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AUTHOR Drewes, Donald W.
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ABSTRACT

Part of a series of instructor training modules on related subjects instruction, this booklet deals with planning the apprenticeship program. The first section consists of an outline of the content and scope of the instructor modules as well as a self-assessment pretest. Covered in the module are the following topics: conducting occupational analyses to determine needs for, support for, and general content of the program; establishing goals and objectives for the apprenticeship program; and incorporating ideas that facilitate the upgrading of the program to keep current with the new technology, new training ideas, and changes occurring in the occupation. Each chapter contains an introduction and objectives, instructional text, an example, additional information, and self-test exercises. Appended to the booklet are answers to the self-test exercises, a posttest, and answers to the posttest. (MN)

PLANNING THE APPRENTICESHIP PROGRAM

Instructor Training Module #2

Donald W. Drewes

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Glossary

The words on this list are used in this booklet. Please review the terms and learn the definitions. The meaning of the words in the text may not be the form of the word with which you are familiar.

Words/Terms

1. *Analysis Coordinator* Individual responsible for coordinating the Analysis Committee
2. *Analysis Committee* Group responsible for conducting an occupational analysis
3. *Analysis Sheet* Forms used in the analysis of worker skills and knowledges
4. *Apprenticeable Occupation* An occupation for which apprenticeship training is suitable
5. *Apprenticeship Committee* Group responsible for administration of an apprenticeship program
6. *Goals* Statements of desired long-range program results
7. *Knowledges* What the job holder must understand in order to perform the job
8. *Motivation* That which prompts a person to act
9. *Objectives* Means for the achievement of goals
10. *Occupational Analysis* A systematic study of an occupation to obtain information needed to plan an apprenticeship program
11. *Plan* A formal document describing anticipated results and strategies for their achievement
12. *Planning* The determination of what results are to be accomplished and how to achieve these results
13. *Psychomotor* Controlled physical/muscular behavior
14. *Sponsor* The organization that has final responsibility for an apprenticeship program
15. *Standards* Descriptions of apprenticeship program characteristics and procedures
16. *Strategy* A means or procedure for achieving results
17. *Technological Change* Changes in the basic way work is performed
18. *Work Activities* Those tasks required to be performed
19. *Work Processes* A classification of work activities

1. How To Use This Booklet

What Is The Series About?

Related subjects instruction is an essential part of every apprenticeship program. It is the program component through which apprentices are taught the background theory and range of applications of associated technical subjects such as mathematics, science and safety. Related instruction usually takes place in a classroom, after the regular work is over. Most frequently, related instruction is taught by a skilled tradesperson or craftworker. For the tradesperson or craftworker to be an effective trainer, he or she must not only know their trade skills, but also they must use teaching skills appropriate for conveying that information to apprentices. This series of materials is written to train related subjects instructors in the critical teaching skills necessary to perform their jobs effectively. The titles of the booklets in the series are:

1. *Introduction to Related Subjects Instruction and In-service Training Materials*
2. *Planning the Apprenticeship Program*
3. *Planning Related Subjects Instruction*
4. *Developing Instructional Materials for Apprentices*
5. *Presenting Information to Apprentices*
6. *Directing Learning Activities for Instruction*
7. *Providing for Individual Learner Needs*
8. *Controlling Instructional Settings*
9. *Evaluating Apprentice Performance*
10. *Communicating with Apprentices*

The first booklet introduces the series, describes the content of each booklet, and provides an overview of apprenticeship and of adult learners. The second booklet describes how to plan an apprenticeship program and may be used by related instructors, sponsors or service agencies. Each of the other eight booklets deals with a set of training skills judged by a panel of experts on apprenticeship to be critical to working effectively as a related subjects instructor.

What Is This Booklet About?

The materials in this booklet deal with planning the apprenticeship program. Planning is important because it provides a blueprint for building a sound program. Like any other blueprint, planning for an apprentice program requires that serious consideration be given the purposes to be achieved and the methods and procedures to be used in achieving these purposes. This booklet addresses the following skills required for the effective and efficient planning and organization of an apprenticeship program:

1. Conduct occupational analyses to determine need for, support for, and general content of the program;
2. Establish apprenticeship program goals and objectives;
3. Incorporate ideas that facilitate upgrading of program to keep current with new technology, new training ideas and changes occurring in the occupation.

This booklet is targeted at an audience of would-be program sponsors, would-be service agency providers such as instructors and administrators in community colleges or technical institutes, and individuals who currently provide services in apprenticeship programs. It does not deal with training skills as do the other booklets in this series.

What Must I Do To Complete My Work In This Booklet?

Working your way through this booklet will require you to read the text, to answer the questions, to perform the exercises, and to complete the pre- and post-assessment instruments. Expect to spend about five hours working through the materials. The only resources you need to complete your work in this booklet are: (1) a copy of the booklet; (2) a pencil or pen; (3) about two hours of time; and (4) recollection of past related instruction experiences.

The materials are written in a self-instructional, programmed format. You may work through the text, examples and questions at your own pace and leisure; you need not complete your work in the booklet at one sitting.

Each chapter in the booklet is devoted to a single skill. The general format of the chapters is similar, with the following parts:

1. An *introduction* describing the skill and the instructional objectives for that skill.
2. *What* is, *when* and *why* to use the skill.
3. Step-by-step *directions* for how to perform the skill.
4. An *example* of how the skill is used in related instruction.
5. A *self test exercise* to apply the information about the skill.
6. Additional *sources of information*

This booklet concludes with an appendix that contains the answers to the self-test exercises from each chapter and the posttest.

Your activities in working through this booklet will include, in order, the following:

- Complete the self-assessment;
- Read and consider in detail the introduction and objectives for each skill;
- Read and study the text, examples and illustrations provided for each skill;
- Complete the self-test exercise for chapter and compare your answers with those provided in the appendix;
- If you complete the exercise as directed, continue your work in the booklet; if you fail to answer the questions correctly, repeat your work in the chapter under consideration; and
- At the conclusion of the booklet, complete the posttest for the unit. Check your answers against those provided. If you exceed the criteria, continue your work in the next booklet. If you fail to demonstrate mastery; repeat portions of this booklet as needed.

How Much Do I Know About The Subject Before I Begin?

The self-assessment will assist you to focus on competency areas associated with planning the apprenticeship program. Read each competency statement listed in Figure 1 and assess your level of knowledge about and your level of skill in performing that task. Knowledge means what you know about the subject while skill means your experience in successfully performing the task. Circle the number that best describes your level of knowledge and skill. Competencies where your ratings are poor or fair are those that you should concentrate on. Pay particular attention to the chapters which deal with those competencies.

Figure 1: Planning The Apprenticeship Program Self-Assessment

Chapter In Booklet	Competency		Rating			
			Poor	Fair	Good	Excellent
2. Skill: Conduct occupational analyses to determine need for, support for and general content of the program.	1. Assess needs for apprenticeship training.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	2. Develop support for apprenticeship programs.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	3. Establish apprenticeship committee.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	4. Analyze apprenticeable occupations and identify work activities and tasks.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	5. Determine job skills, knowledges and motivation necessary for performing work activities.	Knowledge	1	2	3	4
		Skill	1	2	3	4
3. Skill: Establish goals and objectives for apprenticeship program	6. Set apprenticeship training standards.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	7. Set apprenticeship administrative program standards.	Knowledge	1	2	3	4
		Skill	1	2	3	4
	8. Establish program goals/objectives.	Knowledge	1	2	3	4
		Skill	1	2	3	4
4. Skill: Incorporate ideas that facilitate upgrading of program to keep current with new technology, new training, ideas and changes occurring in occupations.	9. Update program periodically to include new technology, and/or training procedures.	Knowledge	1	2	3	4
		Skill	1	2	3	4

2. Skill: Conduct Occupational Analyses To Determine Need For, Support For, And General Content Of The Program

Introduction And Objectives

The planning of an apprenticeship program must be based on a sound assessment of community need. A demonstrated need for skilled trade and craft persons is a powerful argument for an apprenticeship program and can be used to develop support by industry and labor leaders. Support for the idea of an apprenticeship program is absolutely essential since the success of the program is dependent upon a willingness of one or more sponsors to back the program.

Planning for an apprenticeship program requires a thorough understanding of the apprenticeable occupation. Based upon this understanding, job skills are identified and the knowledges and skills to be included in the apprenticeship program are determined. Thus, planning an apprenticeship program requires that a planner be able to:

1. Determine alternative means for assessing the local needs for apprenticeship training;
2. Identify possible ways of obtaining support for an apprenticeship program;
3. Suggest differing ways that an apprenticeship committee might be organized;
4. Identify the steps to be followed in conducting an occupational analysis;
5. Critique an occupational analysis to identify necessary job skills, knowledges and motivations;
6. Apply a technique to identify specific knowledges and motivations for a specified occupation.

As you begin to work through this unit of material, reflect back upon your apprenticeship experiences and knowledge. Draw upon these experiences as you consider how the ideas suggested in these materials could be incorporated into planning an apprenticeship program.

The What, Why, And When Of Apprenticeship Program Planning

Apprenticeship programs, like many other human activities, are performed more effectively and efficiently when they are carried out according to a prescribed plan. The utility of the plan is dependent upon the extent to which it is based upon a sound and thorough understanding of the need for action and the alternative available choices. This information is provided by a technique called *occupational analysis*. Occupational analysis is the systematic study of an occupation to determine. (1) the need for skilled persons to perform that occupation and (2) the skills, knowledges and attitudes required to achieve skill mastery in that occupation.

Occupational analysis is a necessary first step in the planning of an apprenticeship program. However, before conducting an occupational analysis, one must first determine whether the occupation in question is an apprenticeable occupation. Apprenticeable occupations generally are defined as those occupations for which: (a) skills are learned primarily through a combination of on-the-job training supplemented by related technical instruction, (b) require at least 2,000 hours of work experience plus related instruction, (c) involve manual, mechanical or technical skills and are practiced industry-wide as a recognizable trade or craft, (d) involve the development of a body of skills sufficiently well defined to be applicable throughout an industry and (e) do not primarily involve selling, managerial, clerical or professional activities.

Identification of a shortage of skills in an apprenticeable occupation can be used to develop support for offering an apprenticeship program. Since apprenticeable occupations represent a major component of industrial productivity, employers are quick to recognize the threat posed by a shortage of skilled craft/trade personnel. Labor organizations are likewise responsive to labor shortages since shortages signal a possibility of decreased membership. Just as shortages signal an increased need for apprentices, surpluses indicate a diminished enthusiasm for new apprenticeship programs. The upshot is that the argument for offering a new apprenticeship program should be grounded in a documented need for the employment of additional apprentices.

Given that a need for apprentices has been established, the next decision is who will sponsor the apprenticeship program. Apprenticeship programs may be sponsored by a single employer, a group of employers, or a combination of employer and labor organizations. The particular type of sponsorship will depend upon a combination of factors including:

- the extent to which craft employment in a community is dominated by a single employer,
- the willingness of employers to assume training responsibilities,
- the extent of collective bargaining agreements; and
- the local community history regarding apprenticeship training.

Administration of the apprenticeship program is the responsibility of a local apprenticeship committee or a designated official in a particular company. When a committee is used, generally it consists of members representing the sponsoring organizations. If a labor organization is jointly sponsoring an apprenticeship program, the committee is termed a joint apprenticeship committee. Responsibility of apprenticeship committees or the director of apprenticeship includes selecting and indenturing apprentices, supervising training, establishing training curriculum, and certifying apprentices as journeymen upon completion of the program. Given these responsibilities, the role of the apprenticeship committee or director in the planning of an apprenticeship program is well established. The extent to which the committee or director plans the program, implements the plan and monitors the results will determine the extent to which the apprenticeship program operates as an efficient and effective training system for the development of skilled craft personnel.

