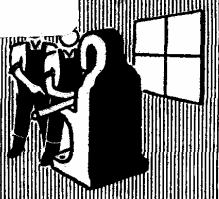


MORE PRODUCTION THROUGH TRAINING

JOB INSTRUCTION

A Manual for Shop Supervisors and Instructors

TRAINING WITHIN INDUSTRY

WAR PRODUCTION BOARD

LABOR DIVISION

For Sale by Superintendent of Documents, Washington, D. C.

JOB INSTRUCTION

A Manual for Shop Supervisors and Instructors

Prepared and made available through courtesy of

WESTERN ELECTRIC COMPANY

TRAINING WITHIN INDUSTRY
Labor Division
WAR PRODUCTION BOARD
Washington, D. C.

FOREWORD

While the importance of systematic job training has long been recognized, attention to the problem rises and falls with the business picture and the number of employees who are learning new jobs. Charles R. Allen's notable analysis, The Instructor, the Man and the Job which first appeared in 1919, has been the basis of several later manuals. Plant Training Practices, Vocational Instructor Training Notes a comprehensive manual published by American Telephone and Telegraph Company, appeared in 1930.

Since that date, however, new developments in manufacturing, in management, and in employee—relation practices have continued, many of them with an important bearing on job instruction. The more detailed analyses of jobs by planning engineers, the application of motion economy to repetitive operations, experiments in better methods of imparting skills, and the recognition of personal characteristics of the learner are a few of the developments which have not been considered in previous manuals.

Job Instruction is designed for study and discussion by supervisors who wish to become familiar with or keep up—to—date on job instruction practices, and for training groups of instructors or employees who have job instruction duties.

The information contained herein is to be used for training purposes only.

CONTENTS

SECTION 1
The Problem of Job Training

"Getting out the work" seldom runs along smoothly without interruption. About the time a group is working together smoothly changes usually occur which make it necessary to train men. Whether these changes are in the form of expanding schedules, improvements in methods, or shifts in organization, they always create training problems. Even reductions in schedules mean that employees have to be transferred to other departments and taught different jobs. Since untrained or poorly trained employees slow up the work and raise costs, it is important to get them trained in their jobs as quickly as possible. To do this training effectively, supervisors and instructors need to know not only the operations they are to teach but the art of teaching as well.

Good teaching is helping people to learn without getting in the way of their learning. Poor teaching may actually hinder their learning. Fortunately, good teaching is an art that can itself be learned. It includes an understanding of how people learn and ability to use effective methods in helping them learn.

Job training covers a wide range, from an hour or two required to "break in" an employee on a simple, repetitive job to the months and even years of training required to teach a highly skilled trade. While much job knowledge is passed along informally from one employee to another in the working group, systematic instruction is usually more economical and effective.

Expert knowledge of the job as an operator is not sufficient to make a instructor. In fact, such knowledge may make it difficult to notice the details of the operation. In teaching the job to a learner, one must pay attention to just these details. The instructor, even though he knows the job as an operator, needs to analyze that job into its detailed operations and often into the motion patterns of which it is composed. He also needs to give attention to the particular characteristics of each individual learner, for no two of them have exactly the same experiences, abilities, and desires. It is to these that the instructor must relate the new job.

Training practices which have proved successful are described in the following pages and the principles which they illustrate are explained. The supervisor or instructor will not always find it possible to apply these identical practices to his own situation, since they were used in different situations. But if he will look for the general ideas which the other fellow's practices illustrate, he will find that they can be applied to his problems too. For these ideas have been derived not alone from the experience of instructors in the shop but also from the growing knowledge of how learning takes place and how it can be assisted by instruction.

One thing more. It must be remembered that to the worker a job means more than just a pay check every week or doing mechanical operations over and over between in and out whistles. It means that he is part of an organization, wherein he has a particular place. It means that he is a human being who wonders what kind of people his fellow workers are, what they are going to expect of him, how he should approach his supervisor, etc. Consequently, job training is more than just teaching a shop skill. It includes helping the worker to adjust himself to his surroundings, giving him an idea of the organization of which he is a part, and the particular place he is to fill in it.

Viewed in this light, effective job training includes a thorough analysis of the job to be taught, skill in the art of teaching, an understanding of the individual learner, and an appreciation of his part in the organization.

This is the point of view from which the problems of job training will be approached in the sections which follow.

SECTION 2
Analyzing the Job

Why a Job Analysis is Necessary

"This job seems all mixed up to me. I don't think I can ever learn it."

"I've been on this job for 3 months, but nobody ever showed me that before. I've wasted a lot of material because of it, too."

"Am I supposed to remember all that the first day?"

"The boss may know this job but he doesn't seem to know which part of it to show me first. He's got me all muddled up. He forgets to tell me about some of the most important points, until I get stuck."

These remarks of employees trying to learn a job suggest that anyone who gives training ought to look carefully at every detail of the job and think of the order in which these details can best be learned before attempting to teach them to someone else.

The instructor, because he is experienced, has been accustomed to paying attention only to the "fine points" of the job—quality requirements, alignment of parts, uniformity of materials, workman like finish, speed, etc. The new man, on the other hand, has to pay attention to such simple things as what to do with his hands, where to look with his eyes, what part of the operation to do first, how hard to push on a lever, how the material or the machine reacts to his effort, etc.— aspects of the job which an experienced man overlooks because they are second nature to him.

The instructor needs somehow to get back to simple and elementary points or the job where the learner will have to begin. One of the most convenient ways for an instructor to do this is to sit down in front of the job with a pencil and paper and analyze it, with the problems of the learner in mind.

How to Analyze a Job for Instruction

Begin by following each part of the job through slowly and carefully, writing down in detail what the worker must do and what information he has to have. Do this by carrying out the following 9 steps:

1. **Outline the working sequence.**
2. **Lay out the motion sequence on repetitive parts of the operations.**
3. **Add safety and health precautions.**
4. **Add quality requirements.**
5. **Add notes on waste prevention.**
6. **Add notes on judgment factors.**
7. **Add supplementary information.**
8. **Add expected output.**
9. **Add learning and teaching aids.**

You will not always carry your analysis through all of these steps. That depends on the nature of the job and the amount of training to be done, but the steps show the order in which a complete analysis of a job from the learner's point of view can be worked out and written up. Each of these steps will now be explained more fully.

Nine Steps in Writing a Job Analysis

STEP 1. Working Sequence. – List all the things to be done, in the order in which you would carry them out on the job. State each thing to be done in a complete sentence,. being as specific and definite as possible.

At the first trial, you will probably mention only a few of the main operations, overlooking the details. Later you will find that you can break each operation down into smaller points.

For example, a skilled workman when he was appointed instructor attempted to write down an analysis of the job he was to teach. After working 2 hours, he had "covered the job" in half a page. When it was pointed out that so "sketchy" an analysis would not help very much in teaching, he went to work again. Soon he had expanded these notes through more detailed analysis to a whole page. By this time, he had begun to view the job as a learner would see it and by working in spare moments for several days he was able to break it down into a more detailed list of operations and points covering several pages.

Where this information is available in the manufacturing lay out, as it often is, use it. If you assume that you "know" from experience, you may be overlooking some of the finer points about the job which are clearly written up or shown in the blueprints. Go over not only the manufacturing layout but also the blueprints, specifications, and any other material supplied by planning engineers. But where this written information is not available, work up the outline of operations from the job itself as explained above.

To illustrate how the working sequence of a job may be out lined, here is such an outline worked out by the instructor for a job he was preparing to teach. The job is a simple forming operation on a punch press. The part is shown in Fig. 1; the punch and die in Fig. 2.

JOB A. Forming Small Part on Punch Press:

Working Sequence:

1. Place pan of parts conveniently on or near press.
2. Lubricate parts in pan by sprinkling with oil.
3. Process each part in the press as follows:
   - Grasp part with aluminum pliers.
   - Place part in gage of tool.
   - Trip press to form part.
   - Remove formed part.
4. Gage parts occasionally to test for quality.

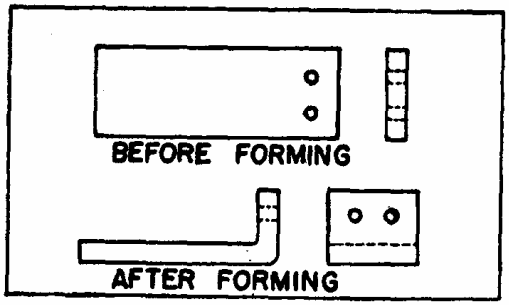


Fig. 1

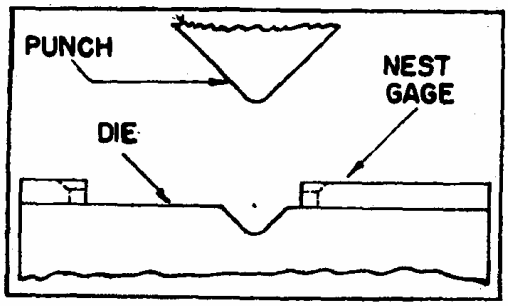


Fig. 2

The rest of the instructor's analysis of Job A is shown later to illustrate the remaining steps (see pp. 6—8).

Here is another example of a "working sequence" written out by an instructor for a more complicated job—an adjusting job at the bench.

JOB B. Adjusting Small Electrical Apparatus Called a "Brush" Using Bench Fixture and Hand Tools:

(Note how careful the instructor has been to use definite and specific terms.)

Working Sequence

1. Take brush from container; check, and adjust if necessary, for lever bind, side play, restoring and tripping requirements. (Experience has shown that on the average 5 percent of all brushes will need adjustment at this point.)
2. Omitted.
3. With brush in untripped position, adjust for equalization of the spacing of the springs and parallelism of the shoes with relation to the forked slide gage and centralize trip lever with respect to the forked trip lever gage. (Experience shows all brushes need these adjustments.)
4. Omitted.
5. Tension all springs on the brushes using combined tensioning device and spring gage, N—2939l. (All brushes need this adjustment.) -
6. Set in untripped position and readjust if necessary for correct spacing of the spring contact shoes with relation to the forked slide gage limits, and for parallelism trip brush (experience shows 50 percent of brushes need these adjustments); observe all brushes for .010—inch clearance at separators between inner and outer springs and for parallelism of spring contact shoes.

Remove brush from fixture, mark with adjuster number and return to container.

Before going on with the remaining steps of your analysis, a word about the form in which you write it up. Do not feel obliged to make an elaborate, typewritten write—up especially at first. The form is not so important as the fact that you make the analysis. Your notes in heir original rough form, just as you pencil them down, are vastly better than no written analysis of the job at all. Begin to use them in rough form right away, as you are giving instruction, keeping them handy and adding additional points from time to time. Here are two schemes which different instructors have found convenient for arranging their notes:

Get a number of ordinary blank filing cards, size 4 by 6 inches, and write down each part of the job on a separate card. This allows space on each card for the more detailed notes indicated in the later steps of the analysis, or if necessary additional cards can be used. Arrange the whole set in working sequence or any other order which is most useful and convenient. Cards are easy to rearrange in making your teaching plan. If you want to see several of them at once they can be spread out on a table. This card scheme, by the way, is one that many writers use in organizing their material.

