirements can be summarized in terms of the level of cognitive skill that is required. Proponents of this perspective vary somewhat in their exact description of the general cognitive skill that is involved (descriptions range from the ability to learn to intelligence to other more specific labels) and generally do not address the question of whether or how such skill might be trained.

The other view is based on the assumption that quite different skills are required in different jobs. This approach, as characterized by Dunnette (1976), involves building taxonomies of skills and of job requirements and attempting to match one to the other. Most of the lists of job requirements and skills that follow derive from this perspective. As Rumberger (1989) pointed, defining skill requirements from either the individual or the job is incomplete. Instead, a usable list of skill requirements is likely to emerge from the intersection of the attributes of individual and of work.

One other general issue that is quite relevant is whether a skill list stems from a narrow or broad conception of job performance. A narrow definition focuses on "proficiency" -- how well the individual can perform (if properly motivated). A broader definition also includes motivation and habits that affect how well the job is routinely performed. Cronbach (1970, p.35) distinguishes the types of tests that are most appropriate to each of these two conceptions as follows:

> "We use these [maximum performance tests] when we wish to know how well the person can perform at his best; they may be referred to as tests of ability. The second category [typical behavior] includes those tests that seek to determine his typical performance, that is, what he is likely to do in a given situation or in a broad class of situations. Tests of personality, habits, interests, and character fall in this category."

This distinction is crucial to a decision whether to focus on more traditional conceptions of skills or also to include attributes such as integrity or achievement motivation.

Another issue is that there is no generally accepted list for defining the dimensions of work skills (Rumberger, 1989; Pellegrino & Varnhagen, 1987). This is due in part to the different perspectives that are adopted in defining work skills and also to the almost unlimited number of attributes or skills that may be identified with job performance. The absence of a

universal list of skills is compounded or caused by the lack of agreement between researchers on what is the most appropriate level of specificity for describing a skill or attribute.

More perplexing is the necessity of defining levels of skill requirements. Often only broadly defined levels such as "low skill" and "high skill" levels have been used. Moreover, there are ill-defined boundaries between skill levels and skill types (Rumberger, 1989).

In the lists that follow, a number of quite different approaches are taken to describing job requirements, and these approaches have been characterized in a number of different ways. In AIR's work on the Army Synthetic Validation Project, we distinguished three very general approaches to describing job requirements. These are:

Task characteristics approaches. These approaches focus on the tasks that the worker performs as part of his/her job. They frequently focus on what is to be accomplished more than on how it is accomplished. "Repairing a toaster" is an example of a job task.

Job activity approaches. These approaches focus on the activities that the worker engages in. Sometimes tasks and activities may be quite similar, but activities are usually both more elemental (a number of different activities are required in performing a task) and more general (the same activities are components of a number of different tasks). "Disassemble the toaster" or "inspect heating element" might be examples of job activities.

Ability requirement approaches. These approaches describe the abilities (or other attributes) that are required in performing a job. They assume that the required abilities can be identified directly for the job as a whole through either judgmental or empirical means.

Task characteristics and Job Activity Approaches

The work itself, or inherent characteristics of tasks, are the units of interest in the task characteristics approach. Tasks impose certain conditions on an individual performing them, such as the goals to be achieved, procedures to be followed, characteristics of the responses, and

activity content. Job activity approaches are based on observations and descriptions of behaviors exhibited by a worker during job performance. Although there are representative examples of each approach, most structured job analysis instruments contain elements or descriptions of both approaches.

The first example is a "task characteristics" approach developed by Farina and Wheaton (1971). This list focuses on aspects of the task being performed and results in an overall assessment of the difficulty or complexity of the task. This approach is consistent with the validity generalization perspective where the primary issue for job analysis is to determine the level of general cognitive skill that is required. This is probably a good example of something that almost surely is outside SCANS's domain of interest because the focus is on variables extrinsic to the persons performing tasks.

Example 2 is a list developed by Berliner, Angell, and Shearer (1964) that typifies the job activity approach. It organizes work behaviors (activities) into four general process categories: perceptual, mediational, communication, and motor.