Although most directly involved in the administration of apprenticeship programs, local apprenticeship committees and apprenticeship directors are not the only entities involved in an apprenticeship program. Other groups and organizations include the U.S. Department of Labor's Bureau of Apprenticeship and Training (BAT), the Federal Committee on Apprenticeship (FCA), the State and Territorial Apprenticeship Agencies (SAC) and the National Joint Apprenticeship and Training Committees.*

Informed planning of an apprenticeship program requires detailed knowledge of the work processes, skills, knowledges, and motivation to perform as a skilled craft person. Provision of this information is the second major purpose of an occupational analysis.

Work activities, classified by major activity divisions of the trade, constitute the *work processes* that define the content of an apprenticeship training program. Work processes consist of major work categories and contain a series of activities under each category. *Activities* are general statements consisting of (1) an action verb and (2) the object that is being acted upon. For example, automobile mechanic is an apprenticeable occupation that may be divided into the following major work categories:

1. Lubrication;
2. Axles and Suspension;
3. Transmission and Clutch;
4. Brakes;
5. Motor Repair and Overhaul;
6. Carburetor;
7. Electrical System;
8. Cooling System;
9. Fuel System.

Activities under the major category of *Lubrication* include among other tasks: (a) fill or pack universal joints; (b) lubricate running gear; and (c) change oil and filters. The action verb — fill, pack, lubricate, change — indicates the work activity taking place. The object of the activity is universal joints with respect to fill or pack, running gear with respect to lubricate and oil and filters with respect to change.

Work processes provide a description of the major categories of work performed and a listing of component work activities for each major category. This way of describing the duties to be performed in an apprenticeable occupation provides a convenient organization for analyzing the job skills and knowledges required for successful performance in that occupation. *Job skills* are defined as statements of what the job holder must be able to do in terms of general areas such as: reading, writing, math, listening, observation and analysis, abstract reasoning, problem-solving, interpersonal relationships and psychomotor skills.

Knowledges are statements of what the worker must understand in order to perform successfully on the job. The distinction between job skills and knowledges emphasizes the difference between what an apprenticeship must be able to do in terms of job behavior (job skill) and the knowledges required to enable the apprentice to produce that behavior. In apprenticeship training, this distinction separates on-the-job training where the apprentice learns by doing and related instruction where the apprentice acquires the necessary knowledge to provide meaning and support to those activities performed on the job.

How To Conduct An Occupational Analysis

Five important steps are required to conduct an occupational analysis. Each step serves a particular purpose. The steps are sequential and lead from one to another in logical order.

*These apprenticeship agencies and their functions are described in Module 1, *Introduction to Related Subjects Instruction and In Service Training Materials*.

Step 1: Assess The Need For Apprenticeship Training In A Particular Trade Or Craft

Planning an apprenticeship program must be based upon a clear demonstration of need. The most direct indicator of need is a shortage of skilled personnel in a particular craft or trade. The extent and severity of the shortage must be documented by hard data rather than speculation. A most direct way to collect such data is to survey employers about current and projected needs for craft or trade skills and the difficulties they are encountering or expect to encounter in hiring sufficient numbers of skilled personnel. Surveys may be conducted formally using a printed questionnaire or done more informally through telephone contact with a reasonable number of employers. Additional data on the demand for craft personnel in a local area can be obtained from the local office of the state employment security agency. Additional sources of information include associations of employers that logically would hire craft or trade members, appropriate union organizations; the State Apprenticeship Agency or the BAT state or district representative, and the National Joint Apprenticeship and Training Committee.

Data documenting existence of a shortage of craft/trade personnel is necessary but not sufficient to justify need for an apprenticeship program. To establish need, demonstrate either that no local training program exists that can fill the need or that there are strong reasons why an existing local program cannot be used. Thus, for a bonafide need to exist, you must first prove that a shortage of craft/trade personnel exists and that this shortage cannot be resolved by any existing apprenticeship program.

Step 2: Build Support For An Apprentice Program

A base of support must be established before an apprenticeship program can be offered. One way to marshal support is to examine organizations in the local community that are most affected by a skills shortage. These organizations will be responsive to suggestions for reducing the shortage. If skills shortages impact more heavily on a large craft employer in a community, then it would make sense to seek support from that source. If, on the other hand, shortages are being experienced by several employers, then their collective support should be sought. It may be that a labor organization sees in a shortage situation an opportunity to augment its membership roles. This being the case, and assuming that no programs are currently in operation, an apprenticeship program might be an attractive option.

Employers may agree readily that a shortage of craft skills does exist yet they may not be convinced that apprenticeship is the preferred mode of training to be used. Arguments for offering an apprenticeship program include:

- Apprenticeship develops and insures a supply of trained workers and supervisors for their operation;
- Apprenticeship increases worker productivity, overall skills level and versatility;
- Apprenticeship minimizes the need for supervision of employees by developing initiative;
- Apprenticeship continues to attract capable men and women into the trade.

There are some negative points to consider. These include:

- Apprenticeship increases training costs resulting from required journeymen's time for providing instruction and supervision.
- There is a cost resulting from somewhat lower initial productivity of apprentices, however, a portion of that cost is offset by the lower wages paid to apprentices.
- There is no guarantee that the trained worker will stay with the company after completion of the apprenticeship period.

In order to convince an organization to sponsor an apprenticeship program, positive returns from adopting an apprenticeship program must be judged to outweigh the negative costs. It is your responsibility as an apprenticeship advocate to convince potential sponsors that the benefits exceed the costs. Remember, apprenticeship is an instrument in human capital that pays continuing dividends to the sponsor.

Step 3: Constitute An Apprenticeship Committee

A sponsor or co sponsors should appoint their representatives to the Apprenticeship Committee. Employer representation should include the Director of Personnel or the Director of Training, depending upon who has managerial responsibility for the training function. If the sponsor is a single employer, a craftsperson and a craft supervisor should be represented on the committee. If a collective bargaining agreement is in effect, the language of the agreement generally will indicate the appropriate union representation. If a group of employers have agreed to sponsor the program, then each employer should be represented on the Apprenticeship Committee. In those cases where the number of employers is large or when an association of employers is involved, the employer association may be represented as a single entity. The number of representatives on the Committee should not be less than three nor generally more than nine. A chairperson should be appointed and given responsibility of convening the

group at periodic intervals. The chairperson should have responsibility for the Committee agenda with the provision that any Committee member be allowed to place an item on the agenda for discussion.

Step 4: Determine Work Processes In A Chosen Trade/Craft

The purpose of this step is to describe the actual work activities that take place during the performance of the occupation. To insure that the description accurately portrays what takes place on the job, an analysis must be conducted by a group of persons intimately familiar with that occupation. Because of the central role of the Apprenticeship Committee in planning and administration of the program, the committee should prepare the description. If members of the Committee feel that they do not have a necessary familiarity with the occupation, they can appoint a stand in representative. This situation might occur when the Personnel Director or Director of Training cannot be expected to have an operating knowledge of all apprenticeable occupations. In these cases, a craft supervisor should be appointed as a possible representative

If the occupation has several specialities, these specialty areas should be represented. Perhaps additional crafts persons can be utilized in the capacity of consultants to the Apprenticeship Committee. In the case of group sponsorship, representatives should be selected that cover the range of occupational activities found across all employers in the group. This insures that persons familiar with all performance variations of the occupation will participate in production of the occupational description For purposes of reference, this group is termed the *Analysis Committee.*

Each member of the Analysis Committee should meet the following qualifications:

- Must have a demonstrated competence in the occupation;
- Must be employed or have been employed in the occupation;
- Must be able to work in a group;
- Must be able to verbalize the activities performed in the occupation;
- Must be committed to the importance of describing work activities;
- Must be willing to devote the time necessary to develop an accurate description.

The Analysis Committee must be convened and the purpose of the task explained. They must understand that their purpose is to identify only those observable behaviors (work activities) that take place on the job. It is critical that Analysis Committee members do not confuse job knowledges with work activities. Job knowledges are assumed to be supportive of the performed activities but are *not* to be equated with these activities. As a practical illustration of the difference, knowledge about bicycle riding and actually being able to ride a bicycle are quite different. One might be quite knowledgeable about theories of bicycle balancing yet be unable to ride. Conversely, one may be able to ride a bicycle yet have no knowledge of the underlying physical principles that make it possible.

The Analysis Committee should meet in a well-lit, comfortable room that has a large uncluttered wall space. The task of the Committee is to generate, through spontaneous discussion, work activity statements that describe what a skilled craftsperson must do. Each work activity statement is preceded by the statement "A journey man must be able to . . . (work activity statement)." The work activity statement consists of one or more action verbs and the object that is acted upon. For example, a typical work activity statement for a mechanic might be, "adjust front wheel bearings"; "rebuild and repair differential centers"; or "re-face, re-seat and grind valves." In each case, the verbs describe what is done and the nouns indicate the objects acted upon. In most instances, eight to ten words will suffice to capture the action verbs and the objects of the action.

These statements should describe the actual work performance of journeymen. Avoid statements that indicate what should be known or understood since they are not observable directly. Prefacing each statement of work activities with the phrase, "A journeyman must be able to . . " maintains this behavior-knowledge distinction clearly and emphasizes the necessity to state work activities in observable terms.

As work activities are generated through Analysis Committee discussion, write these activity statements on three-by-five or four-by-six file cards. Letter the cards with a felt-tipped pen. Print letters large enough to be seen by every Committee member in the room. As cards are filled out, attach them on the wall with plastic putty or some other adhesive. Preferably walls should be on the long dimension of the room and must be well lighted and clear of any obstacles.

Divide the apprenticeable occupation into major categories as a way to simplify the task. Major categories should represent natural divisions of labor in the occupation. Natural divisions might reflect:

a. major areas of specialization within the occupation;
b. functional areas of work grouped around natural processes or sub-assemblies of the structure or assemblies being worked upon; or,
c. natural sequences of operations performed in the course of the work performed.

Major categories of work for carpentry might include, for example:

1 flat work;
2 roughing and framing,
3 scaffold buildings;
4 building and setting concrete forms;
5 installation, erection and repair of fencing metals and woods,
6 layout,
7 roof framing, cornices and bay framing;
8 trim:
9 exterior covering; and
10 woodworking machines.

As a rule of thumb, the number of major occupational categories identified should not exceed ten to twelve.

Once a major category has been identified, write it on a card and affix it to the left end of the empty wall. Use the major occupational category to focus committee discussion and identify work activities falling under that major category. The task of the Committee is to brainstorm amongst themselves until they have come up with a satisfactory definition of the work activities making up that category. Write each activity on a card as it is defined. Post it to the right of the major category card in a horizontal line. Thus when complete, there will be a single *row of cards* that when considered together describe a major work category and its associated work activities. In most cases, ten to fifteen work activities are sufficient to exhaust the variety of activities performed. If more work activities are suggested, review them carefully so as to combine them with existing statements. If the Committee feels that significantly more work activities are required, this probably means that a major category was too broadly defined. Split this major category into smaller categories. In an opposite case, if the Committee is unable to come up with a significant number of work activities for a given major category Combine the category with an existing category.

Repeat the process until all major categories and their associated work activities are defined to the satisfaction of the Committee The product will be multiple rows of cards running horizontally across the wall. Each row will reflect a major category of the apprenticeable occupation.

