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ABSTRACT

This learning module on selecting, clustering, and sequencing performance and supplemental objectives is one of nine developed for use in training administrators, teachers, and prospective teachers in the utilization of Vocational-Technical Education Consortium of States (V-TECS) catalogs of performance objectives, criterion-referenced measures, and performance guides. Information, guidelines, exercises, and self check quizzes are provided on each topic: selecting, clustering, and sequencing performance and supplemental objectives. Examples of module behavior objectives are these: be able to give reasons for deleting performance objectives from a V-TECS catalog; the characteristics of performance objectives provided in a V-TECS catalog; criteria for clustering or grouping performance objectives into units of instruction; and guidelines for sequencing performance objectives or tasks within a unit or cluster. A glossary of terms and a glossary self check are also included. (The instructor's handbook, CE 017 440, contains the checkout activity, a multiple-choice test keyed to the behavioral objectives stated at the beginning of the module. The modules are designed for use with individuals or with groups.) (JH)

Implementing Performance-Based Vocational Education Utilizing V-TECS Catalogs

MODULE 3

SELECTING, CLUSTERING AND SEQUENCING PERFORMANCE AND SUPPLEMENTAL OBJECTIVES

State Department of Education
Office of Vocational Education
Columbia, South Carolina 29201

In cooperation with

Vocational Education Media Center
Clemson University
Clemson, South Carolina 29631

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INTRODUCTION:

Perhaps the most creative and exciting part of teaching is curriculum design and development. And although most teachers do not consider themselves curriculum designers and developers, most of them do, in fact, design curricula. As mentioned earlier, "The curriculum is what students actually do in the classroom or laboratory of a school and not what a curriculum guide says it is."

One of the recurring debates among educators concerns the degree to which the local teacher should be responsible for designing curriculum for a class. The argument is usually stated somewhat as follows: "Which is more valuable—a curriculum-proof teacher or a teacher-proof curriculum?" In other words, would you rather have a curriculum so comprehensive and precise that the design skills of the teacher are not needed or a gifted teacher who is so talented in designing curriculum to meet the needs of students that a curriculum provided by someone else is not needed? Or put even more simply, "Which had you rather have in the kitchen, a good cook without a recipe or a not-so-good cook with a recipe."

The success of an instructional program depends on you, the instructor, in both roles – formulating your "own recipe" and doing your own "cooking." V–TECS catalogs do not provide a curriculum design. In terms of the analogy being used, they only help us decide what to cook, not what the recipe should be.

The purpose of the next three modules is to provide suggestions for designing and developing curricula using the V–TECS catalogs as the major source for expression of objectives. Or, to continue our analogy, they deal with formulating the "recipe."

The purpose of this module is to provide suggestions to the instructor for selecting, clustering or grouping, and sequencing performance and supplemental objectives.

DIRECTIONS:

Module 2 should be completed before beginning work on this module.

Read the OBJECTIVE section. If you think you can accomplish this objective now, turn to the CHECK-OUT ACTIVITY, page 16, and follow the instructions.

If you feel you are not able to accomplish this objective now, look at the LEARNING ACTIVITIES, below. Begin the learning activities and as soon as you feel you are ready, turn to the CHECK-OUT ACTIVITY, page 16, and follow the instructions.

OBJECTIVE:

Given instructional materials developed for this module, the participant will be able, with 100 percent accuracy, to identify on a multiple choice or matching test:

1. reasons for deleting performance objectives from a V–TECS catalog.
2. the characteristics of performance objectives provided in V–TECS catalogs.
3. criteria for clustering or grouping performance objectives into units of instruction.
4. guidelines for sequencing performance objectives or tasks within a unit or cluster.
5. types of instructional units.

LEARNING ACTIVITIES:

1. READ the Glossary of Terms for Module Three.
2. CHECK YOUR KNOWLEDGE by completing Self-Check I – Glossary of terms for Module Three.
3. READ Section I - Selecting Performance and Supplemental Objectives.

   or_____
4. CHECK YOUR KNOWLEDGE of selecting objectives by completing Self-Check II – Selecting Performance and Supplemental Objectives.

