

INDUSTRIAL TRAINING AND ECONOMIC EVALUATION

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Industrial and on-the-job training has been referred to as the shadow educational system in modern society (Goldstein, 1980). As with most shadows, the features are blurred and distorted. In the case of industrial training, the distortions come from the general lack of knowledge about this large learning enterprise.

One purpose of this paper is to clarify the nature, goals, research, and evaluation issues of industrial training so that practitioners in the field will be better able to support and scrutinize this growing educational system. A second purpose of this paper is to illustrate with a number of case studies and examples from the literature the types of data and analyses required by practitioners in the field to make more effective planning and management decisions.

The growing importance of industrial training is reflected in several recent publications (Phi Delta Kappan, 1980; Journal of Industrial Teacher Education, 1978) which suggest that private sector training may even replace military training as a major contributor to the advancement of learning theory and learning technology (Swanson, 1978). This premise is based primarily on economic considerations in the private sector. The case for industrial training, whether on-the-job skills training or advanced seminars offered by universities for business executives, is grounded in the quest for increased productivity and increased profits. A correlate of increased profits is, of course, increased productivity.

¹Major portions of this manuscript were adapted with permission from Richard A. Swanson, "Industrial Training," 5th Encyclopedia of Educational Research (New York: Macmillan [AERA], 1982).

Increasing productivity, in its simplest sense, requires (a) improved equipment/processes or (b) gains in worker knowledge/skill (Jacobs, 1981). The latter implies training that ultimately will result in increased productivity.

Current industrial training practices and evaluations in Western Europe and the United States are seldom described in academic publications or even trade journals (see, for example, Neary, 1974, 1976; Somers, 1971, 1974; & Zymelman, 1976). Unlike public sector industrial psychologists and educators who study the training process or who function as academic critics, industrial trainers or managers are the primary participants in private sector training. While their responsibilities may regularly demand the same rigorous analysis, synthesis, and evaluation as are found in published academic research, their accomplishments typically are disseminated informally to members of a work group or to management in the form of proposals or reports. Unfortunately, there is little time or encouragement to disseminate findings any further than these immediate work settings. In fact, industrial training personnel often are discouraged from disseminating research and development data because of the sensitive or proprietary nature of the information. Thus much of what is occurring in industry cannot easily be reviewed or evaluated.

INDUSTRIAL TRAINING GOALS, CONTENT AND METHODS

Industrial training² was described earlier as the shadow educational

²The distinction between education and training has been debated among learning professionals and non-professionals for generations. However, it is generally conceded that the intent to control the information that the learner receives along with the specification of performance criteria typically distinguishes training from education.

system in modern society. Within the industrial training profession there is no certification or degree program by which one prepares to become an industrial trainer. Higher education programs designed specifically to prepare persons for private sector industrial training are only of recent development (McCollough, 1981). Furthermore, in the private sector, training is a secondary organizational goal that exists to support the production of selected goods or services and the efficiency/profitability of the enterprise. These conditions make it almost impossible for an outsider to predict and cost-analyze the role, staffing, methods, or facilities devoted to training within any one company. Thus, each company independently determines its own goals, content, and methods of training.

The investment decisions concerning training and its function are affected directly by the inner workings of the firm or industry. Nevertheless, the major influences upon training are the financial and non-financial goals of the company. Of course, actual training efficiency and effectiveness also are important influences in reviewing each of the types of training. Often these latter measures serve as proxies for company financial goals concerning training.

The remainder of this paper will address the major organizational influences on training and the general types of training currently taking place in industrial settings. Major evaluation and policy issues will be reviewed in each context.

ORGANIZATIONAL INFLUENCES ON TRAINING (WHY INVEST IN TRAINING?)

The question of means versus ends initially may appear to be a very elementary issue related to industrial training. However, an analysis of

the issue reveals that the evaluation methods used most widely by professional trainers are particularly adaptable to studying questions of means rather than questions of ends (Copa, 1981). As a result, the questions of how-to and the pressures to-do frequently and easily lead the industrial trainer away from both the goals of the organization and the more fundamental question of why invest in training. Furthermore, these meanings outside the context of the organization's goals often generate criticism that such training practices are fads that gain support only through reported successes which seldom are based on systematic collection or careful analysis of data (Campbell, 1971). Industrial training activities considered in isolation from the context of the financial and non-financial goals of the organization are prime targets for such criticism. It is important, therefore, to understand these goals and their influence on training decisions.

