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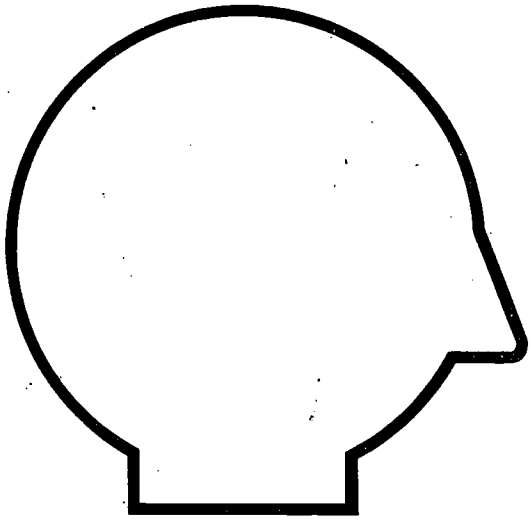
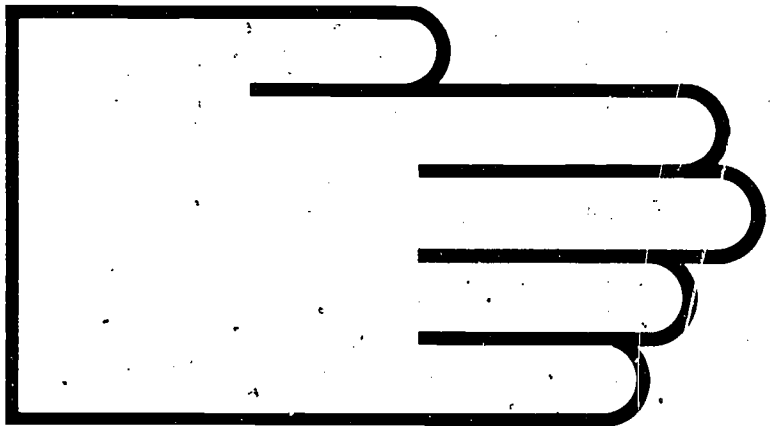
ABSTRACT

This module is an introduction to a series of 25 modules on paraprofessional careers in environmental health occupations. It provides a definition of environmental health and discusses (1) how the modules were developed, (2) module format (competency-based), (3) objectives, (4) criteria to judge student skills, (5) how to use the modules, (6) instructor guidelines, (7) learning activities, (8) where and how to practice, (9) equipment needed, (10) skill-expanding exercises, (11) performance tests, and (12) references. (CT)



Training Vocational Education Students in Environmental Health



U.S. DEPARTMENT OF EDUCATION, Office of Vocational and Adult Education

ADDENDUM

Contract 300800088 was an 18-month contract awarded to Consumer Dynamics, Inc., on January 2, 1980, by the Curriculum and Instruction Branch of the Office of Vocational and Adult Education, U.S. Department of Education.

The activity which is the subject of this report was supported in whole or in part by the U.S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the Department of Education, and no official endorsement by the Department of Education should be inferred.

I. INTRODUCTION

In January 1980, the U.S. Department of Education awarded a contract to Consumer Dynamics, Inc., for the development of 25 competency-based learning modules for use in existing environmental health vocational education programs. The purpose of this report is to describe the educational elements incorporated into those modules. Information on the environmental health field, the nature of the intended users, and the objectives of the modules are discussed below. The following sections describe in detail the components that make up each of the modules.

ENVIRONMENTAL HEALTH

Environmental health is the study of the relationships among a host (human), an agent (biological, chemical, or physical), and the environment. Environmental health professionals seek to recognize, evaluate, and control the impact of environmental factors, such as air and water quality, to preserve and maintain the health, safety, comfort, and well-being of present and future generations. They are concerned, for example, with controlling radiation, environmental noise, sanitation, ventilation, occupational health, and air and water pollution. Eighty percent of all individuals employed in the environmental health field are employed by government; the remaining 20 percent are employed by private sector companies. They operate in food manufacturing industries, sanitary services and utilities, and chemical industries. Employment opportunities in environmental health are expanding rapidly as regulations are being promulgated by local, State, and Federal governments for environmental evaluation and control.