5. READ Section II - Clustering Performance and Supplemental Objectives.

or_____

6. CHECK YOUR KNOWLEDGE of clustering by completing Self-Check III – Clustering Objectives.

7. READ Section III - Sequencing Performance and Supplemental Objectives.

or _____

8. CHECK YOUR KNOWLEDGE of sequencing by completing Self-Check IV – Sequencing Tasks.

9. Turn to the CHECK-OUT ACTIVITY, p. 16, and follow the instructions.

GLOSSARY OF TERMS – MODULE 3

In this module there are terms used with which you may not be familiar. Read through the glossary. Then check your knowledge by answering the self-check on a separate sheet of paper. Compare your answers with those found at the end of this activity.

Basic functional unit – a unit made up of tasks or activities common to several functional units.

Basic subject matter unit – a unit made of subject matter (concepts, principles, facts) common to several subject matter units.

Functional unit – a unit of instruction based on related real-life type activities or functions.

Subject matter unit – a unit of instruction built around related principles. concepts, or facts.

Psychological sequencing – sequencing instructional content from simple to complex, from known to unknown or from concrete to abstract.

SELF-CHECK I

Directions: Match the following Terms and Definitions

TERMS	DEFINITIONS
a. Subject matter unit	1. – a unit of instruction based on related real-life type activities or functions.
b. Psychological sequencing	2. – a unit of instruction built around related subject matter.
c. Functional unit	3. – sequencing instructional content from simple to complex, from known to unknown or from concrete to abstract.
d. Basic subject matter unit	4. – a unit made up of tasks or activities common to several functional units.
e. Basic functional unit	5. – a unit made up of subject matter (concepts, principles, facts) common to several subject matter units.

SELF-CHECK I

Answer Key

1. c, 2. a, 3. b, 4. e, 5. d

Although the V–TECS catalogs provide a very comprehensive listing of performance objectives for specific occupations, these objectives may or may not be appropriate for a particular course in a particular community. It is expected that the teacher may in some cases use the catalog as a "shopping list" of objectives. The teacher with the aid of a local advisory council (when available) will, in essence, "tailor make" an instructional program, using the V–TECS catalogs as a primary or secondary source of objectives, depending upon the nature and scope of the course to be taught.

Or, if the instructor already has well-stated performance objectives for his/her course of instruction, the V–TECS catalog may simply be used as a checklist to assure the completeness of the listing.

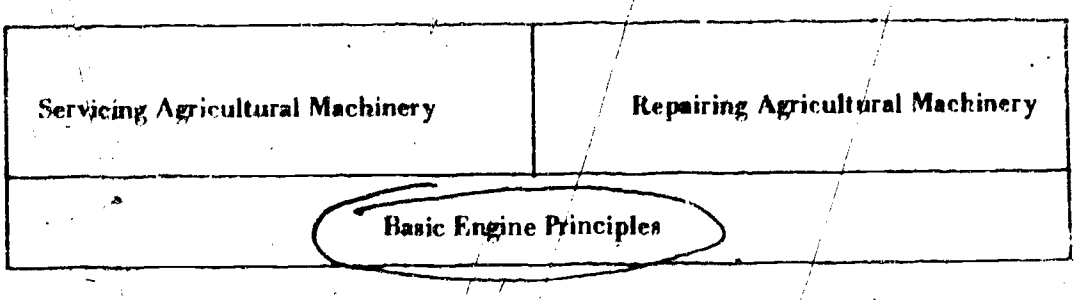
By no means should the V–TECS catalogs be looked upon as the sole source of objectives. In using the catalogs as "shopping lists," the instructor will, in effect, be deleting certain objectives which are inconsistent with the broader objectives of the course. The objectives contained in the catalogs are based on tasks that workers do. Some of these tasks may be too advanced or complex for students at the secondary level, especially at the lower grade levels; therefore, the teacher may delete a task because it is too complex and would be more appropriately taught at a higher level, perhaps even at the post high school level. Other tasks, although performed by workers and listed in the catalog, may be too simple to merit inclusion as an instructional objective in a course at the upper grade levels. Such tasks may have already been taught in a previous course. Other objectives may be rejected because they are unsafe, because it is not feasible to provide the equipment or supplies necessary to perform the tasks, or because the task is beyond the needs of an entry level worker.