The last task then remaining is to sequence the work activities within each major occupational divisional category. Sequencing should reflect the order in which the work activities must be learned. The Analysis Committee should identify a major occupational division represented by a horizontal row of cards and treat that as the baseline row. Order cards within that row to reflect the sequence in which the activities should be learned. A good way to do this is to consider that the major divisional category is the only portion of the occupation to be learned. The Committee members should then ask themselves which work activity should be learned first and in what order the remaining activities should be learned. Order the cards on the horizontal row from left to right to reflect increasing levels of complexity. In a similar manner, sequence the tasks of every other remaining row in order of learning priority.

Each row should then be compared with the baseline row of cards. Do this by selecting a particular row to compare with the baseline. Compare the last card in that row, that is, the one at the farthest right on the wall of the room, with the right most card of the baseline row. If the work activity on the last card of the comparison row can be learned at the same time as the activity on the last card of the baseline row, then place the two cards directly above each other. If the last card on the baseline row must be learned before the last work activity on the comparison row, place the card on the comparison row to the right. Likewise, if the work activity on the last card of the comparison row must be learned before the work activity on the last card of the baseline row, then place the card on the comparison row, to the left of the last card on the baseline row. Determine the exact placement of that card by comparing it with the next-to-the-last card on the baseline row. If these two tasks can be learned simultaneously, then place the cards directly above each other If not, compare the first card with some other card moving to the left on the baseline row until you find a card on the baseline row that contains an activity that can be learned at the same time. This will then establish the placement for the comparison card.

Continue this activity until all cards in every row are placed in proper order with the comparison baseline row The result is not only a sequence for the learning of work activities within each row, but also a sequence of activities across major work categories. This structuring will assist you in determining the order in which work activities should be learned.

The process of identifying work activities and of determining their proper order and structure should be directed by a coordinator The role of the coordinator is to lead the Analysis Committee and to make sure that the Committee is mindful of its purpose and function. The leader encourages Committee members to focus their attention and efforts on the attainment of these purposes. Thus, it is the coordinator's responsibility to provide the initial orientation to the Committee and to serve as discussion leader. As work activities are identified, the coordinator should write these activities on the cards and affix the cards to the wall. The coordinator also is responsible for leading the Committee as they work to arrange the cards within each major division to reflect the order of learning.

The role of the coordinator is critical to the success of

this effort The coordinator must be able to motivate the Committee and to deal with concerns about task complexity The initial tendency of some Committee members will be to consider the task impossible due to the large number of activities that must be generated. This reflects a misunderstanding of the process and too narrow a focus on the scope of work activities to be defined The coordinator must be able to explain the mechanics of the process and to illustrate by example the level of detail required by the process

Identification of the work activities is made easier by classifying activities into those that deal with *data*, those that deal with *things*, and those that deal with *people* Activities that deal with *data* refers to all aspects of an occupation that deal with numbers or written material in whatever form they may be encountered. *Things* refers to tangible materials, objects, products or procedures dealt with on the job. *People* refers to various relationships with others that are required in the conduct of the specific occupation in question As an aid in selecting action verbs, a number of these verbs are classified in Figure 2 according to whether they refer to data, things or people

Figure 2: Classification of Action Verbs

Data

Numerical/Written Material

abstracts
analyzes
calculates
checks
classifies
collects
compiles
computes
considers
copies
counts
describes
detects
discovers
edits
estimates
evaluates
files
gathers
integrates
interprets
listens
looks up
monitors
observes
obtains
prepares
presents
processes
produces
reads
receives
records
refers to
registers
reproduces
retrieves
reviews
routes
scans
seeks
solves
stores
summarizes
tabulates
transcribes
transfers
transforms
translates
types
verifies
writes

Things

Materials/Objects/Events/Products/Procedures

abrades
aligns
alters
answers
applies
appraises
arranges
assembles
assesses
bakes
balances
bids
bores
builds
burns
buys
calibrates
carves
casts
checks
chips
classifies
cleans
codes
compares
conducts
connects
constructs
cooks
copies
creates
cuts
decorates
delivers
demolishes
demonstrates
designs
detects
develops
disperses
disconnects
dispatches
draws
dresses
drills
engraves
erects
establishes
etches
evaluates
examines
executes
expedites
facilitates
fastens
files
forms
formulates
gives
grades
guards
handles
hangs
holds
identifies
implements
initiates
inspects
installs
issues
judges
keeps
lays out
loads
locates
maintains
makes
marks
measures
mills
miters
mixes
models
mounts
navigates
nets
notes
numbers
observes
obtains
organizes
packs
paints
pastes
participates in
places
planes
plans
plasters
pours
prepares
presses
processes
produces
programs
protects
receives
recognizes
reconditions
refinishes
removes
repairs
replaces
reproduces
requisitions
routes
samples
saws
schedules
selects
sells
shapes
shaves
smooths
specifies
splits
sorts
stores
tests
trims
turns
types
unloads
uses
washes
watches
weighs
welds

Figure 2: Classification of Action Verbs (Continued)

Things

Machines
Major pieces of machinery or equipment

sets up
operates
drives/controls
tends
maintains
repairs

People

Clients/Customers/Co-workers/Supervisors/Employees/Patients

advises
amuses
appraises
assesses
assigns
assists
cares for
communicates with
confers with
consults with
controls
coordinates
councils
directs
disciplines
discharges
discusses with
encourages
explains
grooms
guards
guides
hires
influences
instructs
interviews
involves
leads
manages
organizes
orients
persuades
prepares
protects
receives
refers
selects
serves
shows
speaks to
stimulates
supervises
talks to
teaches
tests
trains
waits on

Step 5: Analyze The Work Process Descriptions To Determine Job Skills, Knowledges and Motivations

The major work divisions and their associated work activities identified in Step Four represent the work processes of the apprenticeable occupation. Work processes descriptions can be taken directly from the arrangement of cards produced in the preceding step. Before the cards are removed from the wall, give each row of cards an identification number. Assign each card within the row a letter of the alphabet starting with "a" on the left most card, b to second card on the left and so forth until all cards in the row have been assigned an alphabetic letter. Also assign each card the number of the row to which it is assigned. Thus, each card will have a number and a letter indicator on it. This enables you to restructure the cards, if you so desire.

Given the way the cards have been structured in the previous step, all work activities on cards with the same alphabetic letter can be learned at the same time. The learning order of all tasks can be established by ranking tasks according to their alphabetic designation. Those having earlier letters in the alphabet must be learned prior to those with later letters in the alphabet.

By coding each work activity with a number designating the major activity to which it belongs and a letter indicating the learning order, the work processes description of the apprenticeable occupation can be established according to the following format:

1 Title of the major work activity represented by row one;
  a. Work activity on the card bearing the code 1a;
  b Work activity on the card bearing the code 1b
  .
  .
  .

2 Title of the major work activity represented by row two;
  a Title of the work activity on the card coded 2a;
  b Title of the work activity on the card coded 2b
  .
  .
  .

3 Title of the major work activity represented by the last row where N equals the total number of work activities considered.
  a. Title of the work activity on card coded Na;
  b. Title of the work activity on card coded Nb
  .
  .
  .

The preceding format will provide an ordered description of the major divisions of the apprenticeable occupations and the work activities comprising each occupational division. Because of the nature of the process used to generate the work activities, each work activity represents a statement of observable behavior on the job. Analysis Committee members were instructed specifically to separate job behaviors from knowledges and understandings necessary to produce these behaviors. It is therefore the purpose of this step to concentrate on identifying skills and knowledges that support the work activities. As in previous steps, identification of skills and knowledges can best be undertaken through application of a systematic procedure.

Recall that the Analysis Committee members were instructed to consider the occupation in terms of its *data, things,* and *people* requirements. Use the same three categories as a basis for analyzing the occupation to determine what skills and knowledges an apprentice must have in order to perform the identified work activities. Prepare a separate skills knowledge analysis sheet for each of the three areas. Divide the *things* dimension into subdivions of (a) tools used, (b) materials, parts or fixtures used, and (c) machinery or equipment used.

Analysis sheets are shown in Figures 3-7. Note that all of the skills-knowledge analysis sheets follow the same basic format. Each begins by listing the major types and kinds of data, things or people dealt with. Be careful to provide an appropriate level of detail. It serves no major purpose to list every single tool or all materials used on the job because this results in unnecessary detail. On the other hand, too broad a classification runs the risk of missing major types of tools, materials and equipment that may have specialized knowledge requirements. The intent is to define as major categories only those areas of data, people and things that have materially different knowledge requirements. As in the classification of general work areas, the ultimate level of specification of detail is left to the discretion of the final users.

Figure 3: Skills-Knowledge Analysis Sheet (Data)

A List all major types of data encountered on the job including tools such as technical manuals, instruction sheets, purchase orders, shipping invoices, work orders, and read-outs from dials, gauges or other test measurement instruments

B Apprentice Must Be Able To: (Check all that apply)

_____ Recall factual information
_____ Interpret tables, charts or figures
_____ Locate required data in technical reference sources
_____ Interpret and follow a variety of technical instructions represented in mathematical or graphical form
_____ Keep records according to a prescribed standard of recordkeeping
_____ Record and or compile observed data in written or tabular form
_____ Examine and determine values of data after using specialized measurement techniques
_____ Compute basic measurements (e.g., dimensions, tolerances, spacing, location, angles, diameter, area, rates)
_____ Solve algebraic equations
_____ Input and retrieve data from computer controlled systems

C. Apprentice Must Know (Check all that apply)

_____ How to read and follow technical instructions
_____ How to use tables, charts and figures
_____ How to read blueprints, schematic drawings or orthographics
_____ How to read information from dials, gauges, meters or other such devices
_____ Procedures for locating and using technical reference documents
_____ Appropriate sources of job-related information
_____ Basic terms, symbols, and definitions commonly used in the occupation
_____ Procedures and practices required to fill out orders/requisition/forms/routing slips or other such documents
_____ How to maintain work records according to a prescribed format
_____ How to prepare work performance reports
_____ How to write letters/memos/reports
_____ How to compare whole numbers, decimal numbers, fractions, mixed numbers
_____ How to convert decimals to fractions; decimals to mixed numbers, proportions to percentages
_____ How to add, subtract, multiply or divide whole numbers, decimal numbers, fractions, mixed numbers, denominational numbers, proportions and/or percentages
_____ How to measure distances, angular separation, perimeters, circumferences, areas, volume, rate of change
_____ How to solve algebraic equations and one or more unknowns

D. Based on the worker knowledges checked above, please provide a description of the specific knowledges required for each area checked.

Figure 4: Skills-Knowledge Analysis Sheet (Things) (Tools)

A. List all major types of tools used.

B. **Apprentice Must Be Able To:** (Check all that apply)

_____ Select appropriate tool(s) for task at hand
_____ Make necessary set up or adjustments required to prepare and use the tool(s)
_____ Use tool(s) in a safe and proper manner
_____ Provide for routine care and maintenance of tools

C. **Apprentice Must Know:** (Check all that apply)

_____ Name of tool(s)
_____ Distinguishing characteristics of tools
_____ Purposes or functions served by tool(s)
_____ Procedures for using tool(s)
_____ Causes of tool-related accidents
_____ Safety procedures
_____ Maintenance procedures
_____ Scientific/physical principles underlying tool operation

D. Based on the worker knowledges checked above, please provide a description of the specific knowledges required for each area checked.