Another scheme is to get a large sheet of heavy paper, 24 by 36 inches or bigger, on which your whole analysis can be laid out in chart form. Rule it in several vertical columns and write down your "working sequence" (Step 1) in the first column. Use the remaining columns for arranging the notes you make in Steps 2 to 9.

STEP 2. Motion Sequence.— The next step in making an instructor's job analysis is to break down the more repetitive parts of the job into an exact motion sequence. This step applies not only to very simple jobs consisting of a single repetitive operation, but also to any repetitive parts of more complex jobs having a longer operating cycle.

Although the making of a complete motion analysis is a technical process requiring special training, you can make a practical analysis of motion sequence on most simple operations by watching care fully, over and over, the detailed motions which you or some other expert operator makes as he does the operation. Write down on the left half of a page the exact movements which the operator makes with his left hand, left arm, and left foot if used in the exact order in which he makes them. On the right—hand side of the page, exactly opposite each of these movements, write down the movements which the operator makes with his right hand, arm,• or foot simultaneously with each of the left—hand movements.

To illustrate, here is the instructor's analysis of motion sequence for the repetitive part of Job C, a simple hand milling operation in which the parts are placed in a vise by hand and milled by operating a vertical feed lever. Simultaneous motions are shown opposite each other, connected by broken lines.

JOB C. Instructor's Motion Analysis:

Left Hand	Right Hand
Move part from pan to position in vise jaw	Toss part to container. Reach and grasp vise lever.
Hold part in vise	Close vise.
Reach and grasp milling lever	Idle,
Process part by raising and lowering lever	Idle.
Idle.	Open vise.
Reach and grasp another part	Reach and grasp part in vise jaw.

This is a good place to consider better ways of doing the job you are analyzing. Your study of repetitive motions may have shown you that the job, as it is being done, is wasteful of time or energy. Perhaps you can see a better motion sequence than the one you have been following or which you have been watching some other experienced operator use. During Step 2 is a good time to experiment with the repetitive parts of the job to see if the worker's motions can be improved. There are also some further suggestions on pages 23—25. Instructors are often able to make important savings, both in time and in workers' effort, by ways to improve workers' motions on the job without altering the standard lay—out of the job.

STEP 3. Safety and Health Precautions.—So far you have been looking only at the order or sequence in which each part of the job is to be done. Now look over the whole job again, thinking of the safety and health precautions which you will want to teach beginners on this job, and if possible, the reasons for them. For example, here are some of the safety precautions the instructor wrote down for Job A, less the punch press operation shown on page 4.

1. Use soft aluminum pliers, not steel pliers, to place part in tool.
2. Keep guards properly adjusted.
3. Be sure that the last—formed part has been removed from the tool before placing another part.
4. Keep everything in an orderly fashion:
   (a) Tools and loose clamps away from the press.
   (b) Loose piece parts off the floor.
   (c) Loose parts away from the treadle.

STEP 4. Quality Requirements.—At the proper places in your analysis write down the gage limits for each part of the operation and, if possible, note the reasons for these requirements. Add the feeds and speeds of machines if within the operator's control. Add notes about the quality of supplies and materials, where and how defects are likely to appear, and what to do about defective material. Include notes on appearance factors and workmanlike finish of the job.

Notice, for example, in the "working sequence" for Job B (see page 5) that the instructor has inserted a figure showing the gage limits in Item 6 and indicated by percents the proportion of parts which are likely to require adjustments. On other jobs the type of quality requirements would, of course, be somewhat different.

STEP 5. Waste Prevention.—Add precautions about operating errors which have been common, resulting in wasted material, loss of time, or added cost. Include information about the care and use of each piece of equipment, cautions against abuse of materials and equipment, and special emphasis on the care and use of testing and gauging equipment. For example, here are some of the precautions for prevention of waste which the instructor noted in his analysis of Job A:

1. Be sure each part is properly nested in the gage of the tool before tripping press.
2. Gage parts frequently enough to avoid making scrap.
3. Avoid spoiled parts by removing dirt or slugs adhering to the tool.
4. Avoid waste of lubricant.

STEP 6. Judgment Factors.—Go back over the whole job and make note of those troublesome points where the worker must exercise his own judgment, where he cannot be told exactly what to do, except in terms of what is happening—points where he must be taught to "watch" this or that, and do certain things if such and such things occur in the materials, the equipment, or the product. For example, think of the judgments you must make when driving an automobile on icy or slippery roads. These "judgment points" must be drawn from the instructor's experience by going over each part of the job and looking for them.

For instance, judgments often have to be made such as (a) recognizing a defect, (b) seeing just what is to be done to a part to bring it to the shop requirements, (c) recognizing what will happen to a part under certain conditions.

For example, here are two of the notes of this kind which the instructor made on Job B, operations 5 and 6:

Operation	Judgment Factor
"5. Tension all springs, etc." (See page 5)	By working toward center of limits as shown on gage for tension, the possibility of subsequent steps throwing the tension off is lessened; thus reducing need for subsequent retensioning.
"6. Set in untripped position, etc."	Correction of insufficient clearance affects parallelism requiring rechecking; hence, this should always be done first. Parallelism correction may reduce or increase tension depending on whether contact shoe is tilted in or out.

STEP 7. Supplementary Information. — Make a list of machines, tools, fixtures, gages, and other equipment and indicate where each movable item is to be kept when not in use. If an orderly arrangement of the equipment has not been made, set one up before trying to teach the job. Add notes of how the product from this job fits into the larger finished product as a whole—how it is used, what function it serves, why certain materials and design were required, and any other facts which will make the job more interesting and meaningful to the learner.

For example, at this step of his analysis of Job A, the instructor noted the following supplementary information:

1. Names of parts of the machine (punch press) and tool:
   - Starting switch.
   - Bolster plate.
   - Treadle and foot rest.
   - Ram.
   - Fly wheel.
   - Guard.
   - Punch.
   - Die.
   - Gage for holding piece parts in place.
   - Foolproof devices in tool, if any.
2. Cost of tool, machine, and parts.
3. Fact that developments such as use of compressed air ejector, aluminum pliers, etc., were devised by operators like the learner.
4. Interesting characteristics of the materials used.
5. Tonnage which the press exerts.
6. Special features of the machine.
7. The Company's aim of "quality work"; how quality itself has practical limits.

STEP 8. Output Requirements. — Add notes of the time allowed or the output expected for each separate part of the job and for the whole job (see pp. 25—26). This information can be obtained from the piece—rate records.

STEP 9. Learning and Teaching Aids. — Add list of sources where any material helpful in teaching the job may be found, such as catalogs, charts, standards, models, drawings, photographs, and any other teaching aids.

General Suggestions on the Instructor's Job Analysis

This concludes the explanation of the nine steps in writing an instructor's job analysis. When the supervisor or instructor has finished these steps and arranged all his notes in an orderly way, he has a written analysis of the job from the learner's point of view.

Obviously, a thorough analysis cannot be made all at once. If it is laid away for a few days and then looked over again, new points present themselves. In the meantime, the instructor may be watching the job for items he missed before. He should continue to be watchful after he has a learner beside him—when he is consciously trying to think in terms of the learner's thinking—for that is the time when he will be most likely to take notice of details he overlooked before. If he can get the learner to ask questions it will help especially to show him the technical terms he is using which the learner does not understand.

Since the examples given above were broken up to illustrate different steps in making an analysis, it may be helpful here to see an analysis "all in one piece," just as it was put together by the instructor. The example below is an analysis of a simple drilling job such as is done in a small "job shop." (Note that this analysis differs from the others also in that it is a "generalized" pattern which can be applied to small drilling jobs of varying sizes on different shaped small parts in which specialized tools are not used.)

JOB D. Drilling Holes in Iron Bars

1. **Working Sequence:**

   Arrange parts and work space to provide for shortest motions possible.
   Place drill in drill chuck.
   Adjust height of table and spindle so that drill is close to the work.
   Start machine.
   True up drill.
   Place work on table of machine.
   Line up center punch marks with center of drill.
   Drill hole and lubricate drill.
   Remove chips from work and drill.
   Remove work from table of machine.
   Occasionally remove chips from machine into a pan.
   Occasionally inspect work for the hole size, etc.

2. **Motion Sequence of Repetitive Part of Operation (Simultaneous motions are shown opposite each other.)**

Left Hand	Hold work.
Place work in approximate operating position.	Right Hand
Adjust position of work so center punch marks line up with center of drill.	Grasp lever.
Hold work in position.	Bring lever down until drill point touches work.
	Raise and release lever. Adjust and fasten clamps.
Lubricate drill.	Grasp lever and feed drill part way through work.
Idle.	Raise lever to clear chips. Lower lever and complete drilling.

Raise lever to remove drill; release lever. Loosen clamp.

3. **Safety Precautions:**

   Loose clothing such as neckties, loose sleeves, and open shirts should be avoided as they are likely to catch in moving machines and tools. Operators should not wear gloves while operating a drill press as a glove may catch on the drill and cause serious injury to the hands or arms.

   Hands should be kept away from the drill while it is revolving. A suitable brush should be used for lubricating the drill.

   Safety bars and clamps are provided for safer operating conditions. Under no circumstances should drilling be done without them, for parts are apt to turn out of the operator's grasp, break the drill, and cause injury.

4. **Quality Requirements:**

   Drilled holes must be smooth and approximately straight. Their diameters and locations should not vary more than the tolerances specified for the job. Keeping the table clean and flat will help to maintain quality in drilling operations.

   Excessive burrs may be prevented by using a sharp drill, properly ground, and by avoiding excessive pressure as the drill is breaking through.

5. **Waste Prevention:**

   Drills are frequently wasted by drawing out more than are actually needed and allowing them to remain around the machines so that they are swept into the chips or lost in other ways. Cutting edges are dulled or burned by rotating the drill too fast. Drills are easily broken by careless handling. Since they are expensive, they should be handled with care.

   Chips should be kept off the floor and deposited in the proper receptacles to avoid contamination with other materials or chips of other metals, since they are to be baled, sold, and reclaimed.

   Brushes and oil shall be used plentifully, yet economically.

   Machines and equipment should not be abused by using the wrong tools for making adjustments. Good housekeeping helps considerably by keeping every tool in its proper place. The use of hardened steel hammers by operators is injurious both to drills and machines, especially to the table of the machine. Nicked—up machine tables are indications of carelessness in this respect.

6. **Judgment Factors:**

   Points on which the operator must develop judgment based on experience include the following:

   Truing up of a drill by turning drill in chuck or applying pressure on side of drill.

   Centering of the work with the center of the drill.

   Using proper pressure to start the drill so that it will remain on the center.

   Increasing the pressure or feed to the capacity of the drill, after it has begun to cut its full diameter.

   Lessening the pressure just as the drill is beginning to come through the under side of the part to avoid "catching" or "biting in" of the drill.

Recognizing whether or not the drill is rotating too fast or has been improperly sharpened, by observing the kind of chips it forms.

7. **Supplementary Information:**
   Adjustments on the drill press as to drill position, height of table, height of spindle, and speed of spindle rotation. Information about the drill itself, about the cutting edges, the web, clearances, etc.
   Feeds and speeds for different materials.
   Properties of materials.
   Drill grinding for various materials.
   Selection of drill as to style of shank, carbon or high—speed steel, helix angle, length, diameter, condition.
8. **Expected Output:**
   Expected output will depend on size of holes, thickness of part, number of holes in part, etc. It should be specified whenever this analysis is applied to a specific job.
9. **Learning and Teaching Aids:**
   Illustrated drill catalogs and informational booklets of drill manufacturers.
   Speed and feed charts, lubricant charts, quality standards, and other engineering data provided by the Company.
   Examples of good and poor work, showing how the parts fit into assembly, and results of correct and incorrect procedure.