Financial Goals. It is a simple fact that American and Western European industries exist to make money, not to train their employees. There is not a goods- or service-producing organization that would opt to have a training department if it were able to hire and retain fully competent and job-skilled employees at a competitive market cost. Such organizations train employees because less-than-competent employees reduce the overall productivity of the organization and therefore reduce profits. Training, then, is an investment with an expected return to the organization. Training decisions made outside this context are destined to be short-lived (Douthat, 1970).

The investment-return perspective clarifies one's view of the main training function in the private sector. Within this framework, training

is not a dispensable organizational frill. Rather, it is a tool for economic survival. As such, informed decisions about alternative investments in training--as with alternative investments in physical capital--must be based on their cost-effectiveness which can be determined only by systematic comparison of the costs or resources to be used with the benefits or outcomes to be achieved.

In an accounting sense, costs are defined as total outlays necessary to achieve a given set of outcomes. In a more generic sense, costs can be defined as the value of alternatives or other opportunities forgone in order to pursue a particular course of action (hence the term "opportunity costs"). For example, each time an organization decides to invest in training, total outlays include both the direct costs of equipment, facilities, materials, and personnel, and the indirect costs of output (goods or services) forgone by taking both instructor and trainee away from their normal everyday activities.

Benefits are the opposite of costs in the sense that they represent opportunities gained as a result of engaging in some activity. For example, the principal benefit said to accrue to an organization when it invests in training is an increase in the marginal product of its labor which, in turn, contributes to an increase in total output (goods or services). Since the marginal product of labor is equal to the change in quantity or quality of labor employed, training will yield profits if the organization can appropriate some or all of this increase in the marginal product of labor.

Cost-effectiveness, then, is a technique for selecting from alternative activities that activity which will achieve either a given set of

outcomes at the lowest cost or the greatest benefits at given costs. The underlying concept is that the benefits or outcomes to be achieved must be weighed against the costs or resources to be used. The lower the costs with given benefits, or the greater the benefits with given costs, the greater the cost-effectiveness. Stated differently, the extent of cost-effectiveness is determined by comparing the outcomes to be achieved (at the margin) with the outcomes that could be achieved if those same resources were allocated to an alternative activity.

Cost-effectiveness analysis is complicated by the fact that there are any number of ways to achieve a given set of outcomes, some of which are more cost-effective than others. For example, a decision to cut costs from a specific activity would not be cost-effective if the benefits forgone were more valuable than the benefits to be achieved by reallocating the saved resources to another activity. On the other hand, a decision to allocate additional resources to a specific activity would not be cost-effective if the outcomes to be achieved were less valuable than the outcomes that those additional resources could yield in another activity. Thus, each time an organization considers allocating resources to a specific training program, it needs to assess whether greater benefits could be realized by allocating those same resources to one or more alternative activities. It is important to recognize that programs which are cost-effective are not necessarily the lowest cost or the lowest quality. Similarly, programs that operate at low costs per employee are not necessarily cost-effective, and programs that operate on reduced costs are not necessarily low in quality.

Different comparisons of cost-effectiveness are particularly useful in situations where benefits cannot easily be measured in monetary terms. Typically such comparisons are expressed as ratios that may or may not have required the use of other techniques such as formal input-output or monetary benefit-cost analyses. Determining how best to conceptualize (or define) and measure the various inputs and outputs is a major obstacle often encountered here. Different conceptualizations (such as net expected present value, rates of return, or the use of benefit-cost ratios) doubtless will lead to different comparisons of cost-effectiveness. Nonetheless, cost-effectiveness comparisons of some type are used at least implicitly in most rational decisions. Thompson (1980), Stromsdorfer (1972) and Zymelman (1976) have addressed these issues of specification, measurement, and analysis especially as they relate to industrial training.