Figure 5: Skills-Knowledge Analysis Sheet (Things) (Materials/Parts/Fixtures)

A. List all major types of materials parts/ fixtures used on the job

B. **Apprentice Must Be Able To:** (Check all that apply)

_____ Select materials/parts/fixtures that are appropriate for the task at hand
_____ Prepare materials/parts/fixtures
_____ Store materials/parts/fixtures in a safe and proper manner
_____ Apply/install or otherwise use materials/parts/ fixtures in accordance with commonly-accepted trade or craft standards
_____ Diagnose malfunctions to determine what parts need replacement or reconditioning
_____ Disassemble assemblies into component parts
_____ Assemble parts into subunits and/or assemblies

C. **Apprentice Must Know:** (Check all that apply)

_____ Common names for materials/parts/fixtures commonly used
_____ Distinguishing features/characteristics of different kinds of materials/parts/fixtures
_____ Function(s) of parts/fixtures/materials
_____ Methods and procedures for preparing materials
_____ Methods and procedures for storing materials
_____ Installation/application procedures
_____ Problems commonly encountered in the use of materials
_____ Testing procedures to determine whether parts/ fixtures are effective or need replacement
_____ Order of assembly operations

D. Based upon the worker knowledges checked above, please provide a statement of the specific knowledges required for each area checked.

Figure 6: Skills-Knowledge Analysis Sheet (Things) (Machinery/Equipment)

A. Please describe major types of machinery and/or equipment used on the job.

B. **Apprentice Must Be Able To:** (Check all that apply)

_____ Perform initial set up of machinery/equipment to perform their function
_____ Operate equipment/machinery or otherwise perform processes requiring continuous monitoring, controlling, regulating or maneuvering (e.g., driving motorized vehicles, operating cranes, hoists, saws, cutters)
_____ Operate machinery/equipment to rigorous standards of accuracy and precision
_____ Feed materials and/or off-load product
_____ Carry out detailed testing and/or diagnostic procedures requiring machine/equipment operation
_____ Maintain machinery/equipment
_____ Repair, overhaul, or otherwise recondition machinery/equipment
_____ Repair, overhaul or otherwise recondition machinery/equipment

C. **Apprentice Must Know:** (Check all that apply)

_____ Set-up procedures
_____ Operating procedures
_____ Maintenance procedures/schedules
_____ Principal causes of machinery/equipment malfunction
_____ Basic functions or purposes performed by machinery/equipment
_____ Basic scientific and/or physical theories underlying machinery/equipment operation
_____ Diagnostic methods and techniques using machinery/equipment
_____ Standards for judging quality of work produced
_____ Methods for repairing machinery/equipment
_____ General maintenance procedures

D. Based upon the general knowledge areas checked, please provide descriptions of specific knowledges for each area.

Figure 7: Skills-Knowledge Analysis Sheet (People)

A Please list major types of people that must be dealt with:

B. **Apprentice Must Be Able To:** (Check all that apply)

_____ Follow verbal instructions from others
_____ Communicate results and findings to customers, co-workers, supervisors or others
_____ Counsel and advise others
_____ Recognize and attend to the needs of others
_____ Influence others in favor of a product, service or opinion
_____ Supervise others
_____ Negotiate, arbitrate or otherwise engage in delicate social bargaining
_____ Train others by explanation, demonstration or supervised practice

C. **Apprentice Must Know:** (Check all that apply)

_____ How to listen and carry out instructions
_____ How to communicate intention and feelings to others
_____ Ways and means of motivating people
_____ How to influence others
_____ Principles and practices of good supervision
_____ How to train others
_____ How to be sensitive to the needs of others
_____ How to evaluate performance of others
_____ How to deal with people

D. Based upon the knowledge areas checked above, please provide descriptions of specific knowledges required for each of the checked areas.

After the listing of specific categories of data, people and/or things, the analysis sheets contain space to list a number of activities that apprentices perform on the job. If these activities are required in the performance of the job as described in the work process description, then check each statement that applies. This operation focuses attention on specific types of work activities that are closely related to and supported by worker knowledges and understandings.

Given that these knowledge-dependent activities have been identified, the analysis sheet requires that the general knowledge areas be identified. These general knowledge areas have a close correspondence with activities previously identified. For example, with respect to machinery and equipment, if an apprentice must maintain machinery and equipment in operating order, then it follows that the apprentice must know the proper maintenance procedures. The analysis sheet is intentionally structured to lead analysts from the specific aspects of data, people or things through generalized work activities to a focus upon the general knowledge areas required to support that activity.

The final requirement of the analysis sheet is a specification of the required specific knowledges. Accomplish this by reviewing the general knowledge areas checked and specifying in more concrete terms the nature of the knowledge to be acquired. For example, if it has been determined that an apprentice must know proper maintenance procedures, then the necessary specificity can be added by stating the major types of machines or equipment for which the maintenance procedures must be known.

The intent of the skills-knowledge analysis sheet is to provide a logical procedure for deriving the knowledges necessary to support job performance as described by the work activities. This procedure will provide an objective basis for the identification of required knowledge and will insure that knowledges identified will be those which are demonstrably related to job performance.

Identification of skills and knowledges is based upon the work processes descriptions. The skills knowledge analysis should be performed sequentially. Once selected, a skills-knowledge analysis sheet should be completed in its entirety before going on to another. Work process descriptions should be used in the following manner. Study in detail the first work process and its associated work activities. Complete a skill-knowledge inventory sheet for that work process. Upon completion of the analysis sheet for the first work process, repeat the procedure for the second work process. Add to the analysis sheet additional requirements for performing the second process not already included in the previous analysis. Continue procedure until all major processes and their associated tasks are analyzed. By doing the analysis in this sequential manner, you avoid duplication because only those skills and knowledges not previously recorded are entered.

Conduct of the skills-knowledge analysis should be the responsibility of the Analysis Committee as constituted in Step 4. This Committee has been selected because of their knowledge of the occupation in question. It follows that they should be the most knowledgeable regarding the skills and knowledge requirements of that occupation. Because of the somewhat different mind set involved, it is recommended that identification of work activities and the analysis of the work processes to determine knowledges and skills be conducted in separate settings.

Whereas the previous analysis procedures dealt with identification of required knowledge, an occupational analysis is incomplete without an investigation of the motivational and psychomotor requirements of the occupation. Procedures for performing these analyses are indicated in Figures 8 and 9.

As indicated in Figure 8, the motivational analysis sheet concentrates on the levels of apprentice motivation in terms of: (a) what they should be willing to do, (b) what they should find satisfaction in doing and (c) what they should be committed to doing. The analysis of those areas considered important for an apprentice to be willing to do should concentrate on those aspects of the occupation that are not the most desirable nor pleasant parts, but are necessary to be performed by anyone working in that occupation. Satisfaction deals with those parts of a job that apprentices should find rewarding to perform. Commitment is an even higher level of motivation and refers to the central values that should represent the driving motivational force. Together, these three levels of motivation allow a statement of motivational requirements to be constructed that will provide apprentices and applicants with information as to the motivational requirements of the apprenticeable occupation.

In a similar manner, the psychomotor requirements of the occupation can be determined. The intent of that analysis is to identify physical activity requirements that significantly differ from normal expectations, either in terms of frequency, intensity, or or special requirements. For example, if balancing is required for walking on narrow catwalks, then this would be considered a deviation from a normal balancing requirement of most occupations and should be indicated. The purpose of the analysis is to identify those special psychomotor requirements that are needed by any apprentice who hopes to learn that craft or trade.

Figure 8: Motivational Analysis Sheet

Apprentice Should Be Willing To: (List characteristics of the occupation that may be considered undesirable by some people but are necessary to perform the job. Include items like working conditions, hours, travel, and so forth.)

Apprentice Should Find Satisfaction In. (List major kinds of work situations that apprentices should find rewarding. Include items like performing changing duties, performing routine tasks, dealing with people, working under pressure, solving difficult problems, and so forth.)

Apprentice Should Be Committed To. (List major areas that should be the central concerns for all apprentices. Include items like safety, quality, customer satisfaction, craftsmanship, and so forth.)

Figure 9: Psychomotor Analysis

A. Apprentice Should Have the Physical Capability and Coordination To: (Check any of the following activities which require unusual or strenuous physical requirements.)

____ Walk	____ Carry
____ Crawl	____ Push
____ Run	____ Pull
____ Climb	____ Grasp
____ Balance	____ Position
____ Stoop	____ Turn-twist
____ Kneel	____ Swing
____ Crouch	____ Assemble
____ Stand	____ Disassemble
____ Sit	____ Write
____ Reach	____ Draw
____ Step	____ Draft
____ Lift	____ Talk

B. Please provide a brief description of the specialized physical activities for each activity checked above.

As with the skills-knowledge analysis, the analysis of motivational and psychomotor requirements should be the responsibility of the Analysis Committee. Determination of motivational and physical activity requirements should be completed at the same time the skills-knowledge requirements are being identified. Once completed, the Analysis Committee will have performed a valuable service in that they will have identified the work activities to be performed and the knowledges, motivations, and psychomotor abilities required to perform those activities. These requirements are at the core of planning for an apprenticeship program. They serve as the basis for developing the related knowledges and understandings for those apprentices who possess the necessary motivational and psychomotor capabilities to perform on the job.

Example

The ABC Construction Company is a medium sized firm specializing in highway construction. During the past five years, the company has been experiencing a shortage of qualified heavy equipment mechanics. General foreman, Santos Garcia has become particularly concerned about this problem and is convinced that the shortages will become critical unless something is done quickly. His concern builds to the point that he discusses the situation with the company personnel manager, Bill Anderson. Garcia finds that Anderson shares this concern. They decide to find out whether other construction firms in the area are having similar problems. Anderson telephones several of his counterparts in other construction firms and verifies that they, too, are experiencing similar hiring difficulties. During the course of the conversations, someone suggests that perhaps some action be taken jointly. Anderson is sympathetic to the suggestion and devotes time to exploring the sources of labor supply for heavy equipment mechanics. He calls the secondary school system and is told that no vocational program exists in that area. He also contacts the local technical institute where he is told that they are aware of a demand in that area, but that equipment costs are so great that they are reluctant to initiate a program.

This lack of training programs in the immediate area causes Anderson to consider the possibility of the ABC Construction Company assuming responsibility for training mechanics. However, he is concerned that the number of mechanics required annually would not be sufficient to warrant assuming the training burden. He discusses the idea with Garcia, who agrees that on-the-job training would be an ideal way to train heavy equipment mechanics, but also has reservations about the limited numbers and the cost involved.

In the course of their conversation, they come to the conclusion that such training would be feasible if the training could be jointly provided by several employers. Anderson agrees to explore this possibility. He contacts personnel and training directors of other construction firms in the local area. Representatives in five firms express interest in jointly sponsoring a training program for heavy equipment mechanics. The five meet as a group to discuss the outline of a training program. They decide that the apprenticeship model seems to be the best option. As a natural outgrowth, this group is formally constituted as an apprenticeship committee and is charged with the responsibility of developing an apprenticeship program for heavy equipment mechanics.

Their first order of business is planning the apprenticeship program. Since five firms are involved, the committee members feel it necessary to establish a formal description of the work activities performed by heavy equipment mechanics. Because none of the personnel or training directors feel they have sufficient knowledge of the job, they delegate this responsibility to their general foremen.

The general foremen meet as a group to identify work activities. They use the procedures described in Step 4 to develop their processes description. The work process description developed by this group is in Figure 10.

Based upon the above work processes, the Analysis Committee determines the knowledges, motivations and psychomotor skills necessary to perform these activities. For purposes of this example, only the skills-knowledge analysis pertaining to the use of tools will be presented. The analysis sheet filled out by the Committee is presented in Figure 11.