How Far Does It Pay to Go With a Written Analysis of the Job?

In teaching a job of a highly repetitive nature involving the training over a period of time of a good many operators, it will pay to make the most complete and detailed written analysis of which the instructor is capable, including the full motion sequence. Jobs of this kind include simple assembly operations and simple bench and machine operations as filing burrs, drill press, hand milling, tapping, punch press, staking and feeding machines equipped with magazines or dials. The more simple the job, that is, the fewer and less complex the number of movements, the less costly in time and effort it will be to make a complete analysis.

In teaching more complicated jobs, since it requires a much longer time to analyze them in detail on paper, or where there are only a few people to be trained, it may not pay for the instructor to go farther than Steps 1, 3, and 4. On short—run jobs or where few people are to be trained, he may only carry through Steps 1 and 3. Of course, if the job is extremely simple in motion sequence, Step 2 can also be carried out without much expenditure of time and effort. After -he has finished analyzing one or more jobs, the instructor will be able to judge these values for himself and determine how far it is wise for him to go.

There is one other important use of the job analysis, which may have a bearing on how far the instructor will go in making it. That is its value for improving the efficiency of the operators who already “know” the job. This use will be discussed further in Section 6.

Summary

To be an effective instructor it is necessary to see the job in all its details, not only as the expert operator sees it but as it looks to a beginner. The instructor can force himself to consider all these details by writing out an analysis of the job bit by bit. This job analysis then forms the basis of his plan to “get the job across” to a learner. Some suggestions for setting up such a “plan of instruction” are given in the next section.

SECTION 3
Planning the Instruction

After the instructor has made a thorough analysis of all points of the job, he is ready to consider the question, "In what order should all these points be taught?" and to embody his answer in a definite plan or chart of instruction for the job. For purposes of thinking and planning, the above question can be broken down into four sub— questions, each of which refers to a different kind of learning and, therefore, requires a different kind of teaching.

	Kind of Learning	Sub-question
1.	Job information:	What facts about the job must be given, and when?
2.	The operations themselves:	In what order shall the operations themselves be taught?
3.	Fundamental points of attention:	What fundamentals must be "driven home"?
4.	Higher degrees of skill:	After the operations are learned, what shall be done to build up a satisfactory output?

In this section, each of these questions will be considered in turn.

What Information Should Be Given, and When?

Before he is ready to lay hands on the tools or materials to learn the actual operations, what does the learner need to know about the job, the equipment, and the materials? What must he know a little later, to get ahead in mastering the job? What information can be with held and brought in still later as an interest stimulator after the novelty of the job has worn off? These questions suggest a threefold division of job information as follows:

a. Preliminary job information—needed before or during the first teaching of the operations.

b. Working information—needed in mastering and carrying out the job complete.

c. Supplementary job information—helpful for stimulating interest at the higher stages of skill.

a. **Preliminary Job Information**.—The instructor can look over his entire job analysis for items of information which must be taught at the beginning before the operations themselves are taught, or which are helpful for the "Preparation" step of teaching the operations themselves (see sec. 4, pp. 19—20). Such information usually includes:

1. Facts about the equipment—general operation of unfamiliar machines or tools.
2. Characteristics of the material to be used—especially peculiarities not already familiar.
3. General purpose or use of the product—specific items can be saved until later (see item "a," pp. 14—15).
4. Safety precautions which must be understood before the operations are attempted.
5. Meaning of any new terms which will be used in explaining the operations.

For example, here are notes on "preliminary job information" which an instructor worked up from his analysis of Job A, part of which was shown on page 4.

The job is to form parts like this (show sample) from blanks that look like this (show sample). They are called piece parts. All blanks used must be complete blanks and must have the proper number of holes in positions that appear correct. Using any blanks which do not meet these requirements is wasted effort and may cause breakage in subsequent operations.

After the part is formed it should meet the proper requirements in that the burr should be on the inside of the form, part should fit the gage, and should have the form in the proper position.

In order to safeguard the operator, the tool, and the machine, aluminum pliers should be used in feeding the piece parts into the tool and for removing them from the tool. Aluminum pliers are used because they are softer than steel and will not fly to pieces if they are accidentally left in the tool. The tool will likewise remain undamaged. Even if the operator wears side—screen goggles at all times, the risk of using steel pliers should never be taken.

b. **Working Information**.— If the instructor's job analysis has been worked up as suggested in Section 2, it will be a well organized source from which to draw the working information which the learner needs as he is mastering and carrying out all parts of the job. Such information includes all the safety precautions, job requirements, and notes on the judgments which the learner must make in order to turn out a proper quality and quantity of work. It will be helpful to make a separate outline of this information, arranged in the order it will be used in teaching the operations themselves. For example, here is a portion of the "working information" which the instructor prepared on Job A. Note that much of it is an elaboration of the job analysis which this, instructor worked up first, and which was shown in Section 2. In this case the instructor chose to write out the information in paragraph form, instead of merely outlining it.

JOB A. **Working Information:**

In feeding a part into the tool it should fit into the gage so that it lies flat at each end, the burr side on the right. The lower part of the tool is called the die, while the upper portion that is movable in an up—and—down direction is called the punch. The portion of the tool which keeps the piece parts in the correct position is called the gage or nest. This is how the part fits in (demonstrate). See that there is nothing under the part, i. e., that the part and the tool are clean. --

All parts should be lubricated with clean oil of this kind (demonstrate). Using lubricated parts prevents undue wear on the tool. Sprinkle parts with oil while they are--in the pan.

The switch for starting the press has two positions. •It should first be kept at the left—hand position until the press is fairly well started; then the switch lever should be quickly moved to the right, where it should stay of its own accord. The fly wheel of the machine stores up the energy necessary to do the work. A mechanism called a clutch is used to transmit the fly wheel energy into useful work. The clutch is put into engagement by means of a foot pedal or treadle. After the clutch has been engaged, the portion of the press which holds the punch of the tool comes to its down ward position. This part is called

the ram as it actually rams one part of a tool into another as may be seen here. (Point out parts of machine as they are mentioned.)

All adjustments of the machine or of the guards should be made only by the man who has been made responsible.

Before the operation is started everything should be arranged in an orderly position. No tools, clamps, pans, etc., should be in the way; they interfere with efficient operation. The parts to be used should be located so as to give the least amount of lost motion, since each second lost in moving parts further than necessary cuts down the operating efficiency. The part of the machine where parts may be placed for feeding is called the bolster plate (show).

Care should be taken to remember that each part is in the proper position in the tool and every precaution should be taken to see that only one part is in the tool at one time. Two at a time are known as "double—headers." They are almost sure to damage the tool or the machine. A rhythmic movement must be attained in order to get the most out of the job. (Demonstrate the operation. See Presentation Step, page. 20.)

While parts are being formed, a solid—like blow is felt on the press. These blows should be fairly uniform. If the press is hitting too hard, a much sharper vibrating blow will be heard.[1]

After a number of parts have been made, a check—up should be made on the parts to see whether or not the product is satisfactory. Parts should be checked at least one an hour to be sure that nothing has changed in the set—up. Care should be taken not to damage the gage.

The part that is being made fits into this assembly (demonstrate). Note that if it isn't formed squarely it will hit the detail next to it. If the holes are out of position, it may twist the part, etc. These are the reasons for being careful about the quality of the product. Besides, the product should show good workmanship.

Another quality point to watch for is that parts are some times slightly cracked in forming. If this condition occurs frequent the supervisor or instructor should be notified. The material may be defective.

Pans of finished parts should be removed from the press before they get so full that parts fall on the floor. The pans should be nested in orderly fashion on a skid so that the trucker may easily remove them to their next station.

Note the counting device on the machine. It tells how many parts have been produced.

c. **Supplementary Job Information**.—Instructors have found that after the novelty of a new job has worn off, and the worker has learned to do it with a fair degree of skill, he is likely to settle down into a kind of routine on it and lose interest in further improvements of his skill.[2] One way to keep his interest alive is to see that he learns something new about the job from time to time. A good many items of information about the job, particularly the "why's" of various operations, the characteristics and use of certain materials, etc., •can be brought to his attention as a means of kindling his interest in the job anew from time to time. Here is an example of just one kind of information which might be saved for this purpose. There are many others.

Nothing is rigid; everything is flexible! Few people realize that the apparent rigidity of the "solidest" thing is only relative.

1. Note that this is a "judgment factor" as explained on pages 7—8.

2. On the “interest value” of such information, see also pages 38—39.

They assume because a thing is of steel that it will not bend or break, at least under any ordinary stress. Workers often force parts into gages, assuming the gage is "rigid." Using a delicate micrometer caliper, one man was seen to screw it up as tightly as he could with his fingers before reading it. Yet, even an enormously heavy machine bends and "gives" under operating strains. For example, in some "C—type" punch presses the "C" frame opens up as much as 3/32 of an inch at the time of impact, distorting the alignment of the press sufficiently to seriously affect some tools and work. The weight of a 5—cent piece laid on one end of the long heavy tube of a light—wave apparatus in the laboratory will bend the apparatus enough to distort the beam observably. Engineers always expect steel beams to bend under stress; in fact, even to bend of their own weight. All this explains the care with which machines are aligned, stresses are watched, and limits of use are specified for tools and machines. It explains the emphasis which is placed on using "oversize" tools and massive machines, rather than undersized ones, especially for accurate work.

In What Order Should the Operations Themselves Be Taught?

This problem may be stated in several ways: What parts of the job can the learner do most easily at the beginning? What parts are safe for him to attempt at first? Can the operations be taught in the same order as they are done on the job by an experienced worker, or must some parts be postponed for safety or on account of their difficulty until the learner has developed other skills and gained certain knowledge about the job?

Many jobs can be taught in exactly the same sequence as they are done when the job is being run by an expert operator. The advantage of this, when it can be done, is that the new operator has nothing to "unlearn" later. He gets the correct "form" and sequence right from the first.

Some jobs, however, cannot be presented to the learner in exact working sequence. He will learn to do them finally in that order, of course, but, in teaching him, some parts of the job have to be taken out and taught separately.

For instance, some parts of an operation must be postponed for safety reasons until the learner has gained knowledge and skill in other jobs. This is true of many machine jobs such as punch press, milling, drill press, routine arc welding, bakelite molding, and any other job in which precautions about the safe operation of the or tool need to be thoroughly learned before the operator can be allowed to go through the whole operation for himself for the first time.

In other jobs, there are a great many details for the learner to watch all at once, right at the start. This confuses him and hinders his learning.[1] In this kind of job, the detailed job analysis will help the instructor sort out these details and decide which one the learner needs to pay attention to first, second, etc., as he tries the job for the first time. This clears up his confusion and keeps him from be coming discouraged at the start.

Again, there are some jobs in which the worker must understand the principle involved before he can learn to do the work.[2] This fact shows the learning order. The learner must be given such information and all—round explanation or demonstration as will help him grasp the principle or "big idea" of the thing as early as possible.

