By David S. Bushnell

Input, Process, Output:
a Model for Evaluating Training

IBM's corporate education strategy for the year 2000 uses a new approach for evaluating training effectiveness.

Since World War II, corporations have spent billions of dollars on worker training. As with any corporate investment, training directors are held accountable for the return on that investment; top management is looking for evidence that the dollars spent pay off. Budget justifications are in terms of potential savings generated through productivity gains or improved quality.

Companies are looking for cost-effective training strategies and seriously considering make-or-buy options. The portability and transferability of training materials are issues that multinational corporations wrestle with as global education networks take form and satellite communications proliferate.

Not only is top management becoming more demanding, but trainees are asking for and getting training materials geared to their requirements and delivered on demand. As computer-based training (CBT) and other instructional technologies become readily available (and cost-effective), the challenge for trainers is to deliver course materials in ways that ensure quality products at reasonable prices, tailored to end-user requirements.

Paralleling those trends is the need to link training to future corporate needs and to tie it more closely to other human resource management programs. That is the thrust of IBM's recent effort to project its internal education requirements through the year 2000 (see cover story). Recognizing its responsibility to the corporation to deliver well-conceived and cost-effective training programs worldwide, whenever and wherever they are needed, IBM's education group has opted to overhaul its internal education system dramatically by the end of this decade to meet its anticipated knowledge-worker requirements.

Other advanced multinational companies—Motorola, Xerox, and Federal Express, for example—have also adopted an integrated-systems approach to training improvement. One of their concerns is to anticipate and offer appropriate retraining opportunities before employee skills become obsolete. Another is to maintain the flexibility of their workforces as products and services change to match market opportunities. Still another is to provide appropriate skills training for new hires by means of performance support-systems delivered at workstations. These companies are dramatically lowering the cost of their training programs and, at the same time, increasing their training flexibility and responsiveness by adopting what might be called an input-process-output (IPO) approach to training evaluation.

Why evaluate training?

To put it simply, training directors need to balance the cost and results of training. In the past, much of the cost occurred at the delivery stage. Today, design and development costs are rising rapidly as technology takes more of the responsibility for training delivery.

IBM has found that an IPO approach to training evaluation enables decision makers to select, from several options, the package that will optimize the overall effectiveness of a training program. Those who use the IPO model can readily determine whether training programs are achieving the right purposes. It also enables them to detect the types of changes they should make to improve course design, content, and delivery. Perhaps most important, it tells them whether students actually acquire the needed knowledge and skills.

The IPO evaluation model

If we describe a training system as having an input, a process, and an output, then it encompasses several points (E1 through E7 in the accompanying figure) at which evaluations ought to occur.

At the input stage, the elements (system performance indicators, or SPIs) that could be evaluated in terms of their potential contribution to the overall effectiveness of a training program fall into such categories as trainee qualifications, instructor experience, the availability of already tested instructional materials, the types of equipment and training

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facilities available, and the training budget.

At the process stage, the evaluator needs to specify instructional objectives, develop design criteria, select instructional strategies, and assemble training materials. At this stage, the training actually takes place and adds value to the human resources.

Output elements include such items as student reactions to training, knowledge and skills gained as a result of the training, and improved performance back on the job.

It is helpful to make a distinction between output and outcomes. Output deals with the short-term benefits or effects of training; outcomes refer to longer term results associated with improvement in the corporation's bottom line—its profitability, competitiveness, and even survival. Outcomes do not always flow directly from the outputs of the training, but in the long term, they do dictate training resources availability.

In the figure, note the feedback loops built in at critical junctions in the evaluation process; they make the training systems somewhat self-correcting. For example, appropriate measures taken at the end of the development phase (E4) should help to ensure corrective adjustment at the design stage before an instructor ever steps up to the lectern.

Steps in the evaluation process

The evaluation process involves four steps.

Identifying evaluation goals. This is a critical stage because it determines the overall structure of the evaluation effort and establishes the parameters that influence later stages of the evaluation. Some evaluation goals are qualitatively different from others. For example, some goals may relate simply to measuring student reactions subjectively, while others may be concerned with measuring changes in trainee performance back on the job.

Developing an evaluation design and strategy. The next set of activities centers on selecting appropriate measures, developing a data-collection strategy, matching data types with experimental designs, allocating the data-collection resources, and identifying appropriate data sources. The choices made at this stage are critical because they determine the likely cost, time, and resources—decisions about which SPIs to measure determine the true value of the evaluation process.

Selecting and constructing measurement tools. At this stage, you want to select or construct the measurement tools that best fit the data requirements. Establishing a match between the data and the tool requires the evaluator to judge in advance the tool's reliability and validity.