Figure 10: Work Processes For Heavy Equipment Mechanic

1. Mount and adjust construction machinery equipment.
   a. Position construction equipment in proper mounting alignment.
   b. Mount construction equipment using proper mechanical fasteners.
   c. Connect mechanical, electrical and hydraulic linkages and controls.
   d. Inspect controls to verify that they are operating properly.
   e. Field or shop test mounting to insure proper operating condition.
2. Service and repair running gear.
   a. Inspect track chains, track rollers, front idlers, top idlers, pads and wheels.
   b. Remove, repair and install track chains.
   c. Remove, repair and install track rollers.
   d. Remove, repair and install front and top idlers.
   e. Remove, repair and install pads and wheels.
   f. Inspect and install wheel drums.
   g. Remove, inspect, replace and lubricate wheel bearings.
   h. Inspect, adjust and replace brake shoes.
   i. Inspect, disconnect, clean, overhaul and replace brake cyclinders.
   j. Inspect and replace brake lines.
   k. Inspect, test and replace steering linkage components.
3. Service and repair power train assemblies.
   a. Drain and replace power or lubricating fluid supply.
   b. Disconnect, adjust and reconnect control linkages.
   c. Remove, service and replace universal joints.
   d. Remove, inspect, repair and install clutches.
   e. Disassemble, inspect, replace parts, adjust and reassemble transmission and torque converters.
   f. Remove, inspect, adjust, replace parts and install differentials and final drives.
   g. Detect running faults in transmission, torque converters, differentials and final drives.
4. Service, repair and overhaul gas and diesel engines.
   a. Drain, change filters, replace and replenish chassis lubricants.
   b. Remove, inspect and replace manifold and head gaskets.
   c. Remove, clean, replace parts and install oil pumps and filter.
   d. Remove, clean, inspect and install cylinder heads.
   e. Remove, clean, replace parts, test and install valve lifters.
   f. Inspect, remove and replace timing chains, sprockets and gears.
   g. Remove, clean, inspect and install crankshafts.
   h. Remove, inspect, analyze wear and defects, fits and install bearings.
   i. Grind valves and ream valve guides.
   j. Remove, clean, inspect and replace camshaft and distributor drive.
   k. Clean, inspect and ream cylinder ridges and remove pistons.
   l. Remove connecting rods cap, inspect bearings and reassemble.
   m. Inspect and deglaze cylinder.
   n. Assemble pistons.
   o. Inspect connecting rods, realign and connect to pistons.
   p. Detect and diagnose engine faults.
5. Service and repair fuel system.
   a. Remove, clean and inspect air cleaner and filters.
   b. Remove, clean, replace and install fuel lines and filters.
   c. Remove, test and replace fuel pumps.
   d. Inspect, remove, repair and replace fuel tanks and filler pipes.
   e. Remove, replace and tune carburetors and fuel injectors.
   f. Dismantle, inspect, replace parts and reassemble carburetors and/or fuel injectors.
   g. Check and balance fuel ejection rates.
6. Service and repair electrical systems.
   a. Inspect, test and service batteries.
   b. Inspect, test and replace bulbs, fuses, lamps and gates.
   c. Test circuitry.
   d. Check, inspect, repair, and replace wirings and connections.
   e. Inspect, repair and replace wiring and connections.
   f. Remove, clean and install generators, starter and motors.
   g. Inspect, clean, replace points, adjust and test distributor assembly.

Figure 11: Skills-Knowledge Analysis Sheet (Things) (Tools)

A. List all major types of tools used:

1. Hacksaws, chisels, handcutters and other cutting tools
2. Pliers, clamps, vices and other holding tools
3. Wrenches, screwdrivers and other threaded fastening tools
4. Hammers, punches, drifts and other driving tools
5. Twist drills, reamers, borers, tools and coolants
6. Portable and bench power tools
7. Torquing devices
8. Taps, dyes and other threading devices

B. **Apprentice Must Be Able To:** (Check all that apply)

__X__ Select appropriate tool(s) for task at hand
_____ Make necessary set up or adjustments required to prepare and use the tool(s)
__X__ Use tool(s) in a safe and proper manner
__X__ Provide for routine care and maintenance

C. **Apprentice Must Know:** (Check all that apply)

__X__ Name of tool(s)
__X__ Distinguishing characteristics of tools
__X__ Purposes or functions served by tool(s)
__X__ Procedures for using tool(s)
__X__ Causes of tool-related accidents
__X__ Safety procedures
__X__ Maintenance procedures
_____ Scientific/physical principles underlying tool operation

D. Based on the worker knowledges checked above, please provide a description of the specific knowledges required for each area checked.

1. Learn names of all major classes of tools used, e.g., cutting tools, holding tools, fastening tools, driving tools, drills, reamers and boring tools, portable and bench bar tools, torquing devices, and taps, dyes and other threading devices.
2. Must know the characteristics that distinguish major types of hand and power tools used.
3. Must know the major purposes and uses of each class of tools.
4. Must know how to operate each class of tools in a safe and proper manner.
5. Must know the major hazards associated with the use of each major type of hand and power tools.
6. Must know the safety procedures to be used in order to avoid major tool hazards.
7. Must know how to maintain a class of tools in proper operating order, including cleaning, lubricating, storage procedures.

Additional Information

You may wish to consult the following reference for additional information on conducting occupational analyses

R.E. Adams. *DACUM Approach to Curriculum, Learning and Evaluation in Occupational Training.* Ottawa, Canada: Department of Regional Economic Expansion, Canada Newstart Program, 1975.

Self-Test Exercises

Answer the following questions in the space provided or on separate work paper. Compare your answers with those provided in the Appendix of this booklet.

1. List at least three ways to assess the need for apprenticeship training. For each method, identify a positive and a negative argument for its use.

   Method

   a

   b

   c

   For

   a.

   b

   c

   Against

   a

   b

   c

2. You have been called upon for ideas as to how support for an apprenticeship program may be developed. Outline a series of steps that could be taken

3. Describe the ways that an apprenticeship committee might be organized. List the major advantages for each method of organization.

4. Outline the procedure for constructing a work process description.

5. Which of the following statements do *not* qualify as work activities descriptions?

   a. Inspects castings for visual defects

   b. Familiar with reporting procedures

   c. Troubleshoots control panels

   d. Erects external siding according to specification

   e. Understands application of Ohm's Law to circuit design

6. Consider a specific apprenticeable occupation with which you are familiar. Outline a procedure for determining the *people related* skills and knowledges.

3. Skill: Establish Goals And Objectives For The Apprenticeship Program

Introduction And Objectives

Once the required knowledges, motivation and psychomotor abilities have been identified, a program must be designed for their attainment. The program design consists of two separate components (a) the basic standards that describe the characteristics and procedures of the program and (b) the statement of goals and objectives that indicate what the program intends to accomplish and the means for accomplishment. For the sake of clarification, standards have been divided into those that pertain specifically to the training activities and those that pertain to the administration of the training program. Standards that refer to conditions of training are referred to as *training standards*. Those that pertain to administration are termed *administrative standards*. *Goals* refer to those broad statements that describe the overall purpose of the training program. The means chosen for the achievement of these goals are termed *objectives*. Upon completion of this unit of materials, you should be able to demonstrate your competency by being able to:

1. Define the purposes served by apprenticeship program basic standards;
2. Identify the topics to be covered by basic program standards;
3. Construct and critique specific program standards;
4. Specify the distinction between program goals and objectives; and
5. Write and critique specific program goals and related objectives.

Why Do We Need Standards And How Do They Relate To Goals And Objectives?

If you think of planning as creating an organizational design to manage training, then standards serve as the blueprints of the training system. They show how the training will be organized and operated. Just as blueprints, when read by the skilled eye, describe the completed structure, so do standards describe the planning, implementation and management of an apprenticeship program. They convey in precise terms the content of the training program, the way the training program is organized and managed and the rules and procedures governing its operation.

Whereas standards are statements of what the program is, goals and objectives are statements of intended end results and procedures for the program. Program goals are statements of results expected to be achieved at some future date. They are broad targets that the program seeks to achieve. When taken together, they describe the basic mission or purpose of the program.

In contrast to goals, objectives are more immediate statements of short-term results necessary for goal attainment. Objectives should:

- be worthwhile and significant;
- make a real contribution to program goals;
- be set neither so high as to make them unattainable or so low that their achievement is meaningless,
- suggest appropriate strategy procedures and techniques for the attainment of related goals;
- indicate numbers to be served, skills to be developed and/or other measurable quantities that can be used to evaluate attainment of program goals;
- be precisely stated to reduce the possibility of misunderstanding their intent;
- be shared with those who have a stake in the apprenticeship program outcomes.

How To Set Standards

Work Processes

The most central training standard is that provided by the work processes description (refer to Chapter 2-Step 4). As you will recall, the work processes description states the general divisions of the apprenticeable occupation and the associated work activities that fall under each major division. These work activities are sequenced in the order in which they are to be learned. Taken as standards, these work activities provide the specification for the content to be learned in the course of the apprenticeship. They serve as ready communicators of the content areas to be mastered and place the emphasis directly upon observable behavior. This direct statement of expectations provides a clear message to the sponsor, the instructor and the apprentice as to what is to be learned and the sequence in which it is to be learned.

Related Instruction

Related instruction refers to the learning that takes place, usually in a classroom situation, that is designed to provide the knowledges and understandings needed to support and supplement actual job performance. The content consists of those concepts that flow from the application of more basic theories and practices to on-the-job experience. More basic theories and practices provide models that apprentices can use to derive meaning from their experiences and to explain why things happen as they do on the job.

Because these theories and models are more generalizable and are more difficult to infer from job experiences, it is frequently more efficient to deal with them in a classroom setting where the apprentice is free to engage in the more abstract considerations necessary for their understanding. A fundamental point of importance, however, is that these more basic and abstract theories, principles and models are of importance only to the extent they assist the apprentice to interpret his/her job experience and to perform his/her craft/trade more effectively.

The task is to decide which knowledges can be learned best on the job and which knowledges can be learned best in a related instruction context. This task can be approached by reviewing the knowledges identified in the skills-knowledge analysis sheets as described in Step Five of the previous Chapter. Each skills analysis sheet contains a listing of those knowledges identified as contributing to the performance of job skills. Each knowledge statement should be assessed to determine whether it can be learned best on the job, in a related instruction setting or in both settings. Make the decision by using the following criteria:

On-The-Job Training

- Can be used to impart knowledge in situations where apprentice can learn from direct observation and where there are standard operations, techniques and/or practices that can be observed and modelled by the learner;
- Is particularly well-suited to situtaions where the apprentice can infer desired knowledge from actual hands-on experience and can profit from trial and error, and where there are definite performance standards that can provide immediate knowledge of results that reward the learner for correct behavior.
- Most useful when mistakes are not overly costly in terms of spoiled material, damaged equipment.

Related Instruction

- Best suited for those situations in which knowledge cannot be gained from direct experience; e.g., understanding the flow of electricity, the operation of force, pressure or other theories where only the resultants of the theory can be observed;
- Situations where trial and error learning may be inappropriate; e.g., operational procedures where safety factors may prevent trial and error learning, situations that occur relatively infrequently but are critical when they do occur, and situations where verbal descriptions may provide an acceptable substitute for actual experience.
- Can provide a simulation of on-the-job behavior so as to reduce risk and cost.

Each knowledge statement should be evaluated according to the above criteria and a decision made as to whether it is more appropriately learned on the job, in a related-instruction situation or a combination of the two. Repeat this procedure until all the knowledge statements identified in Step 5 of the preceding chapter have been appropriately classified. The result will be an objective determination of the knowledges to be learned in related instruction.

These knowledges when collected together and presented as a list constitute the content standard for related instruction.

Safety And Health Training

Review the knowledge statements on the skills-knowledge analysis sheet to determine which statements apply to safety procedures. Identify, group and report separately the safety knowledges. They are the safety and health training standards for the apprenticeship program. If desired, these statements may be supplemented by a statement that provides assurances that these knowledges will be developed in a healthful work place that meets applicable federal and state requirements.