Training outputs often are more complex to define and more difficult to measure than training inputs. Simple output measures include number of employees trained and number of training hours completed per employee; more complex measures include affective changes in employees and, most importantly, the economic benefits (usually expressed in monetary terms) to the organization. A knotty problem that arises here is how to determine who benefits from training. Becker (1964), for example, has classified training as either general or specific. General training increases the trainee's productivity in tasks required across organizations, whereas specific training increases the trainee's productivity on tasks required only by the organization. Consequently, on the one hand, the rational profit-maximizing organization typically would not invest in general training

because its benefits accrue primarily to the trainee. On the other hand, individuals typically would not invest in specific training because its benefits accrue primarily to the organization. Obviously, the actual choice of training inputs and outputs to be used and how they will be defined, weighted, and related to profits are crucial determinations that require the most informed judgments of trainer analysts or managers.

Although profit is the major driving force behind industry in the Western world, too frequently it is only a stepchild in the professional training literature that emphasizes means rather than ends. Such literature is replete with reports of how to do it rather than evidence of did it get done. The noticeable void in the literature of the latter may not be representative of actual practice in the field where investment-return decisions are being made daily about such training programs. Nonetheless, even if reports of studies based on such decisions were released by the organizations, many doubtless would lack the methodological rigor and generalizability to be accepted for publication in the research literature. Unfortunately, only a limited number of empirically based cost-effectiveness studies are reported in the literature (see, for example, Antil, 1972; Zemke, 1978; Zymelman, 1976). Four different types of these studies are illustrated in the following paragraphs. The first two studies address the questions of which training program should be authorized and the comparative cost-effectiveness of one program versus another. Two other studies illustrate the questions of whether to invest in training at all and the comparative cost-effectiveness of training versus no training.

The first study (Cullen, Sawzin, Sisson, & Swanson, 1976, 1978) has provided the manufacturing industry with benchmarks for analyzing the training of semi-skilled workers. The purpose of their study was to conduct a systematic comparison of structured versus unstructured (buddy-system) training of semi-skilled production workers in an industrial setting. Although on the face of it structured training appeared to be more expensive, the analysts wanted to determine whether it might be more cost-effective. They concluded that because the cost to develop such a program is fixed and therefore the average cost would be reduced as the number of trainees increased, significant savings could be realized by structured training, thereby making it more cost-effective than unstructured training. As part of the study, participants in each of the two groups completed a mechanical comprehension test and a worker attitude inventory. In addition, the analysts developed and examined a number of measures for each of the two groups (e.g., time required to achieve worker competency, average costs, average production losses, and troubleshooting success rates). They also examined break-even points and looked at projected savings. From this study, the trainer analysts were able to provide management with several useful and important results. It was found, for example, that the time required to achieve competency was significantly less in the structured training program, that average costs were about the same (for 20 workers in each of the two groups), that average production losses were significantly lower in the structured training program, that the troubleshooting success rate was significantly higher in the structured training program, and that worker attitudes were about the same in each of the two groups.

The second study (Thomas, Moxham, & Jones, 1969) was an attempt to compare the cost-effectiveness of two alternative forms of general training for machine operators. The study took place in a small, heavy-duty clothing manufacturing firm during the late 1960s in England. It was concluded that greater benefits could be achieved under the "new" innovative training program than had been achieved under the "old" program, and that the ratio of benefits to costs over a four-year period would be 8:1 for the new program. More specifically, it was found that average performance levels increased by as much as 30 percent during the first year following training and then leveled off, suggesting that the bulk of the overall increase in output due to improved performance occurs in the first year after training. It was also found that the innovative training program resulted in a marked decrease in employee turnover. However, when the implementation of the new training program was stopped after two years, the results again became similar to what they had been under the old program. Thus, there can be little doubt that the benefits investigated in this study can be ascribed to the investment that the manufacturing firm made in a new training program for machine operators. These results were based on data available for 139 and 92 machine operators in the old and new training programs, respectively. The benefits of the new training program over the old program were determined largely by three measures: change in average performance levels, change in average retention time (i.e., employee turnover), and change in length of the training period.