In some cases, it may be appropriate to add entire units of objectives. For example, *The Automotive Body Repairman Catalog* was revised to add an entire unit of mainly cognitive-type (supplemental) objectives related to safety, nomenclature, tool identification, management and job characteristics or, in the case of The Small Engine Repairman Catalog, a unit entitled "Theory of Operation of the Four-Cycle Engine" and a unit on hand tools were added. The objectives for the units were mainly cognitive. So by strict definition these units, being mainly cognitive, cannot be considered truly performance-based as defined in Module 1. However, few would deny the logic and usefulness of such units; some would agree that just as we have performance objectives with related cognitive objectives taken from the performance guides, (see Module 2, p. 18), we may have "psychomotor units" (usually termed functional units) with their accompanying or subsidiary cognitive units (content units). Even though some units within a course are cognitive, the course may still be termed performance-based since most units are psychomotor and the objectives which make up the cognitive units are derived or developed from the psychomotor objectives.

The decision to use a separate cognitive unit to teach fundamental concepts is always a difficult one; for example, consider tool identification. Some persons would argue that the best way to teach tool identification is to teach the identification of the tool at the time it is to be used; therefore, the tool identification should be included in the teaching material to be used when the task is to be accomplished. This is sometimes referred to as the "integrated" method. Others would say that it would be best to teach all tool identification as a separate unit before the more performance-oriented units (sometimes termed functional units) are taught.

Advocates of the latter method would say that this type learning is more systematic and sequential. They would also point out that it would prevent having to include tool identification in every module which required the use of a particular tool.

CHART A



Basic concepts which "cut across" or "undergird" several units pose somewhat the same question. This concept is shown graphically in charts A, B and C. Note how Basic Engine Principles "cuts across" or undergrids two major units of Agricultural Mechanics in Chart A.

CHART B

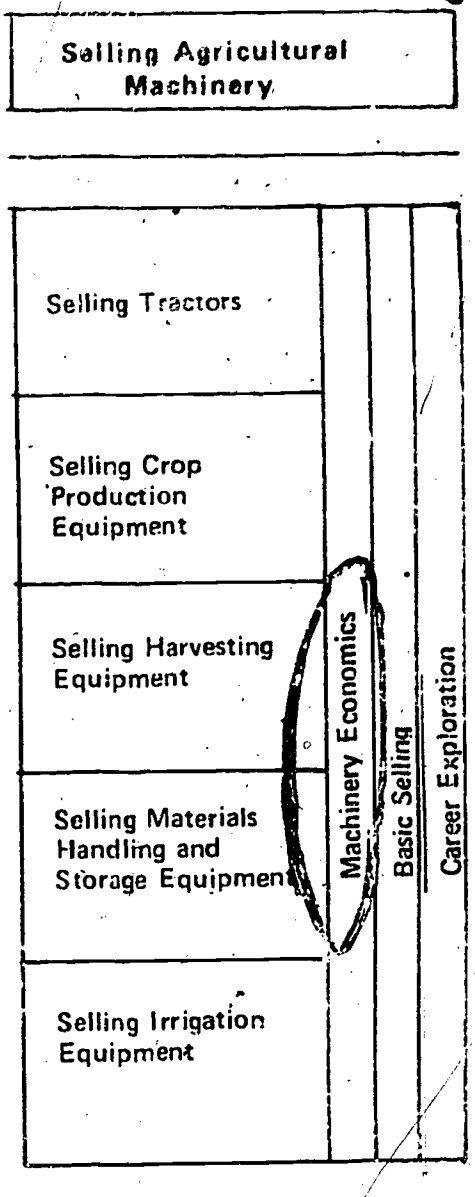


Chart B shows how machinery economics, basic selling and career exploration "undergird" five sub-units of selling agricultural machinery.