EDUCATION

Some environmental health workers can be trained in vocational education programs. Vocational educators provide for the development of technical skills that prepare the student for employment and work. They have developed teaching methodologies that focus on the development and testing of specific performance-oriented skills. Current vocational education programs incorporate standardized occupational proficiency measures and criterion-referenced tests to evaluate student achievement of skills required to successfully complete a job in a work situation. These programs are known as competency-based vocational education (CBVE). CBVE requires instruction geared to each individual's capabilities, needs, and rate of learning; incorporation of the latest technology in the specialty field; and development by each student of skill competencies that meet currently accepted, broadly based, and widely recognized job performance criteria.

Although some vocational education programs do exist in the environmental health field, particularly in water/wastewater treatment and air pollution, chasms exist, rather than gaps, between the perceived need and the availability of training opportunities. The environmental field is rapidly expanding and changing. Existing environmental health curricula vary from program to program, and there is a lack of CBVE-based materials. To help solve this problem, Consumer Dynamics developed 25 CBVE modules in each of seven environmental health subject areas (see Table 1).

MODULE DEVELOPMENT

Graduates of a vocational education program using these environmental health modules will be able to enter the workplace and to operate a machine or to perform certain tasks in the proper sequence at a required skill level. Since the environmental health field employs individuals at a variety of skill levels, including paraprofessional technicians, and professional practitioners, it was necessary to specify the intended level of the modules and to prepare materials suited for the target audience.

Table 1. ENVIRONMENTAL HEALTH MODULES DEVELOPED FOR THE U.S. DEPARTMENT OF EDUCATION

Module No.	Title	Subject Area
1	Operating Sound-Measuring Equipment	Acoustics/Noise Control
2	Obtaining Measurements of Stationary Environmental Noise Sources	Acoustics/Noise Control
3	Operating High-Volume Air Samplers	Air Pollution
4	Using Detector Tubes and Pumps	Occupational Health
5	Collecting Industrial Health Information	Occupational Health
6	Using Precision Rotameters	Air Pollution
7	Calibrating Personal Air Monitoring Devices	Occupational Health
8	Collecting Samples of Workplace Air	Occupational Health
9	Using Air-Purifying Respirators	Occupational Health
10	Operating a Radiation Detection Monitor	Radiation
11	Using Ionizing Radiation Detectors	Radiation
12	Collecting Pests for Identification	Sanitation
13	Performing Analyses for Waterborne Bacteria	Sanitation
14	Using a Swinging Vane Anemometer to Measure Airflow	Ventilation
15	Obtaining Heat Stress Measurements	Occupational Health
16	Collecting Stream Samples for Water Quality	Water/Wastewater
17	Performing Titration Analyses for Water Quality	Water/Wastewater
18	Using an Electric Single Pan Analytical Balance	General
19	Preparing Data for Analysis	General
20	Using Modules in an Environmental Health Training Program	Orientation to 24 Modules
21	Operating Gas-Absorbing Equipment	Air Pollution
22	Using a Stereo Microscope	Sanitation
23	Measuring Airflow in Local Exhaust Ventilation Systems	Ventilation
24	Calibrating a Respirable Dust Sampling Device	Occupational Health
25	Communicating With Environmental Health Staff	General

Intended Users

Because a great need exists for CBVE materials at the most basic level, the modules were developed to train paraprofessional technicians. Environmental health paraprofessional technicians work under the supervision of professional practitioners (administrative or technical) and are involved primarily in performing routine and standardized inspections, field sampling, and testing. They are typically generalists; i.e., graduates of a prebaccalaureate training program (1 or 2 years), whose expertise is usually spread evenly across a number of program areas, and who have limited responsibility in the area of any particular environmental health specialty.

Module Format

To achieve the overall goal of providing CBVE materials for environmental health paraprofessional technicians, it was necessary to develop a module format that meets the needs of the users. Since students enter training programs with a variety of existing skills and interests, the primary requirement being technical skill development, the materials need to be individualized to focus on the psychomotor domain. Since environmental health technicians rely on sophisticated tools for their trade, the modules must train students how to use specific instruments. Students need to enter the work force "job ready"; therefore, the modules should provide a job-related, meaningful experience. Because the modules are competency-based, they need to provide criterion-referenced tests of skill development; and, since the training normally takes place in a vocational education facility (such as a community college or technical school), the modules should provide information for instructors who want to include the modules in ongoing programs. A module format, therefore, was designed to meet all of these needs. The first step in development was the selection of objectives for each of the modules.

