

# Diagnostic Testing For Industry

## How To Eliminate Wasteful Training and Concentrate On Productive Training

JOHN E. WALSH

Diagnostic testing has become a magic word to many companies who are awakening to the fact that blanket training of a specific employee group is sometimes wasteful. As a result the incidence of diagnostic testing has increased greatly since this waste was discovered.

Just what is diagnostic testing? Briefly, when a diagnostic test is administered the desire is to find a point at which each employee of a group should begin his training program. Obviously, the result of diagnostic testing is affected directly by an employee's training and experience. To determine just how much of this previous training and experience has been absorbed and retained by each individual is the purpose of a diagnostic test.

A brief description of some examples of diagnostic tests used in industry will show the common factors in each training situation. Among those who have utilized diagnostic tests are an important east-coast refinery and petroleum research company, one of the major U. S. electronic companies, an important chemical manufacturing firm in the east

and a nationally-known steel-manufacturing organization.

As with many other companies a large firm which manufactures data processing equipment experienced the problem of wide variations in background of persons brought to a central location for product-training. The more classes established, the more apparent it became that a solution had to be found so that the instructors would be relieved of teaching basic fundamentals of electricity and electronics. Testing prior to selection for product training was suggested and the concept was explored fully. In the investigation of testing materials, however, it was discovered that although there are many tests available none was related to the field of concern—electronic data processing machines.

Since no tests were acceptable, the next decision was to develop a training program that would insure that all selectees had a background in electricity and electronics adequate for entrance to product training. Here again, the problem of an employee with some knowledge of these fields was confronted as

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JOHN E. WALSH is Director of the Educational Research Division of the Education Department of International Correspondence Schools, Scranton, Pennsylvania. Dr. Walsh graduated magna cum laude from the University of Scranton, where he received his B.S. degree in Social Studies. He received his Master's degree in History from Lehigh University and his Doctor's degree in Educational Administration from Columbia University. Prior to joining ICS, Dr. Walsh held positions in the teaching and vocational counseling fields. His most recent position was teaching in the White Plains, New York schools.

it had been with earlier training arrangements. At this point the development of two tests to determine the extent of the employee's familiarity with first, electrical theory, and second, electronic theory was suggested. All men nominated for product-training schools were to take these tests. Test questions were selected to provide for the most efficient administration. They were based on the integration of fundamental principles of electrical and electronic theory, and not on specifics. The qualifying grade for each part was 80%. If an employee failed to reach this score on the first phase of the test, he was to be enrolled for the entire course.

Certainly it was possible for the firm to bring each man to a central location and administer a concentrated course of instruction prior to product training. However, a program of this nature would have two very serious disadvantages: (a) the cost would be prohibitive; (b) it would be necessary to remove the field-service men from their assigned territory for a time longer than seemed feasible. It was at this stage that consideration was given to offering the basic material through the correspondence method.

The training department inaugurated a study of accredited home-study schools to determine whether a practicable training program was obtainable. The criteria used were (a) appropriateness of basic material; (b) availability of specialized material; and (c) competency of staff.

A course of study was developed in consultation with a home study school. It consisted of material on practical electrical theory, electronic theory, and components and circuits of electronic data processing machines.

The course has been limited in intent and usage to the firm's field-service men and complete control of the training program is maintained by the firm.

### **Refinery Maintenance Training**

An east-coast refinery was faced with the need for upgrading practically all of its skilled maintenance force. The men to be trained were distributed throughout all ranges of craft skill. Since labor and management could not get together on a standard curriculum to be studied by all hands, they agreed that a testing program should be conducted to determine each man's level of ability and at what point training should begin.

A total of sixteen crafts was involved, most of which are common to all refineries. These are: Automotive Mechanics, Boilermakers, Carpenters, Electricians, Field Machinists, General Machinists, Instrument Technicians, Insulators, Lead Burners, Masons, Painters, Pipefitters, Riggers, Sheet Metal Mechanics, Shop Machinists, and Welders. First, each craft was examined and its function was described with a list of job experiences. Job experiences were analyzed and those which had common elements of skill were combined. Through careful combination and selection, each craft was finally described in a list consisting of about 200 general job experiences. Next the job experiences were grouped together into categories of related jobs and job skills. The final result showed that seven general categories of jobs and skills had to be considered. Courses were developed using correspondence material to fulfill the training needs for each of the categories, based on standards for skilled journeymen. When each course was examined it was apparent that many

categories contained elements common to all. Further, certain basic instruction was required to assure success in each of the sections.