See the entire course in Tractor Mechanics graphically displayed on page 6 . Note that the interrelationships between units as well as the relative amount of time "blocked" for each unit are shown in the chart.

In summary, entire units of either cognitive, affective or psychomotor objectives may be derived from a V–TECS catalog and made into "basic" units which undergird several other psychomotor (activity oriented or functional) units.

CHART C

CURRICULUM CHART

AGRICULTURAL MECHANICS

Selling Agricultural Machinery	Servicing Agricultural Machinery	Repairing Agricultural Machinery	Managing an Agricultural Machinery Business

Orientation (FFA, SP, CE)

Basic Shop Safety

Selling Tractors

Selling Crop Production Equipment

Selling Harvesting Equipment

Selling Materials Handling and Storage Equipment

Selling Irrigation Equipment

Machinery Economics

Basic Selling

Career Exploration

Basic Engine Principles

Small Gasoline Engines

Systems of Power Transfer

Welding

Servicing Tractors

Servicing Crop Production Equipment

Servicing Harvesting Equipment

Servicing Materials Handling and Storage Equipment

Servicing Irrigation Equipment

Basic Lubrication

Career Exploration

Engine Overhaul

Brake System Overhaul

Career Exploration

Business Planning and Management

Service Department Management

Parts Department Management

Career Exploration

As mentioned earlier, most objectives supplied by V-TECS are based on skill type tasks and therefore most are classified as skill (psychomotor) objectives. This does not mean that knowledge (cognitive) or attitudinal (affective) objectives are not equally important. Some instructors may wish to add cognitive or affective objectives, or even make these the major "building stones" in a particular course or unit within a course. Most likely, however, cognitive and affective objectives will be added after a review of the performance guides, as discussed in module 2. Actually, cognitive objectives are added at two points:

1. When we look at the total course to determine supplemental objectives needed, and

2. when we look at an individual performance objective and determine the enabling objectives needed for students to be able to accomplish the task.

The skill (psychomotor) objective was chosen as the basic structural unit because the end product (outcome) of vocational education is best expressed as the performance of tasks. The task makes a more identifiable entity with easily observable beginning and ending points. Expressing objectives in terms of skill objectives also promotes a more activity-oriented curriculum. And finally, some educators feel that even though the teaching of knowledge, understandings, and attitudes is essential, the task provides a better "building stone" for organizing curricula for vocational education.

In summary, the following should be emphasized:

1. A V-TECS catalog is not a curriculum design or plan.

2. The V-TECS catalogs seldom provide "the" list of objectives for a course. It is intended that they in most cases be used only as a "shopping list." Objectives must fit the goals of the course being taught. Some objectives may be too advanced; others may be too simple or may have already been taught.

3. Although most objectives provided by V-TECS are expressed as psychomotor objectives, it is recognized that knowledge and attitudinal objectives are equally important and will be added by instructional designers or classroom teachers.

SELF CHECK II

SELECTING PERFORMANCE AND SUPPLEMENTAL OBJECTIVES

The following performance objectives are a partial list taken from a V-TECS catalog—*Gardening and Groundskeeping*. Assuming that you were planning a course to be taught at the ninth grade level for students studying an introductory unit in ornamental horticulture, which of the following performance objectives would you omit? Why would you delete those objectives? Compare your responses and reasons with those listed below.

Partial list of psychomotor and cognitive objectives from *Gardening and Groundskeeping*

1. Given access to planting tools and supplies, transplant bulbs six to eight inches deep in a prepared bed. The bulbs must be completely covered with topsoil and set with pointed part up.

2. Given the time sheets of four persons and information about the job activities of each during a specified period, list a minimum of five factors that should be considered when analyzing each person's work load during the designated period. For satisfactory performance, a minimum of five student responses should relate to those contained on an instructor's checklist.