Objectives

Objectives tell students exactly what skills must be developed to perform a specific task. They are a key element of the CBVE modules. Two levels of objectives are presented: a general statement of what the students will learn in the module as a whole, and specific statements about what skills the students will develop as they work through the specific learning activities that make up the module. The objectives refer primarily to psychomotor skills (such as calibrating an instrument or collecting a sample). On occasion, a cognitive skill is included (such as determining a condition or describing a situation). Each objective is written so that student attention is focused on the skill to be developed. Subsequent learning activities are devised to lead students through the steps necessary to perform a particular skill. In addition, the objectives are written so that achievement can be measured.

Criteria

To evaluate how well a skill has been learned, the module establishes criteria that must be met and can be evaluated in a criterion-referenced test. These tests enable students to gauge their status with respect to well-defined knowledge and skill competencies related to job-performance requirements. A variety of criteria have been developed to suit the different types of objectives included in the modules. Examples of these kinds of criteria are specific accuracies, time limitations, and performances that emulate those of the instructor. When the criteria are not achieved, students are provided with remedial learning activities to practice until performance is satisfactory.

In the following sections, you will read how the modules are constructed; i.e., what students and instructors must do to use the module, how students are introduced to the learning activities, what steps they encounter in learning skills, how they practice the skills, how their skill performance is evaluated, and where they can go for further instruction.

II. USING THE MODULE

Following a brief "Foreword" and a "Contents" page, the first substantive section of each module is entitled "Using These Self-Instruction Materials." The purpose of this section is to prepare students and instructors for the learning activities that constitute the bulk of the module. This section tells the reader who the module is intended for, where the module is to be completed, and how the self-instruction system operates. There are two parts to this section: "Guidelines for Students" and "Guidelines for Instructors."

GUIDELINES FOR STUDENTS

A sample of these guidelines is shown in Figure 1. This sample is taken from the module "Collecting Pests for Identification." Guidelines in other modules are similar.

The guidelines offer step-by-step instruction to students on how to use the module. The first step is to look at a pretest, the "Performance Test," to determine if students have sufficient skills to start the module or if the students already have the skills and do not require the module. The performance test is described in greater detail in Section VI of this report. The guidelines also recommend entry-level prerequisites such as high school courses and basic understandings. Completion of these prerequisites help students assess if they are ready for the learning activities of the modules.

Once the students complete the performance test, with the instructor's assistance in providing equipment, they decide if the module is necessary, if only selected portions are necessary, or if the entire module is required to achieve the desired skills.

USING THESE SELF-INSTRUCTION MATERIALS

This self-instruction learning package or module is designed to allow both students and instructors flexibility of use. Although primarily intended for use in existing training programs, the module can be used by anyone interested in learning new skills or perking up old ones. Therefore, two sets of guidelines are presented--one set addressed to students and the other set addressed to instructors. First, find out how you, the student, should use the materials in this book.

GUIDELINES FOR STUDENTS

Take the Performance Test as a pretest.	When you pick up this book and work through it, your goal will not be a letter grade or a high score on an exam. Instead, you will work to develop skills that you can measure. You will nothave to worry about how well someone else is doing. Before you start work on this module, you should, first, find out if you have sufficient skills to start training by reading through the section called PERFORMANCE TEST. If you think you can do all or most of the items in this test, ask your instructor to obtain the necessary equipment and supplies. You should have had a course in high school biology, have knowledge of basic differences between flies and mosquitoes and other insects, and have learned how to use a stereo microscope.
Work on parts you need to practice.	If you do everything well, according to the criteria in the Performance Test guidelines, you will not need to spend time working on this module. If after taking the Performance Test you discover there are parts you need to practice, follow the key to each item in FOR FURTHER STUDY.
Work straight through each lesson in the order presented.	Should you decide to completely work through this module, begin with the INTRODUCTION and go straight through each of the three lessons. The lesson begins with the OBJECTIVE of the training. Follow the instructions for each part in the order presented. Practice each step in a lesson until you can do it according to the criteria stated for the step. At the end of a lesson, do the EXERCISES. When there are audiovisuals listed at the end of a lesson, ask your instructor for help in obtaining them.
Take the Performance Test as a posttest.	Finally, after you have mastered all of the exercises in each lesson, ask your instructor to watch you do each item in the Performance Test. The items in the Performance Test are intended for use as a posttest to evaluate the quality of your performance. Turn now to the Performance Test.

Figure 1. Guidelines for students.