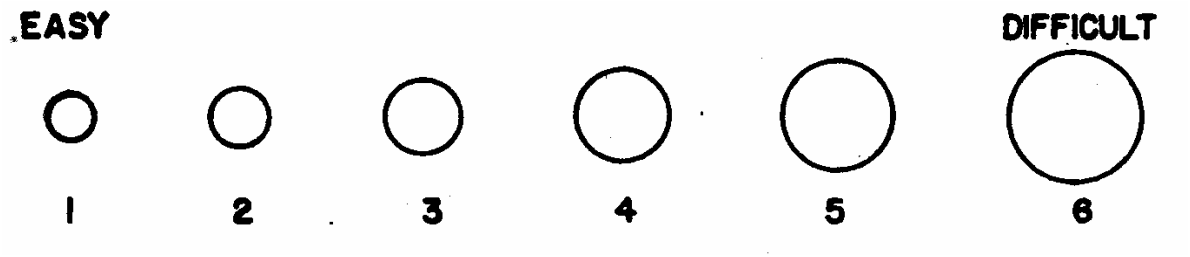
1. This difficulty is explained further on pages 27—28.

2. This type of difficulty is explained further on page 28.

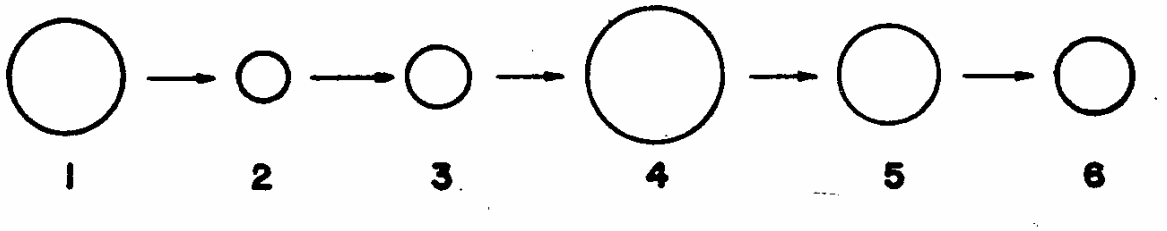
Other details will fall into line easily afterward. For example, the arc welder has to understand something about the principle of the electric arc before he can successfully learn welding operations. To do any job in which the operator has to grind his own tools, he has to understand the principle of cutting angles and have a fair idea of the physical properties of the metals and materials on which the tools are to work.

There are other jobs which require careful planning of the teaching order or sequence because parts of them are machine—controlled. That is, they depend on building up a difficult "knack" or coordination, as in learning to shift gears in a car.[1] The learner has to be able to do it pretty well before he can "operate" the job as a whole. So this part of the job has to receive special instruction, followed by drill, until the learner has mastered the coordination well enough to be able to keep up with the machine and fit this knack into the rest of the operations without getting into trouble. This teaching problem is seen in the more complex machine jobs such as hand—screw machine operation and coil winding.

Applying an Old Teaching Principle.—"Proceed from easy to the difficult; from the simple to the complex," runs an old rule of teaching. But how can the instructor do this with jobs in which the easier parts do not come first? Few jobs do have their working sequence arranged in an order of increasing difficulty, like this:



Instead, the difficult parts of the job are usually mixed in with the easy ones, like this:

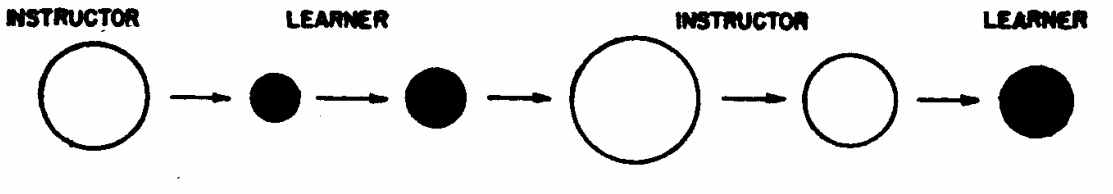


Yet, they have to be done on the job in the correct order, and therefore, for efficiency's sake, they should be learned in that order. What can the instructor do about it?

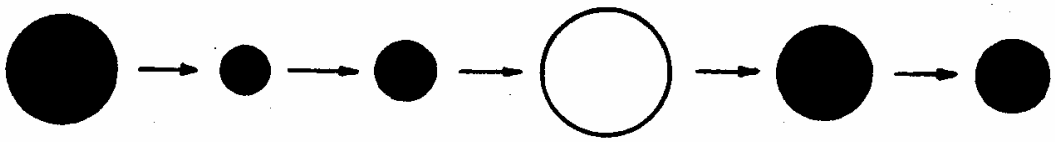
He can keep the job in proper sequence and still teach the easier parts first by setting up his teaching plan like this: He can do No. 1 himself, because it is difficult, while the learner watches. Then he can show the learner how to do Nos. 2 and 3 and let him do them. Then the instructor can do the difficult Nos. 4 and 5 himself, the learner watching.

1. See also page 29.

Then he can teach the easy No. and let the learner do it. Now the learner has been through the entire job, but has been taught to do only parts 2, 3, and 6.



Going through the whole job again, he can teach the next harder part, e. g., No. 5. The next time through, he can teach No. 1. Only No. 4, the most difficult, is left.



But by this time, the learner has seen No. 4 demonstrated three times, has become familiar with the general nature of the job, and has - learned the operations which precede and follow the difficult part. He is now ready to be taught No. 4 in its proper place in the job cycle. Thus, with a little careful planning, the instructor can proceed from the easy to the difficult even in jobs where the hard parts appear in the wrong place in the sequence.

To summarize, jobs may be taught in three different kinds of sequence.

a. Regular Operating Sequence.—This is best for simple jobs without special difficulties or hazards.

b. Special Learning Sequences.—Special learning difficulties may suggest a learning sequence different from that in which the job is done by the trained operator. For example:

1. Safety sequence.
2. Attention sequence.
3. Understanding sequence.
4. Skill or coordination determined sequence.

c. Combination of "a" and "b", in which instructor demonstrates in regular sequence, allowing the learner to "take over" on the easier parts at first, then on harder parts.

Fundamental Points of Attention

In every job there are a few points which the workman must- never be allowed to forget or overlook—points which are so important that they must be "driven home" to every learner and which, if they are kept in mind, will go far toward insuring success. The instructor, since he is an expert on the job himself, will be able to decide what these points are.

For example, a well—known golf instructor "pounds away" on two fundamental points continually: "Keep your chin back" and "Roll your feet."

For most shop operations, one of these points would certainly be, "Check your quality; be sure you are not making scrap." For most machine operations, one would be "Lubricate properly." For all press operations, one would be "See that stock is properly lined up with

the die." For metal—cutting operations, one such point would be "Give your cutting tool strong support."

The fewer the points, the more emphatically they can be "driven home." Roughly speaking, four or five in any one job are all that can be properly emphasized; two or three are better. If possible, reduce them to brief slogans of a few words with "punch," then repeat and pound them home at every opportunity.

There is still the problem of just when to introduce each fundamental point for the first time. The more vivid one can make the learner's first impression of a point, the less "drill" it will take to fix it in mind. The fellow who cracks his head on an overhanging beam does not have to be told repeatedly to "duck" when he goes through that place again. Such drastic methods can seldom be used for teaching, but the exact moment when the learner, is about to make a mistake can often be seen in advance and used to introduce the slogan covering that particular fundamental point, thus making a vivid initial impression. Planning of this kind pays large dividends in teaching.

In short, the instructor's teaching plan should include both a statement of these fundamental points and a choice of the best time to introduce them.

What Should Be Done to Build Up a Satisfactory Output?

After the worker has learned to do the operations correctly from the first, and can turn out a product of satisfactory quality, he is ready for the last stage of instruction—building up his output to the expected level of quantity, without in any degree sacrificing the required quality. The instructor, in this part of his plan of instruction, will make notes of all of the points and ideas that will help toward the goal of output. His notes will include such items as:

"Correct" motion sequence for repetitive operations.

Job difficulties likely to be encountered in equipment, in materials, and in hand skills.

Errors operator is likely to make.

Expected growth in output.

Supplementary information to stimulate interest in the job.

Methods of building up skill and improving the individual's output are discussed further in Sections 5 and 6.

SECTION 4
Teaching the Job

The supervisor or instructor who analyzes the job from the learner's point of view, and constantly studies the learner's reactions as he learns, often does excellent instructing without giving much thought to the teaching process itself. He can do even better, however, and bring his new workers up to full production with fewer delays and difficulties, if he gives conscious attention to mastering the teaching art. It is an old art and a fascinating one, especially to the man who likes to handle people. Correct methods of teaching a job have little to do with books or blackboards. Shouting above the din of machines, standing before the worker's bench, stopping for a moment on his rounds, the supervisor or instructor teaches the "lessons" of the shop or office to the new worker bit by bit. Yet, every such lesson can be well organized in the instructor's mind, whether it is taught all at once or scattered through the working day at intervals between other duties.[1]

Steps in Teaching a Skill

There are four essential steps in the actual teaching of any job "lesson." The instructor doesn't always have to do something about each of the four steps. Often the learner does it himself, but the steps are always there, and each step has its purpose:

STEP 1. Preparation. — To get the mind of the learner focused on what he is to learn.
STEP 2. Presentation. — To demonstrate and explain what he is to learn.
STEP 3. Application. — To let the learner try it out, and to correct his errors.
STEP 4. Testing. — To put him "on his own" and see if he has learned it.

As the supervisor or instructor goes about breaking in new men and helping them to get started properly, he is always carrying on one or more of these four steps. The "lesson" may be very short—not more than 2 or 3 minutes—or it may take more time; but if it is successful, resulting in real learning, the four steps are present and accomplish their purposes in the order named. Because job instruction must be informal, it is especially easy to lose sight of the purposes of these steps, yet if any of them are neglected the worker may fail to make proper progress in learning the job. The four steps may now be explained more fully.

STEP 1. Preparation.—To bring a new idea or process into the mind and muscles of a learner, the instructor must capture his attention and find a way to connect the new lesson with his previous experience. How this may be done is discussed further in the section on "Understanding the Learner." The better the supervisor or instructor knows his man, the easier this step will be, for scattered through the learner's background of experience are bits of knowledge to which the new skill can be connected, with which it can be compared or contrasted, and which can be recalled to illustrate it.

1. The portion of the job which the instructor uses as a "lesson may include the whole of a simple operation or, if the job is more complicated, only a part or sub-operation of it. A "lesson" is as much of the operation as can be explained or demonstrated at one time.

He understands the new by associating it with the familiar. He takes an interest in it as soon as he sees its relation to himself, to his own previous experiences. Therefore, the preparation step is nothing more than helping the learner to recall such experiences and getting his mind focused on them, in relation to the job to be learned.

One approach is to tell him an interesting incident connected with the job. Another is to ask him questions. Better still is to begin by showing him rapidly how the job is done, not to demonstrate it in detail, but to arouse his curiosity and get him to talking or asking questions about it. Such an overall picture of the whole job helps to arouse his interest and to give him a general idea of it.