Example 1

Farina and Wheaton: Task Characteristics Approach

Task Components		Task Characteristics
Explicit Goal	*	Number of output units
	*	Duration for which an output unit is maintained
	**	Number of elements per output unit
	**	Work load imposed by task goal
		Difficulty of goal attainment
Procedures	*	Number of procedural steps
		Dependency among procedural steps
		Adherence to procedures
		Procedural complexity
Input Stimuli	*	Variability of stimulus location
	*	Stimulus or stimulus-complex duration
		Regularity of stimulus occurrence
Responses.....	**	Precision
	**	Rate
	*	Simultaneity of responses
		Amount of muscular effort involved
Stimulus-Response		Degree of operator control
Relationship		Reaction time/feedback lag relationship
		Decision making

* These six task characteristics indexes were most reliable, and were used in regression analyses (postdiction studies).

** These task characteristics indexes had reliabilities above .90, but were not used in postdiction studies (n=28 judges for 15 tasks).

Example 2

Hierarchical Model -- Behaviors, Activities, and Processes

Processes	Activities	Specific Behaviors
Perceptual Processes	Searching for and receiving information	- Detects - Inspects - Observes - Reads - Receives - Scans - Surveys
	Identifying objects, actions, events	- Discriminates - Identifies - Locates - Categorizes - Calculates - Codes
Mediational Processes	Information processing	- Computes - Interpolates - Itemizes - Tabulates - Translates
	Problem solving and decision making	- Analyzes - Calculates - Chooses - Compares - Computes - Estimates - Plans

Processes	Activities	Specific Behaviors
Communication Processes		- Advises - Answers - Communicates - Directs - Indicates - Informs - Instructs - Requests - Transmits
Motor Processes	Complex-continuous	- Adjusts - Aligns - Regulates - Tracks
	Simple-discrete	- Activates - Closes - Connects - Disconnects - Joins - Moves - Presses - Sets

With job analysis, one identifies skills and skill levels needed to perform that job. Examples 3, 4, and 5 are lists derived from widely-used structured job analysis instruments. They illustrate a range of dimensions on both the worker and about the job that may be relevant to SCANS. Example 3, the Position Analysis Questionnaire (McCormick, Jeanneret, & Mecham, 1972) is organized into six general divisions and also includes a number of overall dimensions. The input, processing, output, and relationships with others divisions correspond somewhat to the processes in Example 2. The job context and job characteristics divisions do not really deal with worker skill requirements at all.

Example 4, the Job Element Inventory (Cornelius & Hakel, 1978), does not have an explicit organization to the dimensions. Example 5 is derived from the Occupational Analysis Inventory (Cunningham, Boese, Neeb, & Pass, 1983). The OAI was developed to describe and classify occupations based on their educational requirements. Example 5a shows results from a factor analysis of all of the items from the work dimensions in this inventory. Example 5b shows results of factor analysis of the items that fall under the attribute requirements dimensions. Some of the factors were not interpretable, but the ones that remain are of some interest.

Example 6 shows job behaviors derived from "functional job analysis" (Fine, 1974). This list is particularly relevant because the Dictionary of Occupational Titles describes job requirements in very similar categories. Major requirements are organized by whether they relate to people, data, or things. Within each of these general categories, behaviors are organized by complexity. Data behaviors, for example, range from comparing up through synthesizing.

Example 3

Position Analysis Questionnaire: Divisions and Job Dimensions

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Division 1: Information Input
1. Perceptual interpretation
2. Input from representational sources
3. Visual input from devices or materials
4. Evaluating - judging sensory input
5. Environmental awareness
6. Use of various senses

Division 2: Mental Processes
7. Decision making
8. Information processing

Division 3: Work Output
9. Using machines, tools, or equipment
10. General body vs. sedentary
11. Control and related physical coordination
12. Skilled or technical activities
13. Controlled manual or related activities
14. Use of miscellaneous equipment or devices
15. Handling, manipulating, and related activities
16. Physical coordination

Division 4: Relationships with other persons
17. Interchange of judgmental and related information
18. General personal contact
19. Supervisory, coordination, and related activities
20. Job-related communications
21. Public-related personal contacts

Division 5: Job context
22. Potentially stressful or unpleasant environment
23. Personally demanding situations
24. Potentially hazardous job situations