Students who need the module to achieve the skills are instructed how to proceed on their own, what learning sequence to follow, and how to practice. They also are instructed how to evaluate their progress at the end of the learning activities by taking a posttest, the "Performance Test." (See Section VI.)

GUIDELINES FOR INSTRUCTORS

A sample of these guidelines is shown in Figure 2. This sample also is taken from the module "Collecting Pests for Identification."

The guidelines offer information to instructors on the purpose of the module, how to adapt the module to their particular situation, the self-instruction framework of the materials, and the role of the instructor in using the modules in their courses.

Guidelines on equipment are provided. Since equipment used by environmental health workers varies from place to place, the module describes how equipment other than that described in the module can be used for training. If necessary, instructors can write supplementary materials to accommodate equipment changes.

The guidelines provide information on alternative classroom uses of the modules for: individual students or groups, the instructor's interaction with students, instructor preparation and student evaluation. Instructors are provided with specific instructions about special arrangements required, such as provisions for field trips; laboratory safety precautions that should be followed; and materials/equipment that should be provided. These guidelines help instructors make optimum use of the modules.

USING THESE SELF-INSTRUCTION MATERIALS

GUIDELINES FOR INSTRUCTORS

Approach

The approach of these materials is to provide the student with the opportunity to learn skills for trapping rodents and for using traps and collection devices to obtain specimens of flies and mosquitoes. The equipment you have available may be somewhat different from that presented in the lessons. If such is the case, you may need to write supplementary instructions to point out the equipment differences. The skills tested on the Performance Test are designed for use with any make and model of instrumentation.

Independent Study

Students can work independently and at their own pace. Depending on the time frame you set for completing each lesson, you may want to start a group off in each lesson with a demonstration and informal presentation.

As a Laboratory Workbook

Alternatively, you may choose to use this module as a laboratory workbook in a structured laboratory session. With this option, you may allow students greater access to your assistance, especially in watching them perform the pre- and posttest portions of the training.

General Instructions

Read through each lesson to anticipate what equipment and supplies you will need to make available for students to use. Also, order any audiovisuals or reading materials you think may present a complementary perspective to the training in this module. Use the items in the Performance Test as the minimum requirements for gauging successful completion of the training.

Specific Instructions

In this module, students are asked to visit and return to areas where rodents, flies and mosquitoes live and breed. Recommend several such areas so that small groups of three to five students can visit and not disturb the study environment. After each group has completed Lesson Two, have them visit a different study location. For Lesson Three, have the groups return to the first study location.

Figure 2. Guidelines for instructors.

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III. INTRODUCTION TO THE LEARNING ACTIVITIES

The second major section of the module is entitled "Introduction." This section is intended to lead students who are ready for the module (see Section II, "Using the Module") into the actual subject matter. There are two parts to this section: "Background" and "Objectives."

BACKGROUND

Before students learn specific environmental health technical skills, they are introduced to an overview of why those skills are important. This is a motivational as well as an informative exercise. Information about the skills is summarized in a brief essay.

The background includes material on the history of the environmental health condition (e.g., pests) to which the skill (e.g., collecting pests for identification) is applied. Sociopolitical and economic information on past and present problems is presented. The section concludes with how the skill taught in the module is applied to solving environmental health problems.

OBJECTIVES

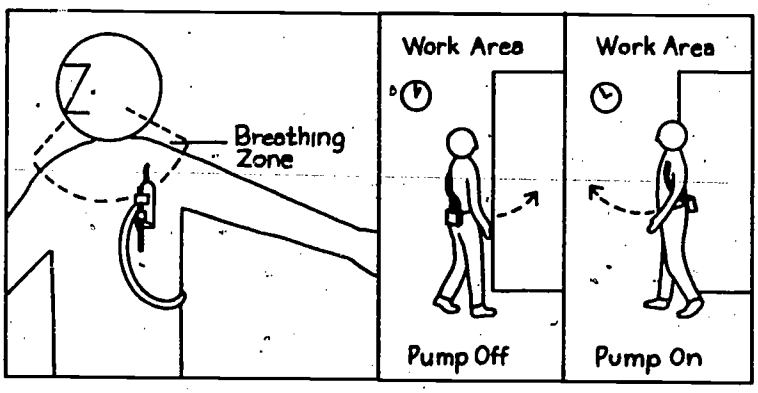
The second part of the introduction specifies the general and specific objectives of the modules. Figure 3 shows examples of these objectives taken from the module "Collecting Samples of Workplace Air."