If the "lesson" is a simple operation that can be easily learned, this step may last only a moment or two. The harder the job, and the further it is from the learner's previous experience, the longer it will take. There is a psychological moment when this step is complete—when the learner is ready to ask, "What next?" Wherever and whenever a learner begins asking questions, trying to find out, eager to know more about the job, no matter how he gets that way, Step 1 is over and Step 2 should begin at once.

STEP 2. Presentation.—Here the new operation is shown and explained. The methods and teaching devices used will depend on the job or lesson, and oxx the learner's previous experience. Mere telling is not teaching. The skillful instructor usually demon the operation slowly, step by step, especially to a beginner. After he has done so, or at intervals between parts of the demonstration, he calls attention to points about the procedure which the learner might not readily notice for himself. He cautions against common errors. He asks questions that cause the learner to think and discover something about the job for himself. An example of the kind of information which one instructor used in this Step is given on pages 13—14. The skillful instructor uses a variety of methods to put over the lessons. The learner's previous experience is still very much in the picture, just as it was in the "Preparation Step," for it is through his own past experience that he "gets" the new lesson.

A common mistake is to try to teach too much in one lesson. If the operation is simple, it should be presented complete. If it is complicated, it should be taught one pari6171 0 T.2((ri6171 0 tim(ler)]TJ
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Real learning occurs when we attempt to put into use what we have been "taught." But the first attempts to "do" must be made under the watchful eye of an instructor who sees that they are correct, for without such a check on his first attempts the learner can learn to do the wrong way as readily as the right way. The employee does not stop learning as soon as the supervisor or instructor leaves him and moves on down the shop. He keeps on learning, right or wrong; as he tries to do the job, he has been taught. If he does it wrong in these early attempts, he learns wrong, unless the instructor discovers his error promptly and helps him to correct it before he has formed a habit of doing it that way.

The instructor can demonstrate again if necessary by doing the operation slowly, step by step, explaining exactly what he is doing at each point. He can give the learner a chance to make repeated trials and see that he gets the correct motion pattern. He can watch him as he tries, and suggest greater or less effort, or changes in motions. He can see that the learner holds his tools and handles his materials correctly from the start. Just as an athletic coach teaches a correct "form" for the high jump, so the instructor, by demonstrating, can give the operator the correct "form" for a shop skill, in order that through practice he will acquire the "feel" of the operation as it is done in its correct or most effective manner. It is highly important also that the learner be told, as soon as he becomes curious about them, the reasons for doing the job in just this particular way. The reasons for particular quality requirements, and how to recognize good and poor work, should be stressed. He should see that "correct form" is nothing more than the kind of motions which highly skilled operators have found to be best:

Teaching thus continues in the application step. The super— visor or instructor encourages the learner to ask questions, explains further, or shows him over again the right way to do the job, but teaches no new jobs or operations. The whole purpose of the step is to make sure that the learner is able to do the job correctly without ma mistakes which may become wrong habits or which may spoil materials or damage valuable machines. Step 3 is finished when it is safe for the worker to go ahead "on his own."

STEP 4. Testing.—The real proof of good job instruction is the ability of the operator to do the job effectively without help. In Step 4 he is left to himself for a longer period of time to see if he can do this. But the supervisor or instructor does not forget him. He still observes him regularly to see that he is not falling into wasteful motion habits He checks his work Does his product pass inspection Is he making a reasonable growth in output If not, some part of the instruction has failed and must be done over.

Summary

The skillful instructor, wherever he teaches any part of a job, carries the learner through four steps:

1. In the "**preparation**" step he gets the learner's attention and interest.

2. In the "**presentation**" step he shows "how to do" that part of the job.

3. In the "**application**" step he lets the learner try to do it, correcting mistakes before they become fixed in habit.

4. In the "**testing**" step he puts the learner on his own responsibility, but keeps close watch of his work until he has gained skill.

The busy supervisor or instructor must often do each of these in short intervals of a few minutes each, stopping beside the learner in his round of other duties. Much of the teaching in the shop is done in this way, but it can still be good teaching, if the purpose of the steps is kept in mind. The successful instructor varies his method to meet the need of the learner but these four steps are always present.

SECTION 5
Building Up Skill

The Later Stages of Instruction

Job instruction is not complete when the transferred operator or the new employee has just barely learned to do the job by himself without help. There is the longer process of building up his skill to the point where he can deliver an acceptable output and earn something more than his "rate." This calls for instruction, too. Mere practice is not enough, as the low output of many experienced operators shows.

The instructor can do much to help build up higher levels of skill if he studies the individual operator closely. In particular, he can look for three things, in the order given:

1. Is he using an economical method of doing the operation?
2. Is he having difficulty in unlearning old habits?
3. Does he need encouragement to "stick to it" until higher skill is reached?

These three things will be discussed in turn.

Restudying Job Motions

Setting up an economical method of doing the operation is, in many plants, the function of the planning engineer. In his layout of the job he frequently provides a carefully planned motion sequence to be followed by the operator, specifying in detail an economical working pattern based on principles of motion economy. Where such a working pattern is provided, the instructor can check to see whether the operator is following the layout exactly or not. Sometimes his difficulty in, attaining higher skill can be traced to failure to use the precise motion pattern specified. The instructor, in checking the operator's method and correcting his errors, will find it helpful to know something about motion economy, in order to understand the engineer's plan and to recognize the operator's mistakes. Likewise, on jobs in which, for one reason or another, a complete motion pattern has not been specified, the instructor who understands motion economy principles can often study the job and see if an economical motion sequence is being used, checking his findings with the engineer responsible. He can also use a general understanding of motion economy in explaining to the operator why the operation should be done in the manner specified.

For these reasons, a brief summary of some of the most important principles of motion economy are given here. They are not in any sense an attempt to outline the techniques of the industrial engineer, but merely to suggest points which the instructor can check when he is in doubt about whether an economical method is being used. These points may be listed in question form as follows:

a. Easier grasping:

Are the parts, containers, assembly fixtures, and the surface of the bench arranged so that parts can be slid rather than carried into position? If grasping of parts cannot be eliminated, can a gravity feed container be provided which has a lip at the front so that the parts can be slid to the edge of the lip for grasping? Can the container be arranged to deliver the parts always to a definite location making it unnecessary to use the eyes in directing the movements of grasping?

b. **Easier reaching:**

Are all tools and materials placed in fixed locations in the work place area as close to the point of use as possible, reducing the distance the operator must reach? Where machines are involved, are handles, cranks, and levers so located that the operator can manipulate -them with the least change in body position and with the greatest mechanical advantage?

c. **Easier "positioning":**

Are mechanical guides provided to assist the operator in placing parts in position? For example, can mechanical stops be provided against which the operator can push parts or fixtures without having to use his eyes to place them in exact position? Can tools be fitted with guides to save positioning with the eyes (e.g., a "finding' sleeve on screw driver to save placing blade in slot of screw)?

d. **Reduced waiting and holding:**

Are materials and tools so arranged as to permit both hands to be usefully occupied most of the time? Are holding devices used (foot operated if possible) to relieve the hands for more useful work? Is the flow of work arranged so the worker does not have to wait for other operations or between his own operations?

e. **Easier disposal:**

Are springs, air ejectors, or drop delivery chutes used to permit finished parts to be disposed of merely by tossing or dropping? Can combination tools be used to save handling of different tools?

f. **Balanced movements:**

Is the work place arranged and the job planned so that the two hands can usually begin and end movements simultaneously and in opposite or symmetrical directions, thus balancing the movements and reducing mental and physical strain?

g. **Economical use of eyes:**

Is the work place arranged for minimum movement of the eyes in doing the job? Do the eyes precede the hands throughout the motion pattern, so that the hands are not delayed waiting on the eyes? If parts must be looked at and grasped by both hands at once, are the points of grasp as close together as possible, reducing delay due to looking from one hand to the other to aid in grasping? Are parts and tools arranged always in the same location so that they may be grasped without looking?

If a careful check on these points shows that changes in the method could be made to advantage, the instructor or supervisor can en list the cooperation of the planning engineer in having the layout changed and providing any necessary changes in equipment.

Improving the Learner's Motions

After the instructor has satisfied himself that the job is arranged in an economical motion sequence, he is ready to observe the motions of the learner to see whether he is executing the job in this manner in all its details.

Since the learning operator may easily become disturbed when he sees that he is being "observed," it is extremely important to gain his confidence and enlist his interest in. improving his motions. This may be done by talking the whole matter over with him and demonstrating how he can do the job more effectively by following a better set of motions or, better still, leading him to discover some of the improvements for himself.

"Unlearning Old Habits".[1]

A second thing the instructor can look for, in seeking to help the learner build up a higher degree of skill, is the tendency to stick to old work habits, once they are formed. The operator usually feels safer to keep on doing his job by the methods he is used to, and unless he has a strong desire to experiment or is fully convinced that a new method will speedily yield returns to him, he does not willingly venture to change. So the task of the instructor is to get him interested in improving or refining his methods. It is not enough to in form him that he is not following the .work pattern specified by the engineer, or even to demonstrate the better method. He looks upon it as the method of somebody else, while his old pattern is his own. The problem is to get him to look upon the new pattern as his own also—to get him to "take an interest" in it, in the same sense that he acquires an "interest" in a new piece of real estate when he becomes its owner. The task is to get him to want the new method in exchange for the old. He must see its advantages, to him and to the organization, and desire to make it his own.

Obviously he will thus "take to a new method more readily if he feels that he has had some part in working out the improvement him self. This suggests how the instructor will proceed. He can begin by talking over the job with the operator, and leading him to voice his own suggestions about how it could be improved. His ideas may or may not be good but, if they are listened to, his "interest" in improvement has begun to be aroused. The instructor can kill this interest quickly by pointing out what is wrong with his suggestions. Instead, he must recognize the good and continue the discussion, holding back his own suggestions until he sees that the employee is ready for them. Sooner or later, if thus encouraged, he will show, by asking a question or by an expectant manner, that he would like to have the instructor's ideas also. Then suggestions can be offered that he is likely to accept, especially if his comments are still encouraged. Often he will repeat the new ideas later as his own, without realizing it. Thus the instructor can get the operator to abandon old habits, to accept and take over many of the points of method which originated with himself or with the planning engineer, and use them in building up a new work pattern that will permit him to reach a higher level of skill.

Encourage the Learner.

The third thing an instructor can look for is discouragement.

"I know how to do this job all right, but I'll never be able to make wages on it. First, I get better and then I get worse."

"I guess I'm about as good on this job as I'll ever get."

These typical attitudes suggest that the instructor or super visor can help a great deal by encouraging learners to stick to it until a high degree of skill is reached.

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[1] Another phase of this problem is discussed later on page 28.

Too many learners stop short of the goal, are too easily satisfied. One reason for discouragement is that their output record does not usually climb at a smooth, steady rate of improvement. Instead, it is likely to have some ups and downs. For example, while the first confusion is being overcome, that is, while the operator is learning to understand the job in all its parts, he may not be able to turn out an acceptable product at all. As he gains in co ordination and gets the "feel" of the operation his gain in output may be rapid but, after these have been learned and the newness has worn off a little, there are times when output stops climbing or even falls back for a while.