The third study (Rosentreter, 1979) was an attempt to determine the cost-effectiveness of an adult-education program offered to department

managers of a manufacturing firm through a contract with a local community college. The specific training program studied was designed to develop managers' facilitative communication skills for goal-setting with subordinates. A secondary objective was to demonstrate the viability of selected economic indices as criteria for evaluation of a firm's adult-education program. Sixty-eight department managers who supervised work groups of 16-30 subordinates in a manufacturing firm participated in the study. Thirty-four of the managers received 15 hours of communication-skills training over a one-week period. To analyze the effectiveness of the training program, four measures were compared both before and after the training for each of the two groups: employee turnover rate, hours of employee lateness, performance appraisal rating, and number of level two employee grievances. The most significant conclusion derived from this study was that a management training program can be effective in changing an organizational variable (i.e., employee turnover) that contributed to the economic profits of a manufacturing firm. Also of significance was the fact that the training program was evaluated in economic terms that were meaningful and understood by management decision-makers in industry. The training program was not effective, however, in significantly decreasing employee lateness, improving the performance-appraisal ratings of managers, or decreasing employee grievances at level two in the grievance procedure.

A fourth study (Meissner, 1975), actually conducted in the early 1960s, also addressed the question of training versus no training. Following a survey of consumer opinions on the quality of bagging services

provided by retail food stores in the United States, a major paper manufacturer conducted some 20 in-store experiments to determine the cost-effectiveness of a training program in "bagsmanship" (defined as "activities involved in getting purchases safely from the checkout counter in a retail food store to the customer's door"). From this study, it was suggested that retail food store managers could expect an 11-fold return on their training investment if they did not have to pay for training materials and an 8-fold return if they did have to pay for training materials. More specifically, the results showed clearly that by adopting a coordinated mix of three carry-bag sizes and by conducting a streamlined in-store program of checker and bagger training, checkstand savings of from 6 to 40 percent could be achieved (with the average decrease in bagging costs of 15 percent per \$1,000 of store sales). Each in-store experiment consisted of two control weeks, one training week, and two test weeks. Bag inventory counts were taken both before and after training to determine the average level of bag costs per \$1,000 of store sales. The calculations made were based on conservative cost assumptions (e.g., higher-than-average hourly wage rates for trainees). Moreover, no attempt was made to measure either any saving in cost of labor that resulted from, or the good will that was created by, the use of proper bagging techniques.

Non-Financial Goals. Although often overshadowed by the concern for profits, non-financial goals have the second major influence on the training function in organizations. Such goals can be either explicit or implicit, logical or illogical. For example, when organizations establish a corporate personnel policy of hiring from within whenever possible, they

also are setting parameters that will affect the training function. Likewise, when organizations are committed to being the financial or technological leader in their field, the policies they establish also will influence the training function.

Surprisingly, organizational goals (both financial and non-financial) and their effects on the training function are almost ignored in the training literature. Consequently, reports of techniques for analyzing organizational goals, along with discussion of the constraints and opportunities that would result, are almost nonexistent in the literature. Since the field of training apparently does little to study these ends, it is not surprising that the field often finds itself dumbfounded when it hears of large training departments suddenly being eliminated or of highly touted training centers having little or no effect on the actual work performance of trainees.

In the past, professional trainers often have relied on narrow or process-related questions of training efficiency and effectiveness--e.g., serving more trainees this year than last year with the same resources, or increasing trainees' post-training test scores. Such (process) measures often are used as proxies to satisfy management concerns about training's contribution to the financial or non-financial goals of the organization.³ In the future, however, and especially during times of economic recession, such proxy measures of accountability--without systematic cost-benefit com-

³Such measures seems to work best in organizations that are fiscally sound, have widely held non-financial goals, and have a well-established and work related training function.

parisons that relate directly to the profit function--are likely to become increasingly less satisfactory for informing management decision-makers.

TYPES OF ORGANIZATIONAL TRAINING

The following typology is an attempt to simplify the melange of different training activities currently taking place. In general terms, three types of training can be identified: skills and technical training, management and subject-matter training, and motivational training. In each context different evaluation concerns and issues arise.