Term Of Apprenticeship

Review the work processes of the apprenticeable occupation and determine the number of instructional hours required to develop journeyman competencies in these work actvities. The decision should assume a journeyman with average mentality and capabilities and with no creditable prior work experience to draw upon. The total number of hours for similar apprenticeship programs can be used as a model. This data can be obtained from the State Apprentice Agencies, BAT representatives or from the standards prepared by the National Apprenticeship Committees.

Once a total number of hours has been determined, apportion the total number of hours across the major occupational divisions contained in the work processes description. Given that a specified number of instructional hours has been assigned to each major occupational division, allocate the hours to each work activity within that division. Thus, the finished product will be an allocation of the total number of instructional hours to each work activity comprising the work processes description. Instructional hours so allocated become the standard and serve as the basis for management of the apprenticeship training.

Instructional hours also should be allocated to related instruction. Review each knowledge statement and estimate the number of instructional hours required to develop competency in that knowledge area. Total the instructional hours assigned to related instruction and review the total in comparison with the total number of instructional hours. If the number of instructional hours assigned to related instruction appears disproportionately large or small, the allocation procedure can be modified accordingly.

The result of this process is an assignment of instructional hours to related instruction based upon the knowledges to be learned in training other than on-the-job training. This provides a specific and defensible argument for the assignment of specific numbers of instructional hours to related instruction. These hours, once specified, constitute the standard with respect to the number of program hours devoted to related instruction.

Probationary Period

A probationary period should be established during which the apprentice must demonstrate his/her capability to learn the skills necessary to function as a craft/tradesperson. As a general rule, a period of one year is a commonly accepted probationary period. Whatever the period, the means of appraising apprenticeship performance to determine whether the apprentice has passed the probationary period should be made explicit. Performance appraisal is generally a function of supervisory evaluation and is described in the next section.

Program Evaluation Records

Standards should be set describing the procedures for recording the performance of apprentices as they progress through the program. A simple and direct way is to use the work process description. This provides a sequential statement of the work activities that an apprentice must learn in order to be deemed qualified to perform as a skilled trades/craftsperson. Performance is best appraised by the immediate supervisor in terms of job performance and by the related instructor. For the case of the apprentice supervisor, it is recommended that performance be rated on a simple five point scale with scale values being interpreted as follows:

0- Apprentice unable to perform work according to acceptable standards;
1- Apprentice requires direct supervision and considerable assistance in defining the task to be performed, selection of tools, handling of materials, sequencing of job activities, and so forth;
2- Apprentice can work unassisted on job under fairly routine standardized conditions but requires assistance in getting started and in dealing with unanticipated problems, events and circumstances;
3- Apprentice able to work without assistance in work activities under standardized conditions, may require occasional assistance in dealing with specific problems and/or in diagnoses of malfunctions or dealing with other unusual circumstances;
4- Apprentice able to perform as journeyman, working without direct supervision and successfully performing/solving all work-related problems.

Arrangements should be made for periodic assessment of apprentice performance. The apprenticeship supervisor initially should rate the competency of the apprentice on every activity in the work process description using the five-point scale. A meeting should be arranged with the apprentice to provide him/her an opportunity to rate his/her own performance using the same scale. Compare the apprentice's self-rating with the supervisor's rating to determine areas of discrepancy.

It is recommended that an apprentice, in conjunction with the supervisor, work out a plan by which the apprentice develops competencies in specified work areas. This plan may be very informal and consist of little more than an agreement between the apprentice and the supervisor as to the work activities on which the apprentice will concentrate and an approximate date for attainment of that competency. A more formalized plan might identify specific work activities on which the apprentice intends to concentrate, describe learning activities, and specify target dates.

The rating must be based upon assessment of actual behavior or the product of that behavior. Supervisors should rate apprentice competency using actual observation of performance supplemented with analysis of finished products. The rating procedure motivates apprentices since work activities (expected behaviors) and the procedures for their evaluation are explicitly known to the apprentice.

Make a copy of the work process description for each apprentice on which to record progress. Note supervisor ratings beside each work activity with the date of the rating. The personalized work process description is a record of individual performance.

Ratings can be used to determine the rate of apprentice progress towards attainment of that particular competency. A personalized work process sheet can also be used to keep a running record of the actual hours that each apprentice has logged in towards obtaining competency for that particular work activity. By comparing the number of hours actually expended with the number of hours allocated and the progress towards competency attainment, the supervisor has a valuable tool to use in the appraisal of apprenticeship progress. A formalization of the work process descriptions as a recordkeeping device for apprentices can be used to constitute the standard

Supervisory Ratio

The number of apprentices to be supervised by each journeyman should be specified as a program standard. The standard insures that the apprentice/journeyman ratio does not become too large so as to preclude efficient supervision. A general rule of thumb in principles of management is that the span of control should not exceed seven to nine. Translated to apprenticeship training, this would mean that ideally no journeyman should supervise more than seven to nine apprentices, unless unusual circumstances are present. In practice, given that journeymen must supervise *and* train apprentices, probably five apprentices per journeyman is a sufficient number. Remember, because apprentices move from work station to work station across the apprenticeship term, each apprentice will (and should) work with a number of different journeymen.

Qualification For Apprenticeship

Standards should be prescribed that indicate admission requirements. To the extent possible, admission requirements should be based on objective evidence that the requirements are related to performance in the apprentice program. The motivation and physical abilities identified in the previous chapter provide an ideal source for admission requirements. Recall that the Analysis Committee specified all physical activities that required excessive or unusual demands. They also identified those occupational duties that an apprentice must be willing to perform, those occupational areas of job satisfaction, and those areas that require develop commitment. A listing of these areas provide valuable information to prospective apprentices. Taken together, these factors can be used as an objective rationale for the determination of admission standards. Admission standards also should include minimum age. As a general rule, apprentice minimum age ranges from sixteen to eighteen.

Equal Opportunity

Equal access to training opportunities is a national priority and is important to ensure that all persons have an opportunity to apply. Apprenticeship programs should incorporate into their standards statements to the effect that the recruitment, selection, employment and training of apprentices shall be done without discrimination as to race, color, religion, national origin or sex. Title 29 of the Code of Federal Regulations — Part 30 pertains to this area. Consult it as a basis for formulating standards dealing with equality of opportunity and access. Also consult information from the Department of Labor about successful outreach and expansion programs that can be used as models.

Apprenticeship Agreement

A central distinguishing feature of the apprentice mode of training is that there is a legal agreement between the sponsor and the apprentice. This legal agreement should provide for:

- The name of the apprentice;
- Address of the apprentice;
- Signature of parent or guardian (if applicable);
- Name of employer and address;
- Signature of authorized company official;
- Provision for approval by the Apprenticeship Committee;
- Provision for sign up by registration agency (if registered);
- Title of apprenticeable occupation;
- Probationary period;
- Term of the apprenticeship;
- Credit for previous experience;
- Date apprenticeship begins;
- Term remaining;
- Biographical information on apprentice (sex, race, ethnic group, highest educational level, etc.);
- Inclusion of standards pertaining to work processes, planned related instruction, wage scale;
- Other standards as may be deemed appropriate.

It is recommended that the State Apprenticeship Agency be contacted, especially if registration is envisioned since some states have specific contract format requirements. In

some instances, the apprentice is indentured directly to an area joint apprenticeship council rather than an employer and, hence, the contract is between the apprentice council and the apprentice.

It is recommended that a standardized legal contract form be drawn up and used for all apprentices in the program. This apprenticeship form then becomes a standard for the apprenticeship program. Since the contract is a legal document, services of a lawyer to review the legality of the proposed form is advisable unless a standardized contract form designed by the State Apprenticeship Agency or BAT is used.

Credit For Previous Experience

Procedures should be developed that provide for credit to apprentices for competencies gained from previous experience. Allocation of credit for previous experience should be based upon a review and assessment of work activities, using the rating scale as previously described.

One way to determine credit for previous work experience is to assign percentages for each scale value. For example, you might provide 25% credit for a rating of 1, 50% credit for a rating of 2, 75% credit for a rating of 3, and 100% credit for a rating of 4. Thus, an apprentice who claims a competency in a particular area can ask for and receive a performance rating. Based on the rating, a portion of instructional credit will be granted. Other schemes for prior credit include credit for prior training experiences, credit for prior supervised work experience, and credit based on results of performance tests such as the National Occupational Competency Tests. Remember, the more explicit you are about the competencies required of a journeyman and the more highly developed your testing program, the easier it is to determine the value of prior experience. Also, remember that in some programs, prior credit is withheld until the probationary period is passed. The procedure, once formalized, should be constituted formally as a program standard.

Wage Schedule

Provision for a progressive wage based upon progress through the apprenticeship program should be included as a program standard. Wage progression arrangements can vary from advancement based on time in the program to a wage structure that is based upon performance attainment. An attainment-based wage structure can be tied into the rate of progress in learning work activities as determined from an analysis of the apprentice's individual performance records.

Recognition For Completion

Apprentices should receive formal recognition for completion of the program. Recognition may take the form of a certificate or diploma signed by the appropriate officials. The certificate attests to apprentices having completed all program training requirements. Make certain that the certificate or diploma has an official look, that it is signed by the appropriate official and that it attests to the fact that the named apprentice did in fact complete all program requirements. Often it is useful to record the work activities that the apprentice is capable of performing. The work process description can be printed on the certificate or as an attachment. Work process descriptions, if included, should be signed by appropriate officials signifying that the apprentice has demonstrated competencies in the areas so indicated.

Union/Management Cooperation

In those areas covered by collective bargaining agreements, provisions should be made for including union representation in all areas of apprenticeship program standards. The specified procedures by which union contributions are incorporated into the design of the training program should be included as a formal standard.

How To Establish Goals And Objectives

A *goal* is a results-oriented statement of intent. Goals are written and provide a general description of an outcome selected to satisfy an individual sponsor or community need. Goal statements clearly designate the desired outcome to be attained as well as who will benefit from the attainment of this outcome. Possible outcomes from an apprenticeship program include:

- Provide a pool of trained craft workers to meet present and future sponsor/employment requirements;
- Assure a supply of skilled workers that will support community economic development expectations;
- Provide increased quality of goods and services produced;
- Increase worker productivity;
- Provide workers a greater degree of job security that comes from having a skilled trade or craft that is in demand;
- Provide versatility of skills needed to meet changing technological requirements;
- Attract capable young men and women into the industry.

Since apprenticeship program outcomes generally pertain to desired changes in the skills of people to the benefit of businesses, individuals, and society, goal statements should contain a results oriented verb that identifies the direction of the desired change.

Verbs Commonly Used With Goals

increase	decrease
expand	reduce
enhance	diminish
develop	lessen
improve	shorten
equalize	curtail

Formulation of goal statements requires that expected outcomes be linked with specific target groups. Target groups with special relevance for apprenticeship programs include:

- Apprentices of all types including adults, youth, women, minorities, veterans;
- Business and Industry
  - Organizational divisions within a specified firm;
  - Sponsoring business firms and organizations;
- Unions
- Local community
  - Employer groups and/or associations;
  - Community residents;
  - Local businesses dependent upon community prosperity;
  - Local economic development.

Example Of A Typical Goal Statement

To Improve The Recruitment → of → Young Women Into The Apprenticeship Program

Outcome — *Target Group*

An *objective* is a detailed and specified description of an outcome. Usually it is written and describes the intended results and objectives in measurable terms. There may be several objectives for each goal. Usually good planning specifies no more than three or four objectives for each goal. Objectives are the means for the achievement of apprenticeship program goals. The fact that objectives focus on means rather than final outcomes provides the basic distinction between goals and objectives.

Objectives should state: (a) what action is to be taken to achieve the goal; (b) what measurable results are to be anticipated to be achieved by the action; and (c) within what time period the results are to occur.