Division 6: Other job characteristics

25. Nontypical vs. typical day work schedule
26. Businesslike situations
27. Optional vs. specified apparel
28. Variable vs. salary compensation
29. Regular vs. irregular work schedule
30. Job demanding responsibilities
31. Structured vs. unstructured job activities
32. Vigilant or discriminating work activities

Overall Dimensions

33. Decision, communication, and general responsibilities
34. Machine and equipment operation
35. Clerical and related activities
36. Technical and related activities
37. Service and related activities
38. Regular day schedule vs. other work schedules
39. Routine and repetitive work activities
40. Environmental awareness
41. General physical activities
42. Supervising or coordinating other personnel
43. Public, customer, and related contact activities
44. Unpleasant, hazardous, or demanding environment
45. (Unnamed)

Example 4: Job Element Inventory Dimensions

Overall Dimensions

1. Decision making/General responsibility
2. Skilled job activities
3. Information processing activities
4. Physical activities/related environmental conditions
5. Using equipment/providing service

Division Dimensions

1. Interpreting what is sensed
2. Using various sources of information
3. Being aware of environmental conditions
4. Using various senses
5. Decision making/People
6. Decision making/Things
7. Decision making/Quantitative
8. Decision making/Medical
9. Performing skilled/technical activities
10. Performing handling/related manual activities
11. Using miscellaneous equipment/devices
12. General physical coordination
13. Controlling machines/processes
* 14. Supervision/coaching and related activities
15. Public/related personal contacts
* 16. Supervision/judgment/coordination
* 17. Exchanging job-related information
18. Engaging in general personal contacts
* 19. Being in a stressful/unpleasant environment
* 20. Being in hazardous job situations
* 21. Engaging in personally demanding situations
* 22. Being alert to changing situations
* 23. Performing repetitive activities
* 24. Interpersonal responsibility
* 25. Working under demanding job situations
26. Performing unstructured vs. structured work

* Motivational component

Example 5a: Occupation Analysis Inventory (OAI): Work Dimensions

1. Human development, assistance, and conflict resolution
2. Sales, service, and public relations
3. Routine semantic and symbolic activities: clerical activities
4. Biological or health-related activities
5. Mechanical repair, maintenance, and operation
6. Activities related to visual aesthetics
7. Utilization and processing of numerical data
8. Botanical activities
9. Activities related to physical science and technology
10. Electrical or electronic repair, maintenance, and operation
11. Building or repairing structures
12. Use of technical-scientific devices
13. Working with animals
14. Improving or monitoring the physical performance, capability, or adjustment of others
15. Food preparation or processing
16. Technical planning and drawing
17. Assembly and fabrication activities
18. Environmental maintenance and planning
19. Performing arts activities
20. (Uninterpretable)
21. (Uninterpretable)
22. Vehicle and mechanized equipment operation
23. Organizing and supervising the work of others
24. (Uninterpretable)
25. Instructing
26. Material handling or arrangement
27. (Uninterpretable)
28. Verbal communication

Example 5b: Occupation Analysis Inventory: Attribute Requirements Dimensions

Title of Dimension

1. Machine operation, maintenance, and repair
2. Development and supervision of others
3. Mathematical/symbolic activities
4. Health/biological activities
5. Representation and production of figural arrangements and relationships
6. Activities related to the aesthetic appearance of others
7. Agricultural/botanical activities
8. Clerical activities
9. Verbal communication: Writing and speaking
10. Performing and visual/decorative activities
11. Material processing and modification
12. Business/sales activities
13. Activities requiring coordination and balance
14. Health-related interaction and responsibility
15. Construction and assembly activities
16. Planning and innovation
17. Direct interpersonal communication
18. Electrical/electronic maintenance, repair, and operation
19. Measuring, testing, and inspecting activities
20. General tool usage
21. General physical labor