All objectives are performance oriented; i.e., students learn how to carry out a task rather than a theory about the task. Two kinds of performance objectives are presented: general and specific. The general objective is in the form of a short paragraph. It contains a broad statement of what the students will be able to do when they finish the

INTRODUCTION

WHAT YOU WILL LEARN

When you finish working through the steps and exercises in this book, you will be able to collect a sample of the air a worker breathes over a period of several hours, and to obtain the necessary information to verify the sampling conditions.



You will learn how to obtain the sample and information about the sampling conditions and prepare the sample for analysis in three lessons:

- o Lesson One

  You will be able to collect information about sampling conditions and about the individual being sampled.

- o Lesson Two

  You will be able to position an air sampling train on an individual so that a representative sample can be obtained while allowing the worker freedom of movement.

- o Lesson Three

  You will be able to adjust the pump flow over the sampling period, and determine if and when a new sampling device may be needed.

Figure 3. Objectives.

module successfully. This paragraph is addressed to the students in simple terms. If necessary, a general statement of the "givens" is included to tell the students particular conditions under which they will do the task (e.g., using a particular piece of equipment). A picture under this general statement of performance objectives gives a graphic overview of the task. It illustrates the setting in which the task activity takes place. The purpose is to visually orient students to the task and to the objectives of the three lessons that follow.

Lesson Objectives

Each of the three lessons that comprise a module has its own objective. These objectives are presented as a group in the Introduction section, and individually before each lesson. As a group (see Figure 3), the objectives provide expanded statements addressed to students about what they will be able to do in an incremental fashion.

Several kinds of lesson objectives are used throughout the range of the 25 modules that have been developed. The most common type deals with procedures/ methods. These objectives present tasks that call for the ability to state the procedure or method for performing a function (i.e., a survey); the ability to describe the circumstances, situations, or conditions that are appropriate for applying the procedure; and the ability to apply the procedure appropriate for the required function. In Figure 3, the objectives for Lessons One and Two are procedural objectives.

Another type of specific objective is the equipment objective. This type presents tasks that call for the ability to identify the parts of a sample or piece of equipment; to describe the function of the sample or equipment; to describe, identify, or locate the source, condition, or situation that is to be sampled or in which the equipment is to be used; and to calibrate and operate the sample or equipment for its intended purpose. In Figure 3, the objective for Lesson Three is an equipment objective.

IV. GETTING THERE--STEPS AND KEY POINTS

This portion of the module contains the actual learning activities. It forms the bulk of the module. Each module contains three lessons, one for each of the three specific objectives. Each lesson, in turn, contains from 6 to 12 incremental steps or learning activities. These are described in greater detail below.

Where and How to Practice

At the beginning of each lesson, the specific objective is restated. Figure 4 shows a sample of the introduction selected from Lesson One of the module "Performing Analyses for Waterborne Bacteria." Following the objective is a statement for students on where and how to practice. The location recommended is that closest to the real-world situation in which the student will have to perform the task of the module. Recommendations on how to learn in the self-instruction mode are presented, including hands-on practice, writing, reading aloud--any pertinent activity that engages seeing, hearing, doing, or speaking. Any safety precautions that must be observed for reasons of personnel welfare and compliance with OSHA or EPA regulations are specified.

How Well You Must Do

This statement contains the standard or criterion for doing the task. It takes into account the level of skill needed to successfully perform the task. The criteria include specifications for the degree of accuracy or tolerance to be achieved. Different types of criteria are used with different types of performance objectives. In Figure 4 the criterion is for an equipment-related objective. Figure 5 shows a procedure-oriented criterion selected from the introduction to Lesson Two of the module "Performing Analyses for Waterborne Bacteria."

LESSON ONE

OBJECTIVE

You will be able to name, sterilize, and assemble the component parts of the membrane filter filtration unit.

WHERE AND HOW TO PRACTICE

In the microbiological testing of water, it is important that it be carried out as aseptically (free from micro-organisms) as possible. You should practice this lesson on a workbench that has been thoroughly cleaned and has room enough to spread out the various components of the filtration unit. The specific testing procedure and equipment you will be using are designed for field use. Under actual conditions you may be required to perform these tests on the tailgate of a station wagon or van. It is important that you learn to minimize any potential sources of contamination.