Skills and Technical Training. Skills and technical training are concerned primarily with worker-thing (machinery, tools, or materials) interactions. This type of training typically is related to the production or sale of goods or services.

There has been a great deal of interchange of knowledge and practice among skills-and-technical-training personnel in the military, in public sector vocational and technical education, and in industrial training. Job and task analysis techniques have been researched for decades in all three fields and are widely accepted in each. It is interesting to note that recent regulatory agency pressures for fair-employment practices in the United States have renewed the training profession's commitment to job and task analysis (Gordon, 1978).

Some of the recent adaptations to job and task analysis have at times taken the analyst away from direct observation of competent workers as the data source (DeCaro, 1978; Folley, 1969; Rosenfeld & Thornton, 1976). The empirical evidence supporting the validity of these methods for specific job settings is thin. Prien (1977) draws attention to the need to match

particular analysis methods to specific training problems or situations. In an effort to value more systematically the importance of tasks within a job, there have been efforts to develop a task-scaling method (Ammerman et al., 1974; Ammerman & Pratzner, 1974, 1975, 1977).

It should be noted that these more indirect efforts have come from public sector vocational educators who necessarily are more concerned about transfer of training than their private sector counterparts. Private sector personnel are more likely to use traditional methods utilizing direct observation of a highly skilled worker and a detailed analysis of that person's behavior in order to identify tasks and their relative importance (Ridley, 1980; Musick, 1981). In addition to careful selection of a skilled worker for analysis, multiple workers often are observed and greater task detail is recorded. Additionally, information such as learning difficulty (Mager, 1967) and the classification of the domain of behavior required of task details (Gropper, 1974; Swanson & Poor, 1981) is being analyzed.

Standard job-and task-analysis techniques are very effective for determining observable worker-machinery interactions of a procedural nature. For example, the details of setting up, running, and shutting down a machine can be determined easily. Another aspect of such a machine or system operator's job that is not so easily understood is troubleshooting the system or the equipment in the system.

Whether troubleshooting a production process (e.g., imperfections in extruded 10" diameter plastic pipe) or a malfunction in the process equipment (e.g., inoperable plastic pipe extrusion machine), the troubleshooting

component is complex. The oil-covered maintenance man of yesterday is more likely to be wearing a white shirt and using an oscilloscope now. Industry demands have changed. At present equipment ranges in size from massive to miniaturized, it is very expensive, it is more specialized, it is more difficult to keep running, it is more difficult to repair once broken, and on-site inventories of back-up equipment and parts are lower (Petzinger, 1981).

The Financial consequences of using an unskilled work force within these conditions can be substantial. Because of this, a recent study by Johnson (1980) is of interest. Within his computer-based troubleshooting training program he also teaches the cost-effectiveness considerations of diagnostic alternatives to specific equipment problems. In a more elementary mode, it should be noted that the analysis required to determine the knowledge and skills necessary to troubleshoot equipment goes beyond understanding procedures. Troubleshooting has largely been ignored by the private sector training and development profession in the United States. It appears that the majority of research and development in the area of industrial process and troubleshooting analysis is being done in Europe (Frank & Smith, 1969). Available research into the areas of process analysis and the use of process simulations (Roberts, 1976) points to an interesting private/public sector issue. The movement in engineering education away from applied studies and the concentration of public vocational schooling on procedural skills leave a void in the general work force. Since the industrial training profession draws from these technical fields, there is an equivalent shortage of competent persons in the area of process and troubleshooting analysis training. The nature of industrial technology

and the problem of keeping machinery running demand greater attention by private and public sector trainers. The high degree of hardware standardization in the military has allowed that institution to stratify and proceduralize the troubleshooting behavior of their technical personnel and thus maintain their efficiency and effectiveness with a minimum of worker training (Folley, 1978). It is unlikely that private sector skill and technical training ever will reach that point of sophistication because of the diversity and competitive nature of industry and its hardware.

Management and Subject-Matter Training. Management and subject-matter training deals with worker-worker and worker-idea interactions. Topics such as organizational communication, employee performance appraisal, decision-making, management by objectives, time management, and fiscal management are representative of management training programs. Management training, at face value, often appears luxurious when compared to more spartan skills and technical training. Managers making decisions about the training of managers tend to be more forgiving as it relates to costs, the immediacy of the returns, and inclinations toward ceremony (Adams, 1976).