Example 6: Functional Job Analysis Function Scales

Things	3a. Precision Working
	b. Setting Up
	c. Operating-Controlling II
	2a. Manipulating
	b. Operating-Controlling I
	c. Driving-Controlling
	d. Starting Up
	1a. Handling
	b. Feeding-Offbearing
	c. Tending
Data	*6. Synthesizing
	*5a. Innovating
	b. Coordinating
	4. Analyzing
	3a. Computing
	b. Compiling
	2. Copying
	1. Comparing
People	*7. Mentoring
	*6. Negotiating
	*5. Supervising
	4a. Consulting
	b. Instructing
	c. Treating
	3a. Coaching
	b. Persuading
	c. Diverting
	2. Exchanging Information
	1a. Taking Instructions-Helping
	b. Serving

* Motivational component

Ability requirement approaches

Ability requirement approaches are based on the notion that abilities are relatively enduring qualities of a task performer. A basic assumption is that different types of attribute/abilities exist. Further, it is expected that there are individual differences in levels of these attributes and these individual differences are related to job behaviors and performance.

The next three examples illustrate ability requirement approaches. Example 7 lists the elements of Fleishman's ability requirements taxonomy (Fleishman & Quaintance, 1984). Example 8, the Attribute Assessment Scale (Wing, Peterson, & Hoffman, 1984), summarizes cognitive and physical abilities more generally and also adds noncognitive abilities. Finally, Example 9 describes Guilford's Structure of Intellect Model. Specific abilities in this model are the combination of a content, an operation, and a product. (There are potentially 150 such combinations.) This example, anchors the other extreme from the Task Characteristics approach (Example 1) and is equally outside the scope of what SCANS requires.

Example 7: Fleishman and colleagues: Ability Requirements Taxonomy

Cognitive, Perceptual, Sensory, Physical, and Psychomotor Components

1. Verbal Comprehension
2. Verbal Expression
3. Ideational Fluency
4. Originality
5. Memorization
6. Problem Sensitivity
7. Mathematical Reasoning
8. Number Facility
9. Deductive Reasoning
10. Inductive Reasoning
11. Information Ordering
12. Category Flexibility
13. Spatial Orientation
14. Visualization
15. Speed of Closure
16. Flexibility of Closure
17. Selective Attention
18. Timesharing
19. Perceptual Speed
20. Static Strength
21. Explosive Strength
22. Dynamic Strength
23. Stamina
24. Extent Flexibility
25. Dynamic Flexibility
26. Gross Body Equilibrium
27. Choice Reaction Time
28. Reaction Time
29. Speed of Limb Movement
30. Wrist-finger Speed
31. Gross Body Coordination
32. Multilimb Coordination
33. Finger Dexterity
34. Manual Dexterity
35. Arm-hand Steadiness
36. Rate Control
37. Control Precision

Example 8: Attribute Assessment Scale

Attributes Included in the Attribute Assessment Scale

Cognitive/perceptual Attributes

1. Verbal Ability
2. Memory
3. Reasoning Ability
4. Number Facility
5. Mechanical Comprehension
6. Information Processing
7. Closure
8. Visualization
9. Perceptual Speed and Accuracy

Physical/psychomotor Attributes

10. Physical Strength
11. Stamina
12. Multilimb Coordination
13. Dexterity
14. Steadiness/Precision

Noncognitive Attributes

* 15. Social Interaction
* 16. Stress Tolerance
* 17. Conscientiousness
* 18. Work Orientation
* 19. Self Esteem/Leadership
* 20. Athletic Ability/Energy
* 21. Realistic Interests
* 22. Investigative Interests

* Motivational factor

Example 9: Guilford's Structure of Intellect Model

Ability Factors

Dimensions/Categories:

Contents

1. Visual
2. Auditory
3. Symbolic
4. Semantic
5. Behavioral

Operations

1. Evaluation
2. Convergent production
3. Divergent production
4. Memory
5. Cognition

Products

1. Units
2. Classes
3. Relations
4. Systems
5. Transformations
6. Implications

Business approaches

Noting that studies of American education frequently give little if any emphasis to the large numbers of high school graduates who do not go on to four-year colleges, several reports have emerged from the business community that address the competencies needed of high school graduates to succeed in the workplace. Notable projects in this country have been conducted by the National Academy of Science (1984) and the Committee for Economic Development (1985). The assessment framework of the City and Guilds of London Institute (1989) also provides a business perspective.