HOW WELL YOU MUST DO-

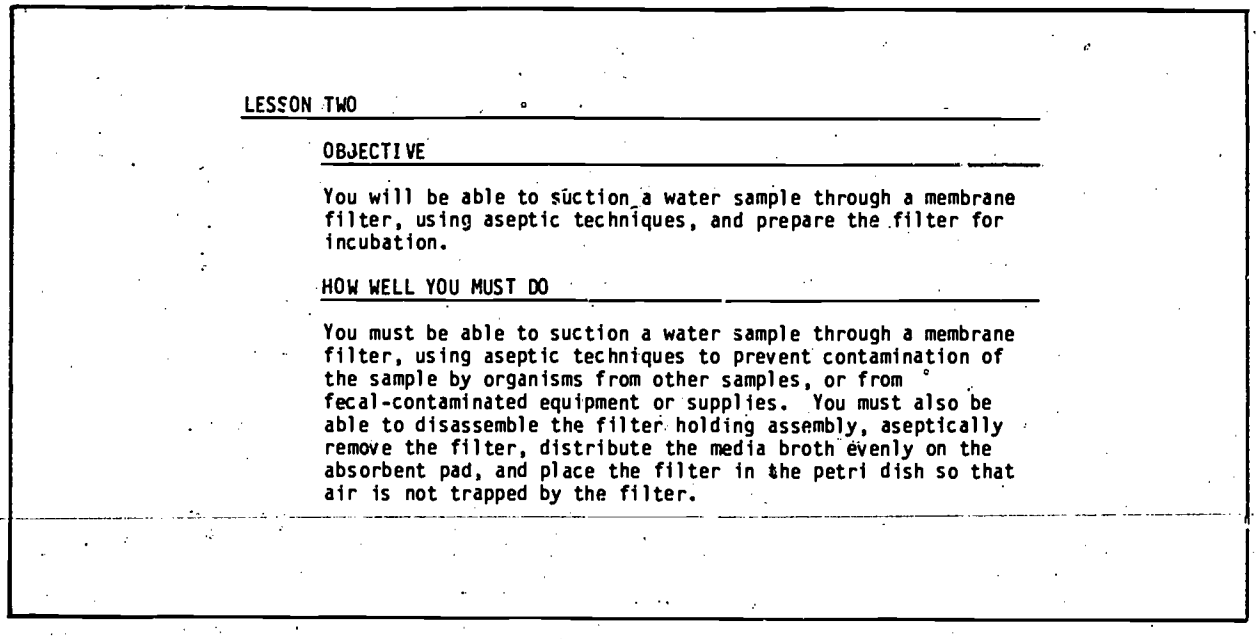
You must be able to accurately name all the parts of the filtration unit and disassemble, sterilize, and assemble the filtration unit in 20 minutes.

THINGS YOU NEED

You will need the following equipment:

- o a portable water laboratory such as the Millipore Model XX63-001-50 or equivalent*, containing as a minimum:
  - a filtration unit composed of a funnel, membrane filter holding assembly, and a receiving flask
  - a hand-operated or battery-powered pump
  - an alcohol lamp
  - plastic tubing with adaptors
  - sterile, buffered, distilled water
  - stainless steel forceps
  - sterile, packed petri dishes, absorbent pads, membrane filter

Figure 4. Sample introduction to one lesson.



LESSON TWO

OBJECTIVE

You will be able to suction a water sample through a membrane filter, using aseptic techniques, and prepare the filter for incubation.

HOW WELL YOU MUST DO

You must be able to suction a water sample through a membrane filter, using aseptic techniques to prevent contamination of the sample by organisms from other samples, or from fecal-contaminated equipment or supplies. You must also be able to disassemble the filter holding assembly, aseptically remove the filter, distribute the media broth evenly on the absorbent pad, and place the filter in the petri dish so that air is not trapped by the filter.

Figure 5. Sample procedure-oriented criterion.

Things You Need

The last part of the introduction to a lesson deals with materials and/or equipment that the students must have to complete the lesson. Figure 4 shows an example. The list is exhaustive; that is, materials are listed for doing every aspect of the task. These materials are usually provided by the instructors.

GETTING THERE--STEPS

The most important part of the module is the set of learning activities contained in each of the three lessons that comprise a module. These learning activities are called "Steps." Each step is accompanied by a "Key Point." Each lesson has from 6 to 12 steps and corresponding key points.