One of the most helpful things an. instructor or supervisor can do is to keep accurate records of how fast other learners have progressed in developing skill on each part of the same job, and be able to tell the new learner what to expect. If he sees how others have had similar difficulties, and knows the rate at which they have overcome them and advanced in skill, it will encourage him and give him an idea of how soon he, too, will be able to reach the higher level. Not only that, but it breaks up the long road he must travel by giving him "milestones" close at hand that he can achieve, one after the other, and thus have a sense of definite accomplishment day by day. In longer job sequences, this can be done separately for those parts that are troublesome.

It is also important for the learner to realize that he must expect a setback in output while he is mastering changes in method. New habits will not go as smoothly as old, until they are practiced for a while. As new parts of the motion pattern gradually click together, they no longer have to be paid attention to separately. When they begin to "do themselves" automatically so that attention need be given only to the process as a whole, a new level of coordination has been reached, at which speed is soon achieved. The instructor can give encouragement by showing from his records the rate at which others have made their way through this habit—building process.

Summary

After the employee first learns how to do his new job there is the long pull to reach acceptable performance. The supervisor and instructor can help the operator in this skill—building process by making sure that the job is set up in an economical manner, by checking the operator's motions and stimulating his desire to follow a good motion pattern, and by helping him overcome discouragement.

Other factors affecting the worker's improvement in skill—his desire to improve, his learning difficulties, etc.—are considered in Sections 6 and 7.

SECTION 6
How the Job Looks to the Learner

The new employee needs an understanding supervisor or instructor to "hold his world steady for him" while he confronts the job and begins to "muddle through" the process of mastering it. Such an instructor gives him a sense of security that allows him to learn faster and adjust himself better in his new situation. This is important, for the new employee's feelings and impressions are facts which have a great deal to do with his learning of the job and his value to the company. The instructor and the supervisor are interested in these emotional and mental reactions because they affect the process of manufacturing. To ignore them is costly and impractical.

The learner's attitude toward his new job is important not only in the case of the newly employed but also in that of the employee who has been transferred from some other job. There is a tendency to assume that the transferred employee does not need any help to learn new skills and become adjusted in a new job. Nothing could be farther from the fact. The transferred employee, when he comes into a new location, is faced with uncertainty. He does not yet know where he stands. Often he is not entirely clear in his mind as to whether he is to gain or lose by the move, and in any case his attitude toward the new job is highly charged with feelings as to how the change is going to affect him. The instructor's problem is to build up an "interest" in the new job as well as to teach those parts of it which the experienced operator does not know. All that was said in Section 5 about building up skill, and the discussion in Section 7 about developing "interest," are applicable in either the new or the transferred employee to take a wholesome and constructive attitude toward his new job.

Difficulties in Learning a New Job

No matter how simple a job is to the man who knows how, it does not look simple to the employee who is learning it. The expert operator finds it easy because he is expert. But to the learner, it looks hard and it is hard for him, while he is learning it.

The supervisor facing hour by hour the difficulties of getting out the product may easily overlook the learning difficulties of his new workers. It is natural for him to think most of results and to spend little time in analyzing the process by which a new e learns to be proficient. Yet a study of each job from the learner's point of view will show learning difficulties in the job itself which hinder the new or transferred employee from coming to full productive ness quickly and easily, and prevent his developing wholesome attitudes toward his associates and the company.

There are at least six kinds of learning difficulties in jobs. They come from the nature of the jobs themselves.

1. Confusion over complex details.
2. Understanding the main idea.
3. Unlearning old habits.
4. Catching the "knack."
5. Getting the "feel."
6. Developing speed and ease.

Learning; Difficulty 1—Confusion Over Complex Details. — Some jobs seem difficult at first because they present a confusing mass of detail. Although each single element is easy, the job as a whole seems complex because all parts of it are unfamiliar. There are many things to watch and to remember. The learner, trying to give attention to everything at once, becomes confused. This difficulty is seen in certain wiring jobs, in coil winding and other complicated machine jobs, and in some of the more difficult bench jobs. One way to appreciate this difficulty is to try to learn a new game of cards quickly enough to begin playing at once with others who already know how to play it.

Confusion over details is present at the beginning in all except the simplest repetitive jobs. The instructor can sort out the details and present them in an economical learning order, directing attention to the easiest and most necessary ones first. Some ways this can be done were explained on pages 15—17.

Learning Difficulty 2—Understanding the Main Idea. — In some jobs the mental element is most important. As the learner looks at one of these jobs it doesn't make sense. He plays around with it for awhile, turning it this way and that in his mind, looking at it from all sides. At last he sees through it, often quite suddenly. He has caught the "big idea." His study of all aspects of the job has resulted in a mental grasp or understanding of the principle of the thing, the central idea on which the whole thing depends.

In many jobs there is an element of this kind. Most of the difficulty disappears as soon as the learner grasps the principle involved. For example, part of the difficulty of learning to grind a drill is mastered as soon as the principle of "clearances" is understood here is another example:

> Two new operators had to spray certain parts with aluminum paint. After the lot was completed, however, it had to be rejected because the masking tape was put on incorrectly and the metal paint had worked in on the insulation to cause short circuits. The operators did a bad job because they did not understand the "main idea", namely, that the masking tape was to protect the insulation and not meant to improve appearance of the paint job, as they supposed. Nobody had warned them of the danger or told them the unusual purpose the tape was serving on this job.
>
> A green inspector, set at work gauging size of holes in piece parts, was told that his plug gage should fit easily into the holes. Later he was found grinding down the plug gage so that it would enter all the parts.

In jobs which have this type of learning difficulty the instructor does not have to wait for the learner to "figure out" the main idea for himself. Often he can save time by pointing it out. Or, better still, he can cause the learner to see it more quickly for him self by asking him the right questions—by using questions to direct the learner's attention to the "main idea" so that he sees it. For example, in teaching an operator to adjust relays or switches, the instructor could first demonstrate the principles of the electro—magnet so that the operator could really understand what he was doing.

Learning Difficulty 3—Unlearning Old Habits. — When an experienced operator has to be transferred from the kind of work he knows to a new job which he does not know, he often runs into a "transfer" type of learning difficulty. This is more likely to occur if the new job looks similar to the old one. He tries to do it as he did the old job, but part of his knowledge is wrong—for the new job. This difficulty may be shown by an example from everyday life.

> "I painted the garage with no trouble at all," says Jim, "but I had a bad time when I tried to enamel the bathroom." Anyone who is accustomed to spreading ordinary linseed paint with a brush knows that you have to brush it out, or rather brush it in, with many vigorous strokes after every dip of the brush. But when you try to do that with enamel, it doesn't work, for enamel has a sticky varnish base which dries quickly. It has to be "flowed on" without too much brushing over. The old habits of outdoor painting "get in the way" when the job is spreading enamel.

An old knowledge or skill, when "transferred" to a new job, sometimes has a negative effect; that is, it hinders more than it helps. Employees who are transferred to a new job carry over to it all the habits of the old one. If the jobs are similar, some of these habits are all right. Others are all wrong; they interfere more than they help. They have to be "unlearned," which is a difficult and confusing process.

The instructor can be helpful here not only by analyzing the new job to be taught but also by finding out as much as possible about the learner's old job and watching for habits that interfere. Then he can explain to the learner why he is having trouble and help him to watch himself for the old job habits which have to be dropped. The related problem of the learner's "interest" and encouragement in learning new work habits has been discussed on pages 25—26.

Learning Difficulty 4——Catching the "Knack." — Some jobs, simple after you can do them, seem hard to the learner because they depend upon catching a peculiar "knack" or bodily coordination which is rather slow in coming. After much effort it "clicks," often with dramatic suddenness. We have all had this experience in learning to remain af in swimming, to keep balanced on a bicycle, or to shift gears smoothly in driving a car. Other common skills which have this learning difficulty are scraping a bearing, sawing (cross—cut or rip), using a hacksaw, filing metal (holding the file level), and planing a board. In the shop, this learning difficulty appears in tensioning springs in relays and switches, in soldering, in pouring castings, in winding coils, and in many other jobs requiring coordination between the eye, the hand, and other parts of the body.

What happens is this. The beginner learns the new skill bit by bit, as fast as he can turn his attention from one part to another. One by one these parts of the process become automatic to him, in a certain sequence. When this has happened to all the parts, the operation almost does itself. He has "caught the knack."

In jobs which include this kind of difficulty, the instructor can help most by demonstrating and explaining the correct method in detail. He can direct attention to each part of the process and encourage the learner to continue his efforts until the parts fall into place in his mind and muscles as a coordinated "knack." After that, it is a matter of practice to acquire speed and ease, which are discussed below under Difficulty 6.

Learning Difficulty 5—Getting the "Feel." — Many skills depend on developing a sense of feeling. In starting a car, we feel just how much to ease up on the clutch pedal to send the car along at an evenly increasing speed. In a strange car, lacking this feeling, we let it jerk. We acquire a feeling of just how hard to press on the accelerator to go faster or slower smoothly. Likewise, an adjuster in tensioning springs comes to feel just how tightly to hold his pliers and just how much to turn them as he pulls them along springs of different thick nesses and degrees of stiffness. In the same way a drill—press operator comes to "feel" how fast to feed his drill into metal and how to ease it through to avoid tearing the under—surface of the part.

This feeling of "enough" or "how much" is partly a sense of pressure felt through the nerves of the skin and partly a sense of tension in the muscles and joints felt through the kinesthetic nerves. We get it largely through practice. In our first trials we do too much or not enough, and note the results. We try again and come a little nearer to the right amount of pressure and tension. We try it over and over, each time modifying our practice according to the results. At last our sense of feeling and our ability to apply just the right amount of effort becomes refined enough to do the act skillfully. We have "caught the feel" of it.

In actual operations, this "feeling of how much" is often combined with a "knack" (Difficulty 5 above). For instance, there is a nicely timed coordination of the right hand and both feet in shifting a car from high to second gear while moving up a steep hill. This coordination we have called a "knack." But it is the "feel" which tells us how fast to let in the clutch and how hard to step on the gas. In driving a strange car, the "knack" of coordinating hands and feet is carried over without difficulty at the first trial but it takes practice to get the "feel" of the clutch and the gas pedal sufficiently for perfect smoothness of operation. The same combination of "knack" and "feel" appears in the operation of a hand screw machine or in the turning of irregular shapes on a lathe by coordinating the longitudinal and cross slide feeds by hand.

The "feel" type of difficulty appears constantly in the shop. The skilled bench—hand does not like to use a strange pair of pliers. Every workman likes the feel of his own tools. The experienced operator goes ahead gingerly in operating a new machine until he gets the feel of it. For the new worker, this difficulty appears in many parts of the job, and overcoming it is an important part of job instruction.

The instructor can help. He can see that the learner is doing the operation the right way—that he has a proper "form," as it is called in sports.[1] He can give him the reasons for following the particular motion pattern of which "correct form" is composed. Then he can check the operator frequently to see that he is following the correct motion pattern. In this way the learner will most quickly acquire the "feel" of the operation.

1. This was partly explained on page 20—21.

Learning Difficulty 6——Developing Speed and Ease — There are a great many jobs, done with effortless ease and speed by the expert, which are difficult and discouraging for the learner, chiefly because they require a long period of practice to attain a satisfactory output. At the beginning, they may present any of the five difficulties mentioned above. On the other hand, they may be simple to understand, contain no puzzling idea or "knack," and may not present any confusing array of details to watch. In fact, the worker may be able to do them after a fashion, almost the first time he tries; yet the speed and ease required for quality and quantity of output are slow in coming.