3. Remove ice, snow, or slush from sidewalks using salt. You may apply the salt by hand or use a mechanical spreader if one is available. Coverage should be uniform with increasing amounts for thicker ice.

4. Given a description of grounds and equipment, write a job description for a groundskeeper employed by a school, hospital, or industry. The job description must include a 50–75 word description of each duty listed in the accompanying checklist. Each item in the checklist must be rated yes for satisfactory performance.

5. A tree is to be killed. Using an ax, cut a 360 degree, 2 inch ring around the tree. All bark and the cambium layers must be removed from the ring.

6. Given a freshly pruned tree with wounds 1 inch or greater in diameter and a pruning knife, apply a coat of antiseptic tree paint to all exposed pruned areas. Periodic observations of the treated areas should reveal that the tree wound is not decaying.

7. Given annual plants in containers, a seedbed, water supply, and access to planting tools, plant annual flowers. The leaves, stems, and roots of the plants must not be broken during the planting process. A visual inspection after 6 hours must show that plants have not wilted.

8. Given the necessary tools and topsoil, fill all holes and depressions in a lawn. The topsoil applied to each depression must match the contour of the area when packed.

CORRECT RESPONSES: Selecting Performance and Supplemental Objectives

Delete: Objectives 2, 3, and 4

Reasons:

1. Objectives Number 2 and 4 could be performed by a ninth grade student, but it was felt that these objectives would be lacking in relevance at this grade level. It was felt that such tasks would be best taught at the eleventh or twelfth grade level.

2. Objective Number 3 would be difficult to perform except in certain weather conditions. The objective may also be too simple to merit instructional time.

Organization of instruction into units (or wholes by any name) often facilitates learning because of the relatedness of the material. For example, if a student studies and performs tasks related to the electrical system as a unit, he/she is more likely to see the interrelationship between the various components of that system. Such relationship may not become apparent in totally random (fragmented) instruction.

Teachers have always organized their teaching by one of the following methods: 1) by subject matter, concepts and principles, or 2) by activities, tasks, projects and problems. Organization of instruction by the first method is classified as subject matter organization, while organization by the latter method is sometimes called functional organization of curricula. Often courses, and especially textbooks, are arranged by a combination of the content and the functional types of organization. Textbooks frequently organize the beginning chapters by subject matter, concepts or principle, while the latter chapters are organized functionally around tasks or activities. Most curriculum guides are a combination of subject matter and functional units. The subject matter units often provide the basic information upon which the functional units are built. See Chart C.* However, functional units may also be basic units when "basic" is used to refer to units composed of the common elements of several other units. For example, in a tractor mechanic's course, a unit on tool identification may be common to several other units. An in-depth study of tool identification at the outset of the course will prevent excessive repetition in the future.

Performance objectives found in V–TECS catalogs are grouped according to major duties of workers. This organization may, in fact, serve as the sole basis for curriculum organization for courses which were designed to provide training for the exact occupations for which the objectives were written. Using job-related tasks as the basic element of the curriculum and grouping these tasks by occupational duty assures functional (activity) organization.

*See page 6

SELF-CHECK III

CLUSTERING PERFORMANCE AND SUPPLEMENTAL OBJECTIVES

Try classifying each of the four groupings of objectives shown on the next page as to type (subject matter or functional). Note that some of these objectives were not taken from V-TECS catalogs and are examples of Supplemental Objectives. Please disregard format and concentrate on the type of unit. Compare your responses with those shown at the bottom of the page.

SELF-CHECK III

Answer Key

	Subject Matter (Content oriented) Units	Functional (Task oriented) Units
Nursery Production	X	
Basic Principles of Plant Science	X	
Propagation and Planting of Plants		X
Soils		X

NURSERY PRODUCTION

1. Given pruning shears and/or knife, container, and plants from which cuttings are to be taken, take cuttings. Cuttings will be 3"–5" in length depending on kind of plant, free from disease, broken stems, and otherwise undamaged.