Figure 6 shows a number of steps and key points selected from Lesson Two of the module "Performing Analyses for Waterborne Bacteria." Each step gives a detailed procedure that must be followed to reach the

LESSON TWO

STEP 9

Rinse the funnel three times with sterile, buffered, distilled water. Use about 25 ml for each rinse and flush the walls of the funnel to remove all residual water sample droplets. Then, with the syringe, generate a suction after each rinse and allow all of the water to pass through the membrane before applying the next rinse.

KEY POINT 9

Rinse the funnel with sterile, buffered water.

STEP 10

After drawing off all the water with the suction, release any negative pressure that may have built up in the filtration unit by gently removing the suction tube adaptor from the filter holder base.

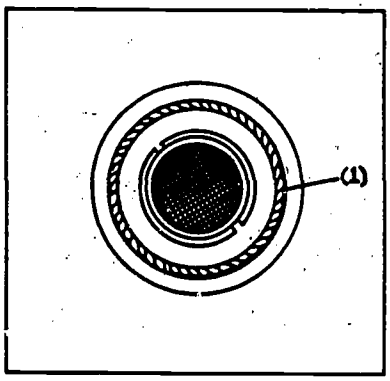
KEY POINT 10

Release negative pressure to prevent damage to the membrane filter.

STEP 11

Turn the twist lock and gently separate the funnel from the filter holder. Without touching any of the inside surfaces of the funnel, hold it in one hand while you gently lift the membrane off the filter holder using the flame-sterilized forceps. Once you remove the membrane, temporarily replace the funnel on the filter holder base.

KEY POINT 11



Hold the funnel aseptically.

Figure 6. Sample steps and key points.

objective and fulfill the intent of the lesson. The steps do not include background information on the theory of practice or procedure except to underscore a critical point in the procedure. A step usually contains three or four related aspects of the procedure. Each aspect directs the students to perform part of a task. The first sentence of a step is the key sentence of the paragraph. The length of the steps is normally between 50 and 75 words, depending on the nature of the tasks performed.

A key point accompanies each step. Each key point contains either verbal or verbal and graphic information. The information relates aspects of safety and health and also critical aspects of performing the step. Key points provide brief, summary statements of what is required in each step. When used, graphics illustrate spatial relationships of pieces in an arrangement, details of parts, a picture of a procedure, and/or visual reinforcement of the content in a step.

By performing the learning activities in the steps and studying the key points, the students are expected to reach the objective of each lesson and achieve the stated criterion. Additional learning experiences are provided in the exercises and in the recommended readings and audiovisuals that follow each lesson. When all steps and exercises in each of the three lessons are accomplished, the students should have mastered the overall objective of the module.

V. EXERCISES

After each lesson in a module, the students are provided with additional activities to strengthen and expand their skills. The primary supplements are the "Exercises" that follow each lesson. Figure 7 shows an example of exercises that follow Lesson Three in the module "Collecting Samples of Workplace Air." As this example illustrates, the exercises usually consist of three or four parts.

LESSON THREE

EXERCISES

Instruction 1: Work through the steps in Lesson Three with a classmate. To perform these exercises, wear a dust respirator. With the sampling pump running, simulate the effects of dust loading on the operation of the pump by slamming the erasers together a couple of times, no closer than 2 feet from the inlet of the sample device. After a couple of minutes or when the cloud of dust disappears, check and adjust the flow. Repeat this process until you can no longer adjust the pump to the desired flow. Note the condition of the filter at the conclusion of the procedure.

Instruction 2: Repeat Instruction 1 except use a sampling pump that has not been recharged after a full 8-hour period of sampling. Using this pump, you will be able to notice that less dust accumulated on the filter will cause the same effect as you observed in Instruction 1.

Instruction 3: Calculate the total sampling period. First, convert the hours and minutes in each sampling period to minutes. Multiply the total sampling time by the pump flow rate.

Instruction 4: Repeat the steps in the lessons, using a charcoal tube sampling device and a filter cassette for total dust sampling.

Figure 7. Sample exercises.

There are a number of forms the exercises can take. All are self-instructional. One form, as seen in Figure 7--Instruction 1, directs the students to apply the procedures learned in all of the steps in the lesson. This reinforces previous learning. Another type of exercise, as seen in Figure 7--Instructions 2 and 4, asks the students to modify the procedures learned in the steps. This helps to generalize the skill. A third kind of exercise, as seen in Figure 7--Instruction 3, helps the students strengthen their skills by learning complementary skills.