To illustrate how objectives differ from goals, consider the goal: *to increase the versatility of skills necessary to meet changing technological conditions.* A set of objectives supportive of this goal might include:

- To analyze within the next three to six months the skill implications of technological advancements in equipment, machinery, materials and processes used in the apprenticeable occupation;
- To review within the next eight months the work processes descriptions in light of change in technological requirements;
- To revise by the end of the calendar year the work processes descriptions to reflect changing technological conditions.

Objectives should begin with strong action-oriented verbs that describe an observable or measurable behavior. The following list illustrates the broad range of program actions that are supportive of goal attainment

Verbs Commonly Used With Objectives

design	implement
prepare	place
involve	serve
inform	support
offer	encourage
provide	enable
stimulate	communicate
review	coordinate

Goals and objectives can be formulated according to a five-step process. Each step represents a set of activities that should be performed in logical order.

Step 1: Assign Responsibility To A Designated Group

Responsibility for formulating goals and objectives should be assigned to a specific group. The most reasonable assignment of responsibility would be to the Apprenticeship Committee which has responsibility for overall program planning. Goals/objectives formulation is a necessary part of planning responsibilities.

Step 2: Secure And Utilize Necessary Supportive Information

In order to insure that goals/objectives are based on best available evidence, data from a number of sources should be assembled and utilized by the Apprenticeship Committee in the goal/objective formulation process. Data should be obtained from the following sources:

- Program standards;
- Skills-Knowledge Analysis Sheets;
- Motivation and Physical Requirements Analysis Sheets;
- Sponsor expectations as to program results;

- Expectations from community support groups,
- Descriptive information of similar programs conducted in other localities,
- Available information from State Apprenticeship Agency and or BAT representative,
- Union expectations as to program outcomes,
- Data from local employers indicating need for apprenticeship program,
- Statements of support from community leaders,
- Standards prepared by National Apprenticeship Committee;
- Relevant Department of Labor materials.

Step 3: Identify The Target Groups To Be Served By The Apprenticeship Program And The Specific Needs Of The Group Filled By The Program

For each identified target group, specific needs may be developed by the Apprenticeship Committee, either as a group or individually. When all the needs have been identified, then the group can turn to the separate discussion of each identified need. Choose a particular procedure based upon the individual styles and preferences of committee members.

Step 4: Define The Apprenticeship Program Outcomes The Best Serve Identified Target Group Needs

Once the needs of various target groups have been identified, identify the program outcomes considered to satisfy these needs. As a general rule, specify no more than two or three outcomes for each identified need. Outcomes may be solicited formally from each Apprentice Committee member or generated from free group discussion. In the case of disagreement between Committee members, try to secure agreement on the suitability, practicality and general intent of the outcome statements. Retain only those outcome statements for further consideration on which consensus is obtained.

Step 5: Formulate Objectives For Each Goal

Once outcomes have been defined, they can be translated into goal statements by linking outcomes with corresponding target groups. Then objectives should be formulated for each goal. The Apprenticeship Committee must insure that objectives are measurable and specified. Further, objectives must serve the goals formulated in Steps Three and Four. Each objective should state only a single aim or purpose and should specify a single end product or result within a specified time frame.

Example

As you may remember, the ABC Construction Company played a key role in the establishment of a heavy equipment mechanics apprenticeship program serving five local employers. The Apprenticeship Committee consists of the personnel and or training directors representing the five sponsoring firms. During the early stages of planning the program the Apprenticeship Committee has met frequently to discuss the major purposes to be accomplished by the program and to set the program standards that will serve to guide program administration. One area that Bob Anderson, the ABC Company Personnel Director, was particularly interested in dealt with evaluation of apprenticeship progress and recordkeeping. He was personally convinced that knowledge of apprenticeship progress should be made available to the individual apprentices and used to motivate their performance. He was further concerned that the assessment of apprenticeship performance should not be regarded as a test with negative consequences if one failed, but rather as a verification that the apprentice had indeed advanced to another plateau of competency. He also was firmly convinced that apprentices should be given much of the responsibility for their own learning. He was successful in persuading other Committee members to accept this view and to design a rating and recording system that incorporated this philosophy.

The assessment system designed by the Committee provides for a large amount of interaction between the supervisor and the apprentice in the evaluation process. Upon entry into the apprenticeship program, the system provides for apprentices to rate the level of their competency on each of the work activities in the work process description. Some Committee members initially raised questions about the wisdom of allowing apprentices to rate their competencies. The argument in support of self ratings was that the self rating exercise would expose the apprentice to the range of work activities for which competence was required as well as focus the apprentice's attention on the assessment of their present skills level. Rather than tending to overrate themselves as some few members feared, the consensus of Committee opinion was that the apprentices would be realistic in their self-appraisal and, if anything, would tend to be conservative in their self-appraisal.

Upon completion of the initial self rating, the design calls for the apprentice and his/her supervisor to meet and to discuss the self ratings. The supervisor's role is to assess the apprentice in terms of formal qualifications and observations of performance and to interpret the apprentice's self rating against the supervisor's perceptions. The result of this meeting is consensus between the supervisor and the apprentice as to the level of competencies the apprentice is bringing into the program. At this time, if any credit for prior experience is warranted, the supervisor is expected to discuss those areas with the apprentice and to indicate those areas in which possibly relevant experience or credentials are disallowed

As an outgrowth of this original meeting, the supervisor and the apprentice agree upon certain work activities that the apprentice will concentrate upon in the near future. These work activities are identified, bearing in mind the sequence of activities to be learned as identified in the work processes. Approximate dates for moving to the next competency level on the rating scale are identified and agreed upon in principle by both the apprentice and the supervisor. This informal contract is expected to make more concrete the learning expectations of the apprentice in the near future. Also, it provides the apprentice a goal on which to concentrate his/her activities. From the standpoint of the supervisor, it provides a rationale for work assignment that contributes to apprentice growth.

The proposed system also provides for an assessment of apprentices' skills when the apprentice feels that he or she is ready for that assessment. This raised some questions initially by some Committee members who were doubtful about the value of allowing apprentices to determine when their performance should be rated. The counter argument was that continual assessment on demand provides apprentice responsibility for directing the rate of learning and requires more self-autonomy with corresponding motivational value. Once the apprentice determines that he or she has mastered the work activity, a request to be fomally rated is made to the supervisor. The supervisor has the prerogative to refuse this request if there is reason to believe that the apprentice is obviously not ready. The supervisor rates the apprentice using a combination of accumulated evidence gained from continual observation of the apprentice at the work station and of the quality of a specific piece of work that was agreed upon to be used as a job sample. Concentration upon a specific piece of work allows the supervisor to use specific examples to support his rating.

Additional Information

For more information on developing goals and objectives, you could refer to the following:

D W Drewes. *Education and Training for Older Persons. A Program Guide.* Washington, D.C.: U.S. Government Printing Office, 1981

Self-Test Exercises

Answer the following questions in the space provided or on separate work paper. Compare your answers with those provided in the appendix of this booklet.

1. Describe the purpose served by apprenticeship standards.

2. List the topics that should be covered by apprenticeship program standards.

3. The Tri-Town Area Apprenticeship Council has requested assistance in determining standards regarding related instruction. What procedure for constructing these standards would you recommend.

4. How do goals and objectives differ?

5. Suppose that you were called upon to develop objectives for an apprentice program. What criteria would you use in writing objectives?

4. Skill: Incorporate Ideas That Facilitate Upgrading Of Program To Keep Current With New Technology, New Training Ideas And Changes Occurring In The Occupation

Introduction And Objectives

Change is a way of life. Although always present, it is now more than ever important to be able to adapt to the wave of new technology The information revolution has replaced the industrial revolution and no one is isolated from its effects The age of electronics and progress in micro chip technology is altering our lives. The computer is expanding our capacities at an explosive rate and is changing the way work is performed. This change cannot be ignored by those programs that develop the trades and crafts skills that make our standard of living possible To be ever responsive to the changing demands of technology represents a continuing challenge to apprentice training

As you work through the material in this unit, you must strive to sharpen your awareness about the nature and direction of technological change and its implications for apprenticeship training. When you complete this unit, you should have the competencies to:

1. Locate one or more new technologies likely to change occupational skills requirements;
2. Critique and identify new technology to determine skills implications;
3. Revise work processes to account for changing skills requirements;

Why Be Concerned With Technological Change?

Technology is changing at an explosive and, to some, an alarming rate. We stand on the threshold of an information revolution that likely will surpass in magnitude the developments accomplished during the industrial revolution. Tiny micro-chips that can rest on the head of a pin have made possible the development of desk-sized microprocessors that accomplish what a room full of computers did only a few short years ago. Light, when properly focused, can be used to cut metal. Computer-controlled robots will replace their human counterparts in the performance of varied industrial activities. Employers are expected to turn to new technology in an effort to improve productivity and to maintain a competitive position in world markets.

Technological change influences work in varied and changing ways. In some instances, existing skills will become obsolete. In others, the technology will upgrade existing skills by placing an increasing premium upon diagnostic and problem-solving capability or by requiring new skills in order to work with new materials, machines or processes. Whereas technology may eliminate some jobs, it will create others. Although the exact impact of technology is difficult to predict, it certainly will influence to some degree most apprenticeable occupations. The anticipation of forthcoming technological changes and the modification of apprenticeship programs to accommodate to these changes is the responsibility of good program planning.

How To Keep Apprenticeship Programs Current

Technology seldom changes abruptly enough to render an occupation totally obsolete. What happens instead is that over a period of time, the occupation changes to accommodate the skills required by the technology. The rate of that change depends upon the speed at which the technology is adopted. If apprenticeshp training is to be a viable training mode, it must produce journeymen with the skills demanded by the current state of technology. To do otherwise runs the risk of preparing people whose skills are obsolete and their resources wasted in terms of potential benefit to society.

Updating apprenticeship programs to insure that they are in accord with current technological requirements is a three-step process. New and changing technolgical demands first must be identifed. Once identified, the implication of these technological changes with respect to skills training can be assessed. The capabilities of existing apprenticeship programs to produce competencies and skills can be compared against the changing skill requirements and the programs updated so as to produce the skills demanded.

Step 1: Identify New Technologies That Likely Will Impact On The Occupation

This task requires knowledge of the state-of-the-art technologies that soon will be available in the marketplace and are expected to influence current craft skill requirements. These technologies may be incorporated in new machinery and equipment, materials, tools, or changes in marketing, sales, distribution or manufacturing processes that can be expected to influence the apprenticeable occupation. Locating these technologies requires the development of an intelligence network that provides information as to forthcoming changes in products and procedures. Important sources for information about anticipated technological changes include:

- Trade publications;
- Manufacturing sales representatives;
- Trade associations;
- Universities and community colleges (especially those that have an extension service);
- Newsletters that specialize in new technology identification;
- Consultants;
- Other industry representaties.

This information should be systematically collected and periodically reviewed to determine its implications for the apprenticeable occupation. The review should concentrate upon determining whether the technology is currently available in the marketplace, and what would be the likely rate and scope of its use by business and industry. Determination of use frequently will involve assessment of the likelihood that one of several available prototypes ultimately will become the industry standard.

The Apprenticeship Committee should bear the central responsibility for reviewing the technological scene and for determining which technologies have the greatest likelihood of changing the skill requirements in apprenticeable occupations. The committee must decide the extent to which new technologies will have a direct influence on the shop floor. If the technology appears destined for use by the industry, then it is the responsibility of the apprenticeship program to incorporate this change into its training plan.