The National Academy of Science assembled a panel representing different types of public and private sector employers, labor unions, university scholars, and representatives from the education community to identify "necessary skills." Like SCANS, the panel approached its task from the viewpoint of skills needed in the workplace rather than required courses. Employers do not care what courses a student took to acquire needed skills, but rather whether or not the student possesses those skills. Core competencies within the domains of knowledge, skills, attitudes, and habits that "will equip young people for success in the labor market throughout a working lifetime" were identified. These competencies are listed in Example 10.

Example 10 Core Competencies identified by the National Academy of Science

Command of the English Language

Reasoning and Problemsolving

- Identify problems
- Consider and evaluate possible alternative solutions, weighing their risks and benefits
- Formulate and reach decisions logically
- Separate fact from opinion
- Adjust to unanticipated situations by applying established rules and facts
- Work out new ways of handling recurring problems
- Determine what is needed to accomplish work assignments.

Reading

- Understand the purpose of written material
- Note details and facts
- Identify and summarize principal and subsidiary ideas
- Be aware of inconsistency in written material
- Verify information and evaluate the worth and objectivity of sources
- Interpret quantitative information: for example, in tables, charts and graphs.

Writing

- Gather information suitable for the purpose
- Organize information in a logical and coherent manner
- Use standard English syntax
- Apply the rules of correct spelling, punctuation, and capitalization
- Use reference books such as a dictionary, a thesaurus, and an encyclopedia
- Write legibly.

Computation

- Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately
- Calculate distance, weight, area, volume, and time

- Convert from one measurement system to another, for example, from English to metric.
- Determine the costs, time, or resources necessary for a task
- Calculate simple interest
- Compute costs and make change
- Understand simple probability and statistics
- Calculate using information obtained from charts, graphs, and tables
- Use ratios, proportions, percentages, and algebraic equations with a single unknown
- Estimate results and judge their accuracy

Science and Technology

Oral Communication

- Communicate in standard English
- Understand the intent and details of oral communications
- Understand and give instructions
- Identify and summarize correctly principal and subsidiary ideas in discussions
- Obtain, clarify, and verify information through questioning
- Participate effectively in discussions

Interpersonal Relationships

- Interact in a socially appropriate manner
- Demonstrate respect for the opinions, customs, and individual differences of others
- Appreciate the importance and value of humor
- Offer and accept criticism constructively
- Handle conflict maturely
- Participate in reaching group decisions

Social and Economic Studies

- The history of present-day American society
- The political, economic, and social systems of the United States and other countries
- The Fundamentals of economics, including a basic understanding of the roles of money, capital investment, product pricing, cost, profit, and productivity, and market forces such as supply and demand
- The concept of "trade-offs" and the differences between economic principles, facts and value judgments

- The roles of industry and labor in creating wealth, maintaining employment, and raising the standard of living
- The forms and functions of local, state, and federal governments
- The rights and responsibilities of citizens
- Civil rights and justice in a free society.

Personal Work Habits and Attitudes

- A realistic positive attitude toward one's self
- A positive attitude toward work and pride in accomplishment
- A willingness to learn
- Self-discipline, including regular and punctual attendance and dependability
- The ability to set goals and allocate time to achieve
- The capacity to accept responsibility
- The ability to work with or without supervision
- Appropriate dress and grooming
- An understanding of the need for organization, supervision, rules, policies, and procedures
- Freedom from substance abuse
- Appropriate personal hygiene.

The Committee for Economic Development (CED) has long encouraged the business community to take an active role in education. Their 1959 report "Paying for Better Public Schools" called participation in education a responsibility of American businesses. Noting a growing inability to compete in world markets, the CED became concerned about the number of high school graduates lacking "the basic requirements for success in the workplace." Their 1985 report "Investing in our Children" identified individual traits that are important for success in the workplace, strategies for increasing investment in education, programs for upgrading the professionalism of teachers, and ways that schools and business could forge partnerships.