Depending on the nature of the skill to be learned, a wide variety of exercises have been developed. Some, not shown here, direct the students to practice labeling parts of equipment and to explain their function by writing a short description beneath the illustrations provided. Some exercises reiterate the standards with instructions to the student to practice them, and others require the students to apply procedures presented in all previous lessons. The purpose of all the exercises is to assist the students in meeting the criteria of the module.

If additional readings and audiovisuals are recommended, they are listed at the end of the exercises in each lesson (see Section VII of this report).

VI. THE PERFORMANCE TEST

Each module has a single "Performance Test" located at the end. The performance test serves a dual role--as a pretest and as a posttest. Part of a performance test is shown in Figure 8. This test was selected from the module "Collecting Samples of Workplace Air." The sample in Figure 8 is incomplete because the actual test is three times as long.

PRETEST

The performance test is first used as a pretest. Following instructions presented in the "Guidelines for Students," the performance test is taken before the learning activities are initiated. How well the students do on the pretest allows them to decide how to proceed with the learning activities--that is, if the whole module or only portions must be studied.

The performance test begins with instructions that direct the students to check their skills and then demonstrate them to the instructors. Each numbered item in the test represents an aspect of a

PERFORMANCE TEST

Instruction 1: Check your skill level or progress by working through each of the items in this test. If you can perform each item as well as required, place a check in the space provided. When all of the items are checked, you are ready to demonstrate your skills to your instructor. You may use the following list, if needed. You will be considered trained in a skill after your instructor aproves your performance of each of the following items.

COLLECTING INFORMATION ABOUT SAMPLING CONDITIONS AND THE INDIVIDUAL BEING SAMPLED

Instruction 2: The following items must be performed in an actual workplace to test skill development.

No. 1 _____ Characterize WORKPLACE CONDITIONS, including the presence of visible airborne dusts, visible mists, strong or unusual odors, and cleanliness of walls, ceilings, floors and equipment.

No. 2 _____ Identify the PROCESS EQUIPMENT, including manufacturing specifications, frequency of operations, maintenance, and repair, and what worker is responsible for performing which task.

No. 3 _____ Identify the WORKER and what he or she does, and for how long.

No. 4 _____ Identify the SAMPLING EQUIPMENT, including the type of pump and sampling device, manufacturer's specifications, and flow rate calibration data.

FOR FURTHER STUDY

If you could not perform one or more of the four items above, review and practice the following lesson steps:

No. 1
Lesson One, Step 2

No. 2
Lesson One, Step 3

No. 3
Lesson One, Step 4

No. 4
Lesson One, Step 5

Figure 8. Example of a performance test.

particular skill. The test requires the students to demonstrate the performance of that skill. Using the results of the pretest, instructors and students can determine which steps the students must study in the module. The section entitled "For Further Study" shows exactly the step(s) to study when an item on the performance test is missed. This is a learning feedback loop.

POSTTEST

When all of the learning activities (steps and exercises) have been completed, the students again turn to the performance test and use it as a posttest. This allows the students to assess their progress and decide which steps require further practice. Successful completion of the performance test is evidence that the students can perform the skills described in the objectives at the level specified by the criteria.

VII. REFERENCES

Three types of references are used in the modules. At the end of each lesson, if supplementary materials are available that can provide a complementary perspective to that lesson, additional readings are suggested; films and slide/tape programs also may be recommended. On the last page of each module, references used in the development of the module are provided.

VIII. SUMMARY

Twenty-five self-instruction modules in environmental health vocational education have been developed. The modules are designed to allow both students and instructors flexibility of use. Although primarily intended for use in existing training programs, the modules can

be used by anyone interested in learning new skills or perking up old ones. The goal of the modules is to develop performance skills that can be measured. The modules are designed for use by students working alone, in small groups, or under the direction of instructors. The learning may be part of a college program or on-the-job training with government or industry.

The instructional design of the modules represents the state of the art in hands-on vocational education training. Complete guidelines for students and instructors help them make full use of the materials. Pre- and posttests allow students to demonstrate their progress. Feedback loops enable reentry into the learning cycle at appropriate points. Criterion-referenced objectives allow the performance of skills to be effectively evaluated. Each of these facets improves the training opportunities for students interested in pursuing careers in environmental health.

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