2. Given 100 fresh tip cuttings, fungicidal dip, rooting aids, and prepared rooting beds or pots containing a rooting medium, stick the cuttings into the medium. Cuttings will be treated inserted into the medium at a minimum depth of 1" with the medium around each plant.

3. Given a rooting bed or flat filled with rooted tip cuttings, remove 25 of the rooted cuttings by hand without causing unnecessary damage to the roots or to the foliage.

BASIC PRINCIPLES OF PLANT SCIENCE

The student will be able to:

1. Classify a plant according to its life cycle and botanical class.

2. Identify the major parts of a typical plant and describe the fundamentals of each part.

3. Describe in writing and/or by drawing the reproductive system of a typical plant.

4. Explain in writing and/or by diagram the basic process of plant growth.

5. State the major functions of the elements essential for plant growth.

6. . . . .

PROPAGATION AND PLANTING OF PLANTS

1. Given a particular kind of flower seeds, flats or containers and growing medium, plant seeds. Seed must be spaced and covered in accordance with requirements of a particular species.

2. Given a previously prepared field area, treated bulbs, the required stakes, string, tools and equipment, plant the bulbs. Bulbs will be planted in straight lines, spaced five to six inches apart and firmly covered with soil to a depth of about 1/2 inch.

3. Given a mist propagation system and five different time interval settings for the time clocks, set the clocks to activate the system in accordance with the prescribed times. The system must function accurately with no more than ten percent variation from the prescribed time intervals.

4. Given pruning shears and/or knife, container, and plants from which cuttings are to be taken, take cuttings. Cuttings will be three to five inches in length depending on kind of plant, free from disease, broken stems, and otherwise undamaged.

SOILS

The student will be able to:

1. List the major steps in the evolution of a typical soil from rock.

2. List the major components of a typical soil.

3. When given four soils (representative of each of the four land classes), correctly label each.

4. When given the land capability class of a given soil site and the major limiting conditions, select (from a list of recommended land treatments) those recommended for a given soil site.

5. Complete a typical soil sample information form.

6. Interpret a soil sample report form.

7. . . . .

SECTION III - SEQUENCING PERFORMANCE AND SUPPLEMENTAL OBJECTIVES

Sequencing can be a very important factor in the success of an instructional program. Motivation is enhanced, relationships between instructional content expressed, the orderly presentation of prerequisite knowledge and skills assured, unnecessary duplication avoided, and gaps in instruction prevented.

Tasks may be sequenced into one continuous list. Or, tasks may be clustered and then sequenced within each cluster. And finally, clusters as single entities may be sequenced.

The major rationales for sequencing are as follows:

1. Sequencing to enhance motivation. It is extremely important to let students experience first those tasks which are likely to excite students about the task or series of tasks to be mastered.

2. Sequencing according to the order in which the task is performed within the work environment. This is especially appropriate when the teaching procedure involves a series of fixed steps.

3. Sequencing according to a psychological order. This method emphasizes the ease of learning. Instructional content is arranged from simple to complex, from the known to the unknown or from the concrete to the abstract. Learning is made easier because the student is always moving forward from a base of prior knowledge.

4. Sequencing according to a logical order. Sometimes it is not desirable to arrange learning by the order of job performance. The second or third task in the sequence may be very difficult, thus violating the psychological order of simple to complex. When the sequence is arranged to enhance psychological organization (simple to complex), it no longer can be accomplished in the order in which the task must be performed in the job environment. This problem is often resolved by using a system whereby the instructor demonstrates the difficult steps while the student performs the simpler steps. Finally, the student develops the skills and knowledge to perform the more complex steps after observing the instructor's demonstrations.

5. Sequencing such that selected objectives are taught concurrently to make better use of available equipment, supplies, etc.

All types of sequencing will probably be used in a typical instructional program.

GUIDELINES FOR SEQUENCING

The following guidelines for sequencing may be helpful:

1. Place the more interesting tasks early in the sequence to enhance motivation.

2. If you have not already identified and organized tasks common to several units to form a common or basic unit, as discussed in Section II, you may wish to do this in order to prevent excessive repetition. This unit of objectives, a unit common to several units, should be taught first if it is prerequisite or fundamental to other units. This is especially true of units built around subject matter or concepts.