Step 2: Assess Impact On Training Requirements

Once a technology has been identified as having the potential for altering the competencies required in an apprenticeable occupation, the impact of that technology on skills training must be assessed. Assessment requires that the new technology be understood in detail. Hence, the requirement in Step One that an information network about potential technological changes be established. Product descriptions should be carefully reviewed and the areas of change pinpointed. These areas of change must be scrutinized to determine whether existing skills will suffice or whether new skills will be required. In some instances, the technological change will require only that the craftsperson have knowledge of the properties of a new material or a minor modification of an existing process. In other instances, the technology will alter completely the nature and sequence of the work activities and will require the learning of new skills. Electronic components is a particular case in point. If the electronic componentry is modularized and repair is simply replacement with another like unit, then the impact of the technology is relatively minor. If, on the other hand, repair does not involve interchangeable units and must be performed on site, then the skills impact of the technology could be considerable. Such characteristics of new technology must be carefully reviewed to determine skills impact.

For each technology that has been identified to impat on the occupation in question, a description of the worker skills requirements should be prepared. Worker skills analysis should describe the worker skills in terms of:

- Information to be processed;
- Operational processes;
- Repair skills;
- Routine maintenance skills;
- Problem-solving skills; and
- Changes in organization of work that would alter the people-related skills.

The apprenticeship committee should document their findings. Documentation should be organized according to major skills areas. This documentation may be formal as in the case of a report or informally presented as a discussion document. The important point is that an active attempt be made to determine the implications that the new technology will have for craft skills.

Step 3: Update Apprenticeship Program To Take Into Account Anticipated Skills Requirements Due To Changing Technology

The results of the skills analyses performed in Step Two should be used as a criteria to assess the adequacy of the existing training program. Compare the work activities and their associated knowledges against the skills required by the new technology. Review existing work activities and knowledges to determine what modifications may be necessary to incorporate new skills demands. The appropriate location for modification should be determined as well as the nature and scope of modifications required to expand existing skills training to incorporate new demands.

Revisions in the work activities and associated knowledges have implications for program standards. Do revisions call for increasing the term of apprenticeship? Can emphasis on other skills be reduced while keeping the number of total hours constant or must additional hours be added?

The decision about whether the skills should be developed, whether on the job or in related instruction, also must be reconsidered. If assigned to related instruction, the impact on the total number of apprenticeship hours assigned to related instruction must be reevaluated.

Such changes will affect program standards. Make the effects explicit by revising standards accordingly. Only through the development of such a procedure for systematically determining the effects of technological change can the apprenticeship program be considered truly responsive to the apprentice, the sponsor, the community and society.

Example

The Clover Manufacturing Company sponsors an apprenticeship program for machinists. The company, as part of a major capitalization effort, has been considering the acquisition of computer-controlled milling machines. The plant manager, the production engineer, and the purchasing agent have been investigating the market with respect to competing manufacturers. In the course of their deliberations, they have collected information about computer-controlled milling machines and their capabilities.

Having heard about the interest in moving from numeric to computer control, Sandy Dickerson, Chairperson of the Apprenticeshp Committee, approached management with her concern about the implications for the apprenticeship program. Management concurred that conversion might introduce a problem and encouraged her to assess the implications for the apprenticeship program. They made available for study all written information about equipment options.

The Apprentice Committee conducted a detailed study of the matter beginning with a review of available information. Eventually a decision was made by company management to purchase equipment from a particular manufacturer. The sales reprsentative was requested to provide specific information to the Apprenticeship Committee. As an outgrowth of their analyses, the Committee determined that the only significant change seemed to be in the use of the microprocessor to control milling machine operations. As a result of their investigation, they came up with the following new work activity: "Must be able to input machine-setting parameters into the computer." This replaced a previous work activity: "Must be able punch and load paper tape into control device." The Committee believed that the learning time for the two activities were equivalent so that no adjustment was required in the term of the apprenticeship program. Since the work activity was judged to be learned on the job, there was no implication for standards pertaining to related instruction. No other changes in apprenticeship program standards were required. With this modification, the Apprenticeship Committee felt confident that their program was responsive to state-of-the-art technology demands.

Additional Information

You may also refer to the following related sources:

D.W. Drewes. *Working for America: A Worker-Centered Approach to Productivity Improvement.* Raleigh, NC: CONSERVA, Inc., September 1982.

D.W. Drewes. *Vocational Education: Its Role in Productivity Improvement and Technological Innovation."* Raleigh, NC: CONSERVA, Inc., September 1982.

J.A. Jaffe, E.H. Oglesby and D.W. Drewes, eds. *Technologies of the '80s: Their Impact on Trade and Industrial Occupations.* Raleigh, NC: CONSERVA, Inc., September 1982.

Self-Test Exercises

Answer the following problems in the space provided or on separate work paper. Compare your answers with those provided in the Appendix at the back of the booklet.

1. Indicate how you would go about locating new technologies that are likely to change occupational skills requirements.

2. Outline a procedure for assessing the implications of new technology with respect to skills training.

3. Describe a procedure for revising the work activities and associated knowledge to reflect changing skill demands.

5. Appendix

Answers To Self-Test Exercises

2. SKILL: Conduct Occupational Analyses To Determine Need For, Support For And General Content Of The Program

	Method	*For*	*Against*
1. a.	Formal employee survey	Comprehensive coverage	Time consuming
		More accurate results	Costly
b.	Informal employer survey	Faster	May be biased
		Requires less effort than survey	Limited coverage
c.	Secondary data from other source	Easy to acquire	May not be available
		Data collected by 'experts'	Data may be outdated
			May not apply to local conditions

2. Steps for support building should include:
   a. Document shortage of craft/trade skill.
   b. Identify potential sponsors (employers and/or unions) affected by skills shortage.
   c. Draw up a list of benefits of apprenticeship training.
   d. Anticipate arguments against apprenticeship training.
   e. Show potential sponsor(s) that potential benefits from an apprenticeship program can be expected to exceed anticipated costs.

3 a.	*Single Employee*	Single firm provides major employment opportunities for craft/trade
b.	*Group of Employees*	Skills shortages experienced by multiple employees
c.	*Labor Organization*	Union has historically assumed responsibility for craft training
d.	*Combination*	Collective bargaining agreement between management and labor

4. a. Form an Analysis Committee
   b. Appoint a Chairperson
   c. Convene committee
   d. Instruct committee as to purpose
   e. Identify major work categories
   f. For each major work category, define work activities
   g. Order work activities according to order of learning
   h. Record major work categories and associated work activities ordered according to learning priority.

5. h. and e. Both statements refer to required knowledges (familiarity and understanding) rather than actual job behavior.

6. You should consider the following elements:
   a. Identify and describe types of people required to be dealt with in the course of performing the job.
   b. Define the job skills required to deal with the people identified.
   c. List the major knowledge areas that are necessary in order to exhibit the job skills defined in b.
   d. For each major knowledge area identified in c., provide a more specific description of the knowledge(s) required.

3. SKILL: Establish Goals And Objectives For The Apprenticeship Program

1 a Describe structure of the program.
b Communicate program procedures
c Serve as guidelines for program administration

2 a *Training Standards*

Work Processes
Related Instruction
Safety and Health Training
Terms of Apprenticeship
Probationary Period
Program Evaluation Records
Supervisory Ratio

Administrative Standards

Qualifications for Apprenticeship
Equal Opportunity
Apprenticeship Agreement
Credit for Previous Experience
Wage Schedule
Recognition for Completion

3 In developing related instruction standards, you should.

a Review the skills-knowledge analysis sheets
b. Identify knowledge and understandings that

- Deal with basic theory and principles
  Cannot be expected to direct observation and, or on-the job experience
- Are crucial to job performance but occur so infrequently that they are not likely to be learned on the job
- Require charts, graphs, and other supplemental material to assist learning
- Will profit from group discussion and problem-solving

c. Assign a number of contact hours considered necessary to master each knowledge and skill.

d. Total the number of hours of related instruction and compare with total number of hours allocated to the apprenticeship program.

4. *Goals* are general statements of program intent stated in terms of a target group to be served and a desired outcome for that target group.

Objectives are specific statements as to how the goal will be attained in terms of actions to be taken, measurable results to be achieved and the timeframe allowed.

5. Objectives should:

a. Be worthwhile and significant
b. Be realistically achievable
c. Describe appropriate strategies for goal attainment
d. Indicate numbers served, performance to be attained or other measurable results
e. Be precisely stated to insure understanding.

4. SKILL: Incorporate Ideas That Facilitate Upgrading Of Program To Keep Current With New Technology, New Training Ideas And Changes Occurring In The Program

1. Gather knowledge about technological changes from a variety of sources including:
   a. Trade publications
   b. Manufacturers' representatives
   c. Universities/community colleges
   d. Trade associations
   e. Consultants
   f. Knowledgeable company personnel
   g. Local businesses and industry with similar craft/trade requirements.

2. a. Identify nature of technological change in terms of
      · equipment/machines
      · operational processes
      · materials
      · tools
      · work setting
   b. For each area of change identified in (a), analyze the impact on job skills with respect to
      · operational skills
      · repair skills
      · problem-solving, diagnostic or trouble-shooting skills
      · data collection and analysis skills
      · people-related skills
   c. Identify new knowledge requirements related to
      · operational procedures
      · maintenance procedures
      · repair procedures
      · troubleshooting procedures
      · safety procedures
      · materials handling
      · basic theory

3. a. For each new knowledge requirement, review existing work activities and knowledges and select those that come closest to matching the new requirements;
   b. To the extent possible, modify existing knowledges to incorporate new requirements;
   c. For those instances where no similar current knowledge existed, add the new knowledge to the apprentice program content.
   d. Determine whether the new knowledge can best be gained through on-the-job or related instruction;
   e. If on-the-job, modify the work activities to provide opportunity for mastery of new knowledge;
   f. If the new knowledge is to be gained through related instruction, modify the standards for related instruction accordingly.

Posttest

Directions. *Read the following questions. For those requiring written answers, write your answers in the space provided. For multiple choice questions, circle the letter(s) of the correct answer or answers. Remember that more than one answer may be correct. Check your answers with the suggested answers that follow the questions. If you answer at least 70 percent of the questions correctly, you have successfully completed this module. If not, repeat the section(s) of this module with which you had the greatest difficulty.*

1. Which of the following is *not* a direct responsibility of an apprenticeship committee?

   a. Development of selection standards
   b. Assessment of individual apprentice performance
   c. Establishment of training curriculum
   d. Certification of completion

2. Classification of work activities by major activity areas is termed _____

3. The most direct indicator of need for an apprenticeship program is:

   a. shortage of skilled craft/trade workers.
   b. lack of existing training systems.
   c. employer support.
   d. increased applicant interest.

4. In developing work activities, statements such as "Apprentice must be familiar with . ." or "Apprentice must be aware of . . ." should be avoided because _____

5. The analysis sheets used to analyze an occupation are organized according to three major dimensions. Name the three occupational dimensions.

   a. _____ b. _____ c. _____

6. The purpose of the occupational analysis sheets is to:

   a. identify job skills.
   b. determine equipment needs.
   c. specify worker skills and knowledges
   d. all of the above.

7. Apprenticeship program goals should contain a clear statement of (a) _____ and (b) _____

8. Apprentice program standards are useful because they describe (check all that apply)

   a. the content of the program.
   b. expected program results.
   c. the way the program is organized.
   d. the rules governing program operation.
   e. strategies for the attainment of program goals.

9. Describe the criteria to be used in deciding whether knowledges and skills should be learned on the job.

   a.

   b.

   c.

10. List at least three ways that credit should be given for previous experience.

    a.

    b

    c.

11 Identify the three procedural steps for determining the effects of technological change on apprenticeship programs.

    a.

    b

    c