Acquiring ease and speed is the main difficulty in simple, repetitive jobs such as assembling, but it appears as the last stage of learning in nearly all jobs. It might be called a "long practice" kind of learning difficulty. Every operator with a high degree of skill and large output has faced this difficulty and conquered it. Some of the things the instructor can do to assist the learner to meet this difficulty have been discussed in Section 5.

Summary

Why does the man who had a hard time learning a job often turn out to be an excellent instructor? Because he has run into all the learning difficulties anybody is likely to have on that job, and he remembers and looks out for them in his instruction. The instructor who didn't have such a tough time learning it can do this too, if he will try to look at the job through the learner's eyes. His job analysis also will help him discover which of these learning difficulties are present in the job.

SECTION 7
Understanding the Individual Learner

In getting out the product in the shop, the instructor or supervisor fixes his attention upon materials. In instructing, his attention is upon men—their minds, muscles, feelings, and attitudes. Just as he has come to know steel, brass, and bakelite to do the operating job, he seeks to know men to do the instruction job. He observes them and talks with them. He notices what they do. He attempts to analyze their actions. He listens to their comments and encourages them to talk because the more nearly he can come to knowing each operator as a person, the better he can adapt instruction to his needs.

Hindrances to Understanding Men

Understanding people is not a simple process. The supervisor or instructor who says, "1 can size up a man as soon as I put him to work," is usually deceiving himself. It will be helpful to notice some of the habits of self—deception by which many of us over—simplify this art of understanding people, and which actually hinder us in under standing them.

The "Die—Casting" Habit. — Too often, as we observe individuals, we try to sort them into types or, to put it another way, to force them into imaginary molds which we have set up in our minds, much as the die-caster squirts metal into different kinds of molds. They may be different shapes before they go in, but they're all alike when they come out!

We feel that we have completely cataloged Bill Jones when we say that he is a "good mixer," that we have defined Tom Smith when we put him down as a "tough customer." But we can't do that with people, if we really wish to understand them. We must study each one from all• sides, not pour them into molds or cast them into types.

The "Replica" Habit. — "He reminds me for all the world of Bill Brown," we say, and thereafter we notice most easily the traits which are like Bill Brown and ignore those which are different. Once we have made up our minds he is "like Bill Brown," we close our minds to the possibility of his having other characteristics which might be useful to us in teaching him the job. We stop studying him, with the result that we never discover many of the interests and abilities which are part of the man, and which would be useful to him in learning, useful to us in teaching him and finding the right place for him.

The "Go, No—Go" Habit. — "I can tell whether a man will make a good operator in this job as soon as I see how he follows directions," said a supervisor. "If he listens carefully to my directions for doing the job, and does it exactly as I tell him, he will make a good man. If he doesn't get the directions the first time, but tries to 'dope out' his own way of doing it, he seldom learns to do good work here." This supervisor, if he really does follow the way of thinking which he de scribed, is classifying all employees into two classes: (1) Those who follow directions to the letter, and (2) those who try to figure out methods of their own. His gage of men is two—valued, "go" or "no—go."

There are no “in He is applying an inspection technique not an understanding one.

People are seldom “either—or.” Trait studies of individuals show that approximately two—thirds of them have each of the commonly observed traits to a moderate degree, that is, they are close to the average in it, and that only a small percentage have markedly large or small degrees of any trait. Not “either—or” but “the degree to which” should be the guiding concept in studying people.

Similarly, it is easy to fall into the habit of judging employees solely by how well they do that particular phase of the job in which the instructor prides himself, overlooking their skill or lack of skill in other important parts of the work. For example, in one assembly and adjusting job the instructor had worked out a better way of tensioning a small spring. He took pride in this. It was very easy for him to fall into the habit of judging operators almost entirely by the way they tensioned this spring and to pass over other parts of the operation. People’s reactions cannot be measured fairly with any single gage. They are too complex.

The “Formula” Habit. — Closely related to these “stereotype” ways of looking at people is the practice of dealing with each “type of person” in a certain set manner. It has been said that the way to “handle” the “old timer” is to “let him alone,” that the best way to get along with the “chronic kicker” is to “lay down the law,” that the way to teach the new worker is to “show him how” to do the job and “tell him what” the requirements are.

Of course, these methods work a good deal of the time with many of the people with whom supervisors and instructors have to deal. Other wise they would not be so commonly accepted. But they become a hindrance when they are used as excuses for lumping people together in groups or types and avoiding the responsibility of trying to understand each person as an individual.

In short, people cannot be handled like piece parts or apparatus. Each is an individual, different from every other. “Stereotyping” them, classifying them, standardizing them, or reducing them to formulas—habits of thinking that work well with inanimate things—often prove to be actual hindrances in handling people.

The “Standardization” Habit. - Supervisors and instructors may become so accustomed to thinking in terms of standards that they look only for common responses of “the worker,” and pay little attention to the special interests, abilities, and peculiarities of individual employees. Yet it is these special characteristics that yield fruitful contacts upon which to base effective instruction. It is the ways in which a person is different, and especially the ways in which he is superior to the “mine run” of people, which furnish the key to his special interests, for he tends to develop strong interests in the fields in which he possesses ability. The instructor has the problem of taking each of these unique and different personalities, finding out what he is like and to what he will respond, and fitting him into a job and into a working organization.

How to Study the Employee as a Learner.

How can the supervisor or instructor understand a person who comes into his organization well enough to train him successfully in a new job? He can talk with him, question him, observe him, throw out conversational leads to draw him out, listen to him, and think and listen and think, seeking ever to look behind appearances and first impressions into the background of feelings, sentiments, and other reactions—to—experience which make up the man himself.

A Plan of Studying the Individual Learner

Keeping in mind that it is not a question of "either but rather of "the degree to which," the instructor can use the following nine questions in his study of each individual he has to train. In using each question, however, the instructor must think constantly, "To what extent does he do this? In what degree is this true or not true of him? How far is this aspect important in this individual? Why does he react the way he does?" Here are the nine questions:

1. Does the learner overlook parts of the job at first?
2. Does the learner fail to understand instructions?
3. Does the learner's attention wander from the job?
4. Does he learn from his mistakes?
5. Does he try to devise new ways of his own to do the job instead of following directions?
6. Does the learner lack interest in the job?
7. How does he respond to recognition?
8. Does the learner stand on his own feet?
9. Does the learner seem ill—adapted to the job?

Each of these questions may now be considered a little further.

1. **Does the learner overlook parts of the job at first?** Does he miss a part of the instructions when he is given a start on the new job? Most likely he does. Is he therefore stupid or careless? Not at all. He is merely human. The human mind has a perfect mechanism for avoiding overload. It simply ignores. If parts of the situation are wholly unrelated to the individual's past experience or to his present interests, he "pays no attention to them." If the total situation demanding his attention—for example, the new job— is complicated, his eyes and ears first grasp only those aspects which interest him most. If his experience with these is satisfying, he soon explores further and is ready for more instruction. The supervisor or instructor can help, first, by noticing the points of the job he seized upon at the beginning, as cues to his interests, and relating the rest the instruction to these interests; and second, by noticing what points of the job the worker missed and bringing these to his attention as soon as he is ready for them. All this can be done more easily if the supervisor has made a thorough analysis of the job from the learner's point of view and arranged this material in effective learning order in a plan of instruction, as explained in Sections 2 and 3.

2. **Does the learner fail to understand instructions?** — Does he misinterpret them? Does he fail to catch the point of the explanation? Does he seem "a bit thick?" The easy way out is to label such a person "dumb" and thus avoid all responsibility for making an efficient operator of him.

This, however, neither saves the man nor gets the work done, and what is more it is usually unnecessary. Most workers who have passed the employment office are high enough in mental capacity to learn readily the jobs to which they have been assigned. When they fail to understand, it is not from "dumbness" but from narrowness of experience. They are like the city boy who, on his first visit to a farm, tried to get a pail of water by calmly holding up the pump handle, waiting for the water to come. Why shouldn't he? He had seen hydrants with pull—up handles but he had never seen a pump in a well.

The worker who learns slowly because of narrow experience can usually be trained by patient, well—planned instruction and often makes a superior operator. Cues to his background and his interests may be gained by encouraging him to talk about the job, listening to him with out interruption, and giving attention as much to what he takes for granted as to what he actually says. Gaps in his background can be filled by giving him actual experiences in the shop.

The worker who misinterprets instructions and thus makes mistakes is a similar problem. On account of the narrowness of his experience he fails to understand. Where others might have got meaning he draws a blank because he doesn't know the "code." Yet he fears to reveal his ignorance. What does he do? He bridges the gap by using his imagination and, whenever he guesses wrong, he makes mistakes. The remedy is to make connection with his meager experience by finding out as much about it as possible and to win his confidence to the point where he is willing to ask questions. It often helps to have him repeat instructions back again in his own words: "Now just to be sure I've made it clear, tell me what it is you're going to do."

Care in explaining shop terms will help greatly. One worker tells of his first day in the shop thus: "The boss gave me a big pan of little gadgets and said, 'Take these piece parts over to that bench and "mike" 'em. The "max." and "min." are six and ten.' Then off he went and I spent the next 3 hours trying to figure out what mike, min., and max. had to do with the job, and what I was supposed to do with the pan of gadgets."

Ignorance of shop terms and shop customs is by no means confined to "new" employees fresh from the employment office. Picture an experienced employee newly transferred from a distant department, trying to adjust himself to a new location and learn a wholly new kind of job. During his years on the old job he has gone along paying little attention to other organizations, yet now on the new job he is ashamed to reveal his ignorance. He is grateful to the instructor who will take the trouble to discover the limits of his experience and give him the help he needs.

3. **Does the learner's attention wander from the job?** — Does he seem to be oversensitive to noises, changes in light and ventilation, presence of other workers or passers—by? If so, he is merely responding naturally—acting "like a human being." Most individuals find it hard not to pay attention to all that is going on around them, especially to noises and to people. Ideal conditions under which to learn a new job would include a quiet room alone, in the absence of such ideal conditions, the new worker, in addition to mastering his skill, has to be come accustomed to a "total situation" which is strange and fascinating.

In fact, a part of any skill is an ability to ignore everything except the activity itself—to concentrate one's attention on it. Witness the ability of the champion athlete to forget his gallery and lose himself in the game.

Complete absorption in a task and disregard of surroundings amid the distracting noise and activity of a manufacturing plant is not a natural act. It is an achievement—that is, it can be learned. Fortunately, most workers are able to learn it for themselves in a relatively short time. Sometimes it is possible to help the worker who is unusually sensitive to distraction by placing him in a less exposed location where noises are more uniform or monotonous or by transferring him to work which requires a broader spread of attention or which includes dealing with a large number of people.

4. **Does he learn from his mistakes?** — Every learner is likely to make mistakes until he has mastered the skill of the job. Often his mistakes are costly. We try to avoid them by

Even what appears so like the model as to be sheer imitation is really reinventing or "recreating" of each part of the act in his own mind and muscles. Only by making it his own, a part of himself, does he learn it.