A critical part of the CED report was a survey of employer needs (Levine, 1985). A survey, developed by Levine after extensive consultation with the marketing and personnel departments of several major employers, identified sixty skill attributes grouped into 10 clusters each representing a broad aptitude, skill, or behavior:

Striving to do well
Priority setting and working under pressure
Problem solving and decision making
Working well with others
Communicating
Learning how to learn
Physical and safety demands
Number skills
Office skills
Mechanical and laboratory skills

The complete list of 64 skills is shown in Example 11. Representatives from large and small companies rated each attribute on three scales: importance for entry level success, importance for advancement, and difficulty in finding people with that attribute. Attributes in the areas of striving to do well, learning how to learn, priority setting, and communication were found to be most important for entry level success.

Example 11: 64 attributes identified by CED

STRIVING TO DO WORK WELL

--Displaying pride and enthusiasm in doing the work well
--Maintains accuracy on repetitive tasks
--Is able to recall large amounts of detailed information
--Makes it a practice to follow up on things to be sure they get done
--Is punctual and dependable in getting to work

PRIORITY SETTING; WORKING UNDER PRESSURE

--Uses good judgement in setting work priorities to meet deadlines and schedules
--Adjusts priorities in light of new circumstances
--Sticks with a task until it is completed, in spite of distractions
--Is ready to put in extra time to work
--Is organized and able to handle well many things at one

PROBLEM SOLVING; DECISION MAKING

--Skillfully determines what the problem really is and how it can be solved
--Recognizes a problem is building up, and immediately takes corrective action
--Comes up with alternative approaches which lead to a sound conclusion
--Asks pertinent questions which yield the information needed
--Recognizes when help or advice from others is needed, and gets it
--Makes suggestions for more efficient, less costly ways of doing things
--Handles situations on his/her own without needing to be told
--Reviews activities and assesses need for change

WORKING WELL WITH OTHERS

--Works cooperatively with people of different personalities, race, sex, etc.
--Is able to help customers identify their needs, and tie sales efforts to these needs
--Participates as a team member, e.g., helps co-workers, shares helpful information, etc.
--Is aware of impact he/she makes on people, e.g., dresses appropriately, uses businesslike manner
--Provides helpful, friendly service to customers, even though they may be impatient or indecisive
--Works well under close supervision

COMMUNICATING

--Prepares clear and concise written materials
--Speaks with clarity and conciseness
--Records information legibly, e.g., billing information, accounts payable, etc.
--Listens carefully to instructions and correctly carries them out
--Seeks clarification when something is unclear
--Is able to read and comprehend written materials
--Takes care to use proper English
--Explains ideas clearly
--Can report accurately on what others have said
--Reads accurately for information and detail

LEARNING

--Is able to absorb training quickly
--Profits from constructive performance feedback
--Reaches out for tasks of increased complexity and responsibility

PHYSICAL AND SAFETY DEMANDS

--Displays good hand-eye coordination
--Operates machinery with good manual dexterity, stamina, and agility
--Follows prescribed safety standards
--Remains alert to potential safety hazards
--Adapts to unusual work environment, e.g., confined spaces, damp or dirty areas, heights, etc.
--Has valid driver’s license and can operate Company vehicle

NUMBER SKILLS

--Is able to add, subtract, multiply, and divide quickly and accurately
--Consistently checks calculations, and corrects errors
--Skillfully operates calculators and adding machines
--Is able to make correct change for a customer
--Is able to carry out computations involving formulas
--Recognizes when a calculation is "out of line"

OFFICE SKILLS

--Types with good accuracy and speed
--Visualizes how to prepare materials to be typed for best effect

--Quickly and accurately enters information into a computer via keyboard equipment, e.g., work processing equipment, computer terminal, etc.
--Is knowledgeable in grammar, punctuation, and meaning of words
--Detects incorrect spellings in materials being processed
--Consistently proofreads work and corrects errors
--Is proficient in transcribing machine dictation
--Takes shorthand and transcribes notes with speed and accuracy
--Quickly locates items in alphabetical lists

MECHANICAL AND LAB SKILLS

--Understands how mechanical equipment works well enough to diagnose problems
--Is able to understand and use mechanical drawings, layouts, diagrams, etc.
--Is able to assemble and operate tools or equipment used on the job
--Is able to apply knowledge and skill in elementary science, e.g., basic chemistry, biology, etc.
--Carries out careful, systematic experiments or analyses so work can be replicated easily

For over a century the City and Guilds of London Institute has offered job analysis, training, assessment, and certification which is designed to be "relevant both to industry and also to young people preparing themselves for working life". They have developed over 200 occupational specific "schemes" which describe how certificates are earned, assessments conducted, and syllabuses used to define areas of assessment. They have also developed one general purpose scheme which may be highly relevant to SCANS. Called Technology of Skilled Processes, this scheme purports to identify those process competencies which are common to a wide range of occupations.