A basic section was developed to provide the mathematics and basic craft skills common to all categories. This is where diagnostic tests proved useful. Individual diagnostic tests were constructed for each section of each craft, based on the various job experiences included in each section. A battery of tests was administered to all eligible personnel. The scoring of the tests plus a related skills test given on the job demonstrated the skill of each examinee in the individual occupational categories of his job. When the results were determined, each man was trained in the techniques and related trade procedures where weaknesses were apparent. Time, effort, and study were not wasted in those areas where an acceptable standard was shown.

### **Chemical Plant Training**

An eastern chemical manufacturing firm decided to inaugurate a new program of education within its plant. Among those who were to be trained were men of all levels of job experience. The problem was, of course, to select the level at which each man should begin his training program.

A set of diagnostic tests were set up to fill this need. They were developed in an ascending order of difficulty of the material which should have been familiar to the trainees. The tests were administered in total to all of the craftsmen employed.

After the tests were scored, it became apparent that the bulk of the men were not highly competent in their respective

technical jobs. A program of basic study was necessary for almost all of those who were tested. Only in a few outstanding cases were individuals above this low level of competence. Since this indicated to the company that many of the employees were depending on only a few others for advice, a contribution was made in two areas; first, it was easy to judge in what areas training was necessary, and furthermore it was easy to select those individuals within each group who were leaders, and who were capable of assuming additional responsibility.

### **Steel Craft Training**

A steel-manufacturing organization wished to test employees of the electrician, hydraulic, and millwright crane-repair trade. These men had already been studying in an organized-training program. The company desired to test the effectiveness of the training, and to determine whether or not the employees within each trade could be classified in order to realize maximum efficiency from them.

These tests were developed on the basis of an overall training program and no attempt was made to break the examination into sections. The examinations were composed and administered, and upon their correction it became apparent that in many areas the students were highly competent. On the other hand, it was evident that in several portions of their course the students had been receiving less benefit, and further training was indicated. Consequently, almost every man was required to undertake further study in certain subjects.

### **Some Precautions**

Diagnostic testing must, however, be used with caution. First and foremost

to administer a test without first establishing an objective for training accomplishes nothing. Naturally, in order to establish the over-all training objective it is necessary first to study the job requirements for each individual to be trained. In other words, what is the individual to know when he has completed his training? The first step obviously is to study a description of each job. Once the job functions are known, then areas may be designated in which a degree of excellence is required. Now comes the chore of building a test to determine each student's competence in each particular area.

Tests may be so constructed as to cover an entire operational field in one examination or may be broken into many tests to cover each individual segment of the field. Very often the latter course

is preferable. For example, a machine shop worker's knowledge of lathes may be outstanding because of long practical work in the shop having to do with lathes, yet his test results will indicate that his proficiency on milling machines or some other phase of machine shop work is less than adequate. In cases of this type it might be wise to give separate examination segments on each shop operation.

It is interesting to note that reliability of the diagnostic tests that have been developed has been sufficient for action on the part of the companies involved to use test results in evaluating their personnel for merit increases, job promotions, and other immediate apparent uses. But the main purpose has been, and is, to eliminate wasteful training—to concentrate on productive training.

## International Contest For Management Papers

The Council for International Progress in Management announces a contest for a paper on "Scientific Management and Its Responsibility For Bettering the Standards of Living in the Americas," held under the auspices of the Council's Mexican counterpart, the Confederacion Patronal de la Republica Mexicana. Papers may be of any length and must be sent in duplicate to the Confederacion Patronal de la Republica Mexicana, San Juan de Letrán 13 Mexico 1, D.F., Mexico, no later than January 15, 1961. Additional information on rules for submission of papers can be obtained from CIPM, 247 Park Ave., New York 17.

First prize is 15,000 pesos (at present exchange, approximately \$1,200), a gold medal and a diploma. Second prize is

10,000 pesos (at present exchange, approximately \$800), a gold medal and a diploma. Third prize is a gold medal and a diploma.

The Confederacion Patronal, a Mexican management association, is holding the contest in conjunction with the Third Inter-American Management Conference which will take place in Mexico City, March 6-11, 1961, under the Confederacion's direction. Representatives of industry, consulting firms, and universities from all the Americas will meet at this Conference to hear papers on topics of mutual concern in the management field and to exchange ideas and experiences. The Conference is held under the auspices of the Pan American Council of the Comité International de l'Organisation Scientifique.