Not that he should ignore the model set by the instructor's demonstration. He usually tries to make his own act as near like it as he can, as far as he sees it. But he doesn't see it all! Certain de tails escape him. So when he attempts to reproduce the act, and comes to a point where his memory pictures of the instructor's demonstration are blank, he improvises or experiments to fill the gap. If he guesses right, he learns that part with very little practice, and the instructor never finds Out that he has "invented" that part of the operation for himself. If he guesses wrong and does it in an ineffective way, he will have to unlearn that part and learn a better way—a wasteful process.

How can the unfruitful experiments of the learner be reduced to a minimum? By clearer seeing and understanding of the operation, alternated with short trials closely supervised and carefully analyzed by the instructor. Mere telling is not teaching. The learner's attention must be directed to every little part of the operation as the instructor demonstrates and explains it. He should be told the reasons for doing the operation just that way, -so far as the instructor knows them. And in his early trials, the instructor can watch closely for parts of the operation he has missed and re-demonstrate them as he needs them.

6. **Does the learner lack interest in the job?** — Does he fail to put forth the effort necessary to learn to do the job well? A boy will have an interest in a job if he feels that it is in harmony with his own purposes, that it is "getting him somewhere." If he can identify the job with himself, see its connection with his own life, with his cherished ambition, then he is "interested in the job" in the same sense that a man who buys an interest in a business is "interested in" that business. When this happens there is no trouble about effort.

But often the new worker cannot see any relation between his own plan for the future and the job to which he is assigned. The instructor can explain to the worker how upgrading takes place and what avenues of advancement are open to him if he is efficient in each job along the line. Some young workers are victims of the "white—collar" craze; their only idea of advancement is to get out of the shop and into the office, without any clear understanding of the possibilities of either. A supervisor or instructor can often render a real service to such young people by giving them facts regarding the values of shop experience, no matter where later promotions or transfers may lead, and helping them to think over their plans and ambitions in the light of these facts rather than on the basis of family or personal prejudice regarding "overalls" or the "white collar."

Occasionally the supervisor or instructor finds an individual who has "hitched his wagon to a star" far beyond the limits of his capacity, background, and education. - In helping such a person to get his feet on the ground the services of skilled personnel counselors may be helpful.

On the other hand, some learners in the shop seem to have no definite ambition or plan of action for their lives at all. By talking with them and becoming better acquainted the instructor may be able to discover such an ambition and help the worker to connect his job with it. If not, the counselors mentioned above may often render valuable assistance.

A more simple key to the worker's interest is some activity which he enjoys doing for its own sake. One supervisor makes a practice of talking with the new worker about his hobbies. He discovers what the worker likes to do and often is able to relate the job to these interests, or to help him transfer to a job which he enjoys doing.

Knowledge of his own progress stimulates the learner's interest. Supervisors long ago discovered the value of operator's performance records as an incentive, especially when presented in graphic form. We like to beat our own record, to see ourselves grow in skill, and most of us like to engage in rivalry with others. Rivalry in out put, however, is a form of stimulation which has to be handled wisely, especially during the training period. Progress in learning does not always register in daily output. While learning correctness of "form" and developing the ability to reach quality standards, output may not show a daily increase and the worker should not judge his progress by it. The instructor can prevent discouragement and loss of interest by directing his attention to this fact, as previously explained on pages 25—26.

Then there is the matter of social approval. Any experienced supervisor knows the value of recognition as a stimulation of interest in the job. Praise is discussed further in a different connection below.

The effectiveness of all these ways of reaching the worker's interests and relating them to the job lies in the fact that a man re acts as a whole. We sometimes talk of training his muscles or his brain or his hands. We can't. His whole self is being trained by every experience he has. We teach the man, not his hand. When he has mastered a skill, the whole man has it, uses it, and is proud of it. The man himself has ambitions to which the job may or may not be related. The man himself enjoys doing it, or is indifferent to it. The man himself basks in the appreciation of his fellows when they recognize

One instructor, in training a man to turn out a bushing on a turret lathe, said, "This part will be hardened and ground and put into a molding machine to guide the mold down into place accurately each time it is closed to mold a casting."

Many instructors make it a point to tell the operator how his product will be used: "This goes into an airplane to show the pilot so and so—." "This goes into an instrument panel to show so and so—." "This is for the new Pittsburgh office, etc."

In a highly specialized factory it is difficult to provide the interest which the old craftsman felt in the product of his hands because it was all his own, from raw material to finished masterpiece. The modern shop, where the worker can see the whole product fabricated before his eyes, provides an opportunity to revive this kind of interest. For the same reason, moving workers about from job to job until they have become familiar with all the operations on a particular product adds to their interest. Each job takes on meaning and significance as its relation to other operations and to the whole product is seen. The worker can "see what he is doing" and see that it is worthwhile.

Likewise a worker has more interest in his machine if he understands how it works, the principles of its operation, what it can do, and, just as important, what it cannot do; i. e., the limits of its operation. When the worker knows these things, instead of blindly following the directions of the machine setter or the equipment man, •he takes an interest in the machine. Because he feels that he understands it, he comes to identify it with himself, just as he does the job in which he "has an interest." It becomes his machine, and thus a new interest in the job is born.

The largest factor with which a supervisor or instructor has to deal is his worker's "interests." This emphasizes again the need for the supervisor or instructor to become well acquainted with his workers as persons, to understand their backgrounds of experience, their hopes and purposes for the future, their bents and special abilities, all in order that he may help them to discover real and lasting connections between themselves and their job.

7. **How does he respond to recognition?** — Does praise stimulate him? How does he take criticism?

Experienced supervisors know that a little recognition adds zest to the job and stimulates a man's efforts. This is especially true of the learner, because he feels insecure and uncertain about himself anyhow. Building his confidence is part of the instructor's art.

Recognition of good work can be given in many ways. Posting records of progress has been discussed above. Advancement to a harder or more important job stimulates a learner just as it does an experienced worker. Whenever he is ready for a more difficult step in the learning of the job, the instructor can use this for stimulation by saying, "You've done well with that. You're ready for this harder job now."

The most tangible form of recognition is of course the weekly pay envelope. An increase in his rate is a visible goal. But so many factors over which the instructor has no control enter into determination of wages that he finds other forms of recognition also necessary as instruction incentives.

Using an advanced learner occasionally as an instructor is a form of recognition. It adds prestige and gives a bit of recognition to those who are competent.

Praise in the presence of the group is an effective form of recognition, so long as it is fair. It is usually stronger than praise in private but more difficult to give because the members of the group are always making comparisons. Both approval and correction are necessary, but criticism should be given in private, or at least in the semi— privacy of shop noises. Given before the group, it results in con-fusion or resentment, which prevents learning.

The new worker learns more from praise than from censure. The reason is simple. He is blundering about, seeking the right way to do each part of the job. When he happens upon a right way, and the instructor approves it, he knows he has got that part of the job, and seeks to repeat it. At the same time he experiences a glow of satisfaction which spurs him on to master other parts of the job. But suppose he tries a wrong way and is "bawled out?" What has he learned? Simply that that one way is wrong. He still does not know a right way and may try many other wrong ones before he finds a right one. Meanwhile he feels discouraged because of the disapproval. The alert instructor will of course seize such a moment to demonstrate again the "right way" to do the operation, though that is beside the point here. It is often necessary to point out mistakes but, even at its best, censure or adverse criticism helps the learner too slowly on his way to skill. Instead it is better to catch him as often as possible doing the right thing, even by chance, and speed him on his way with a word of appreciation.

The best criticism is self—criticism. The instructor can ask the learner what is wrong with the way he is doing the job. He can help him analyze his work by asking, "Is this part right?" "Did you do thus—and—so?" or by suggesting, "Suppose you look this over and tell me when I come back what should have been done differently."

8. **Does the learner stand on his own feet?** — Does he lean on the too much, or go to the opposite extreme and act as if he knows it all?

Most new workers are a bit fearful and lacking in confidence, some more and some less. They show it in curious and contradictory ways, as the above questions suggest. A little fear when facing a new situation serves to awaken most persons to greater alertness and effort. They are able to rise to the occasion and soon overcome their- fears. They "take things in their stride." Yet there are many individuals who lack emotional balance, who have not learned to take life as it comes, to face reality as adults. It is important, however, to remember the caution about "die—casting" people into molds, to notice "the degree to which" the individual lacks emotional balance. Differences in individuals range all the way from the person who adjusts himself to the job situation promptly, stands on his own feet, and quietly tackles every thing in a matter—of—fact way, to the person who leans on others and expects favors, who covers his fears with over—boldness, or who seeks to "make a good impression" instead of concentrating his attention on learning the job.

While the supervisor or instructor cannot go along indefinitely trying to help a maladjusted person "grow up," he can often add to the timid learner's confidence by pointing out his successes and, on the other hand, bring a bluffer back to reality by facing him with the demands of the job. He is interested at all times in each operator's reactions to the job and to his fellow workers, because they are facts which affect his learning and doing the job, and his attitude toward it and toward the whole organization.

9. **Does the learner seem ill—adapted to the job?** — In spite of the best efforts of line supervisors and personnel organization, employees are sometimes placed on jobs they cannot do satisfactorily. Two cautions are in order here, however.

First: Do not assume that an employee is a misfit in a job until he has been fully and correctly instructed on that job and has shown that he cannot do it successfully. Many men have been called misfits on jobs they never had a fair chance to learn. Often a slow learner makes an excellent operator. It is a misfortune for him if he has to begin the job under a supervisor or instructor without patience and willingness to instruct.

Second: Do not assume that when a worker is a misfit in one job he is useless. Any supervisor of long experience could tell stories of "misfits" who found other places where they made good. Few misfits are totally unfit.

The instructor's part is to get acquainted with the employee, to win his conf4 discover what he can do and likes to do, find out his difficulties on the job and see that he either learns it or gets a fair trial at other jobs for which he is better adapted.

Summary of Section 7

The successful instructor will seek to understand each learner. He will:

1. Avoid stereotype thinking; i.e., study each operator as an individual.
2. Notice the degree to which each learner has difficulty in paying attention to the details of the job.
3. Size up the learner's alertness and his background of experience.
4. Watch for evidences of distraction.
5. Note the degree to which the worker seems to learn from his own mistakes, and how well he can follow directions.
6. Study the interests of each learner and seek to discover how they may be related to the job.
7. Observe the learner's reaction to the opinion of others and the degree of his self—reliance.
8. Study the misfits to assist in their successful adjustment. In short, the instructor or the supervisor who gives instruction will study each learner from the time he begins to learn a job until he is fully trained, seeking to discover how he can be instructed best.

GENERAL SUMMARY

Proper instruction of employees in their jobs can be an important factor both in operating effectiveness and in worker satisfaction. It has been the purpose of this manual to bring together the experience of industrial teachers and the knowledge of students of the learning process, in a series of concrete suggestions as to how jobs can be analyzed and instruction planned to meet the learner's needs, how the teaching process itself can be done successfully, how higher levels of skill can be built up, how special learning difficulties can be recognized and overcome, and how the particular characteristics of the individual learner can be sized up and used to advantage. Fullest use of these suggestions cannot be attained overnight, for directing human learning is a complex process demanding intelligent and interested attention to detail over a period of time. But the supervisor or instructor who masters the art of good teaching will reap returns, not only from seeing the growing skill and satisfaction of the man he trains but from the increased effectiveness of the whole organization of which he is a part.

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