The City and Guild syllabuses give detailed descriptions of the skills reflected on a certificate and an assessment. Often used as a source document for the development of training programs, the syllabuses typically identify skill levels and evidence required to indicate satisfactory levels. For example, in order to demonstrate sufficient command of distillation technology to cope with minor changes, the candidate must demonstrate the ability to describe pressure. Required evidence is:

a) define pressure
b) i) state the SI unit for pressure and its multiples and submultiples
   ii) state the quantity and unit symbols for pressure
   iii) relate the units of gas pressure (PA, N/m bat, millibar)
c) relate gauge pressure, atmospheric pressure and absolute pressure and perform calculations using these terms
d) state the meaning of the term vacuum

For each desired skill, they have identified what they consider to be evidence of the skill. They distinguish between job specific skills and those general skills which take different forms in different contexts. Communication skills, for example, are common to many jobs but the specifics change. City and Guilds defines these skills in terms of activity and context. Example 12 contains the communication skills listing from one of their syllabuses.

Example 12: Communication Skills from City and Guilds of London Institute

Objectives

01 Read and understand data.
02 Identify statements which are not supported by evidence within a given context.
03 Find and use information.

Level I	**Level II**	**Level III**
At level I, students should demonstrate the following competencies in familiar situations typically encountered by all persons as adult members of society	At level II, students should demonstrate the following competencies in familiar and unfamiliar situations involving a wide range of people; in initiating communications with individuals or small groups; in sustaining a constructive role within small groups.	At level III, students should demonstrate the following competencies in familiar and unfamiliar and public situations involving a wide range of people; in initiating and sustaining effective communication with individuals and groups of various types: in tackling open-ended communication problems requiring a critical appraisal of the options available within the situation.
Read and understand given texts in different forms.	Read and understand written texts in different forms.	Read and understand written texts in different forms.
Read and understand given tabular and graphical information in different forms, including sketch maps, diagrams, pie charts,bar charts, pictographs and tables.	Read and understand tabular and graphical information in different forms, including sketch maps, diagrams, line graphs, pie charts, bar charts, pictographs and tables.	Read and understand tabular and graphical information in different forms, including sketch maps, diagrams, line graphs, pie charts, histograms, pictographs and tables.
Identify the main points of a given text.	Identify the main points of a given text.	Identify the main points of a given text.
Read and understand material presented in both written and graphical forms.	Read and understand material presented in both written and graphical forms.	Recognize the different types of language used in different situations.
		Recognize the different attitudes and roles in a writer.
		Recognize implicit meanings in written and graphical material. Evaluate the effectiveness of material with respect to it intended purpose(s)/audience.

Two other lists are added here. The first is a general list of work-place skills identified by Carnevale, Gainer & Meltzer (1989) for the American Society for Training and Development (ASTD). The report was based on a survey of Fortune 1000 companies. The general categories here are:

- learning to learn
- basic skills (reading, writing, and computation)
- communication (listening and oral communication)
- creative thinking and problem solving
- employability (self esteem, motivation)
- interpersonal (negotiation, teamwork)
- leadership and organizational effectiveness

The next is a set of skills list identified by Levin, Rumberger & Finnan (1990) paper. These are generally similar to the ASTD list. They are:

- basic skills
  - reading comprehension
  - written communication
  - numeracy
- higher order skills
  - problem solving
  - decision making
  - planning
  - evaluation
  - obtaining and using information
  - learning skills
- social skills
  - oral communication
  - cooperation
  - working in groups
  - peer training
- attitudinal
  - initiative
- physical skills
  - sensory perception
  - manipulative
- technical knowledge

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