Prior to the emergence of the career development movement in the 1970's (Walter, 1976; Morgan, 1977), general management training was used to implement career progression programs in large companies (Bright, 1976). The pattern was rather simple and effective, and it still exists today. Promising managers are selected to attend one of a sequence of courses at company headquarters where they are provided general job-related management information and are introduced to selected corporate operations and per-

sonalities. Participants are observed as much during out-of-class events as in the training sessions themselves. High potential people from among the participants are noted by management and tagged for later promotion. The cycle of training and promotion continues with each visit to headquarters becoming more selective. The cycle usually is capped off with intensive management seminars held at prestigious universities. These seminars typically last from one week to three months.

There is almost a complete void in the literature as to methods of analyzing the specific subject matter dealing with management behavior. The needs assessment research literature has provided effective methods of distinguishing training from non-training problems (Harless, 1975) and yet there are not equivalent methods for specifying the subject matter that should be covered within a particular area of need. For example, determining that training for first-line supervisors is needed is quite different from determining what content should be covered in a program for first-line supervisors. Two recent publications attempt to fill this analysis method void (Swanson, 1981; Zemke, 1982).

In a nutshell, the issue is that the rather powerful job and task analysis tools that exist for skills and technical training do not exist for management and subject-matter training. This void results in a reliance on external consultants who typically emphasize training programs that deal with general management topics. Furthermore, such programs often are the target of the "training faddishness" criticism that was noted earlier (Campbell, 1971). At the present time, for example, wellness training is one of the fads that may not be recognizable in another five years.

As one might expect, the services of consultants are costly and encourage the organization to hire in-house persons with the same analysis and design competencies. At the same time, the direction in management training is away from general management training to more specific management knowledge and practice with closer scrutiny of its financial and non-financial goal payoffs. The additional design and development time required to produce these more specific programs also has created a dichotomy of sorts. On the one hand, there is an increased number of organizations that are marketing their training programs outside their companies in order to gain a profit on their investment. On the other hand, there are efforts to limit competitors' knowledge of in-house training programs in that they are perceived as proprietary and the source of a competitive edge. Training programs that have important financial consequences often end up being guarded just like new products, manufacturing processes, or raw-material formulations.

Motivational Training.⁴ The third type of training, motivational training, is designed to influence human attitudes and beliefs. While it might be tempting for persons to equate all motivational training with sales training, that clearly would be a misrepresentation. For example, the intent and method of many safety training efforts and management semi-

⁴Ethics about the means and ends of motivational type training also are becoming critical concerns (Clement, et al., 1978). Training with the intent to manipulate a person to accept a predetermined position without that person ever being made aware of the process or intent is considered unethical in most educational circles.

nars could be classified as motivational training. Likewise, much of what goes on under the name of sales training could best be categorized as skills training or management training.

Sensitivity training is a method of motivational training that gained a great deal of attention and was implemented widely in the late 1960s and early 1970s. However, the implications of efforts aimed at changing deeply rooted values to modify organizational behavior have been challenged from a number of positions (Campbell & Dunnette, 1968). Goldstein (1980) noted that sensitivity training lacks a theoretical base, Smith (1976) highlighted the lack of long-term effects, and Cooper (1975) reiterated that ethical concerns still appear to be the most significant issue surrounding sensitivity training. Newer methods of attitudinal training such as organizational development and quality circles, while still largely unproven, do not rely on the revivalist type of techniques frequently found in sensitivity training. Rather they appear to be grounded in both human and organizational needs and seem to rely on more straightforward methods to obtain desired changes (Miller, 1976; Yager, 1981).

In summary. This paper has attempted to review the industrial training and related evaluation literature in order to give the practitioner in the field a clearer understanding of requirements for rationally understanding and proposing such training. It is clear that the literature is thin on these topics, especially as it relates to economic and accounting analysis. Equally clear are the needs for practitioners to better understand and address the economic objectives of their organizations and to work more effectively with their accounting and financial analysis departments.

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