3. As a general rule, place the easy-to-learn objectives early in the sequence.

4. When possible, sequence objectives so that what is learned in one task facilitates learning in following tasks. Or put another way, the output of one task serves as input to the next task.

5. If possible, identify prerequisite knowledge or skills and introduce this knowledge at a point prior to the time it is to be applied.

6. If possible, introduce the complex task late in the teaching sequence.

7. When possible, arrange procedural skills in the order required on the job.

8. Sometimes sequencing will be influenced by the season. For example, instruction in agriculture or horticulture is sometimes sequenced to fit crop production schedules, e.g., tasks related to poinsettia production will probably be scheduled in the fall; bedding plant production in the spring, etc.

Other instruction may likewise be scheduled by season in order to synchronize the teaching of tasks with events to occur in the community.

Instruction is sometimes most effectively accomplished outside the classroom, e.g., planting or harvesting trees. Weather and the seasons thus become a factor in sequencing these activities.

SELF-CHECK IV

SEQUENCING PERFORMANCE AND SUPPLEMENTAL OBJECTIVES

The following performance objectives are from a duty grouping found in the V–TECS catalog *Food Management, Production and Service Occupations.* On a separate sheet of paper, try sequencing these tasks and give reasons for the sequence chosen. Compare your sequence and reasoning with that provided in the Sample Response.

Hints: Consider the major rationale listed on page 12. Select the one or ones you feel best fit(s) this task list.

The tasks below were taken from V-TECS catalog *Food Management, Production and Service Occupations.*

Duty: COOKING FOOD*

1. cook eggs by simmering (boiling)
2. prepare soup
3. make biscuits
4. cook meat by baking
5. make muffins
6. cook vegetables by deep fat frying
7. cook eggs by poaching
8. make corn bread
9. cook meat by barbecuing
10. cook eggs by frying
11. make coffee
12. cook meat by frying
13. make cakes
14. cook vegetables by broiling
15. cook vegetables by baking

*Tasks, rather than objectives, are used in this Self-Check as a matter of convenience.

SAMPLE RESPONSE to Self-Check — Sequencing Tasks or Objectives

Sample teaching sequence:

1. make coffee

Cook eggs:

2. simmering
3. frying
4. poaching

Cook vegetables:

5. baking
6. broiling
7. deep-fat frying

8. prepare soup

Cook meat:

9. baking
10. frying
11. barbecuing

Baking:

12. biscuits
13. corn bread
14. muffins
15. cakes

The sequence of this particular duty group (Cooking Food) from the V–TECS catalog *Food Management, Production and Service Occupations* is probably not critical and there is probably no one best order. However, the rationale for the sample sequence shown below is as follows:

1. When possible, the simpler tasks were placed early in the sequence, i.e., making coffee was thought to be a relatively simple task and was placed first in the sequence. Baking a cake was thought to be very difficult and was, therefore, placed toward the end of the sequence.

2. Similar tasks were grouped and then placed in order of complexity, i.e., cooking eggs (simmering, frying and poaching). Note that simmering was thought to be less complex than frying and frying less complex than poaching.

3. Groups of tasks were again sequenced in order of complexity. For example, cooking eggs was thought to be less complex than cooking vegetables, cooking meats or baking.

4. Other sequences could, of course, be used. Some other possibilities are listed below:

   a. sequence by type of cooking, i.e., frying, baking, or broiling.

   b. sequence in the order typically used in preparing a meal, i.e., start by cooking the items which take longer to prepare, etc.

   c. sequence in the order for a specific meal, i.e., breakfast, lunch or dinner.

CHECK-OUT ACTIVITIES

Inform your instructor that you are ready to be tested. You will be provided with a copy of a multiple choice/matching test and an answer sheet. Record your answers on the answer sheet and return both the test and the answer sheet to the instructor.