Reliability answers the question, "Does the tool provide a consistent and accurate measure of the behavior being assessed?" Validity is a much more complex concept and therefore is much more difficult to establish. A measurement tool is valid if it meets several criteria. The criteria include face validity, content validity, and construct validity. Some of the tools currently in use:
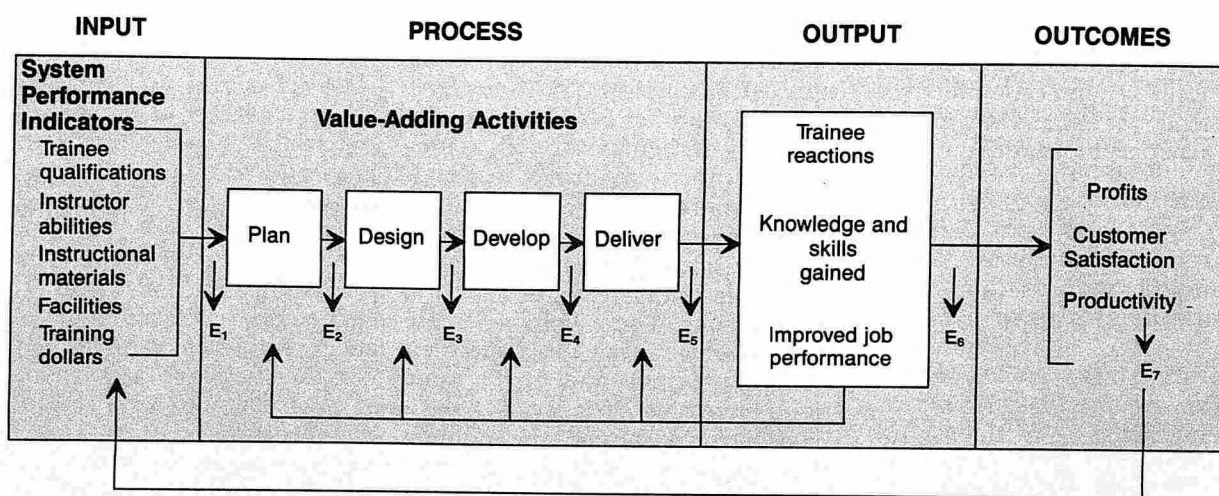
- questionnaires;
- performance assessments;
- tests;
- observation checklists;
- problem simulations;
- structured interviews;
- performance records.

The type of measurement tool you select will vary according to the level of evaluation you need to carry out. If you are concerned with the measurement of individual cognitive abilities, then data collection and analysis techniques need to go beyond the traditional. For example, you may require detailed measures of recall, error, and reaction time; you can build these into the learning module as you study it. At the other extreme, assessing the value of a nuclear-power-plant-operating-room simulator requires the aggregation of data over several months and the handling of emergency conditions.

Analyzing data. This stage of the evaluation process involves the ability to tie the results of the data-gathering effort to the original goals of the evaluation. The following questions come to mind:

- Is the information collected really "need-to-know" information?
- Is the evaluation strategy gathering the right amount of information to answer the key questions raised?
- Is the measurement procedure disruptive to the education activities?
- Are the analytical procedures appropriate for answering the questions raised?

An input-process-output approach to training evaluation

INPUT	PROCESS	OUTPUT	OUTCOMES
System Performance Indicators Trainee qualifications, Instructor abilities, Instructional materials, Facilities, Training dollars	**Value-Adding Activities** Plan → Design → Develop → Deliver	Trainee reactions, Knowledge and skills gained, Improved job performance	Profits, Customer Satisfaction, Productivity

E_1 E_2 E_3 E_4 E_5 E_6 E_7

After the data are analyzed, you need to make conclusions and recommendations and present the findings.

A key issue at this stage may involve the potential cost of additional data analysis, especially if the results fail to answer the questions originally posed or if they do not satisfy management's need for information. As with the original evaluation plan, the costs must be weighed against the potential benefits of the additional effort.

IBM's built-in global education network evaluation mechanism

The success of IBM's proposed global education network largely depends on the built-in mechanisms for tracking trainee progress, module completions, and mastery of various learning assignments. The network not only must gather and analyze these essential data, but also must feed the results back into the system to ensure that it can adapt to changing requirements. Thus, the system helps the learner assess his or her own progress in meeting educational goals and guides prospective learners as they attempt to sort out which learning modules they should take on.

IBM's evaluation system will continually and automatically update the employee's profile of skills, aptitudes, and learning preferences. It will assist line managers as they undertake to monitor the progress of their employees. It will provide continuous feedback to instructional material developers on necessary improvements in instructional modules. And it will enable top management to determine the return on its investment in the various components of the education and training system.

The ultimate payoff or added value of an employee's learning experience is how well he or she performs on the job. The quality, timeliness, and effectiveness of the learning experiences are only part of the reason an employee is able to perform effectively; other causes of high performance also must be considered through the use of sophisticated measurement tools and techniques. The goal, however, is to quantify in dollars just what impact a particular course of study had on an employee's ability to perform his or her job.

IBM's master plan for education in the year 2000 is already underway. The company is moving ahead with establishing a common set of guidelines and exploring alternative delivery systems. The outcomes of those programs are being evaluated at several levels. Line management and staff responsible for IBM's education and training programs are beginning to accept standard business measures based on performance improvement, not simply on the number of training-class hours. They are stating learning objectives in ways that make it possible to determine whether they are achieving them at a prescribed level of quality.

IBM is developing a well-articulated, overall corporate strategy for education that preserves the flexibility and responsiveness of a decentralized delivery system. To accomplish all that, line management is actively involved at all stages of the planning process to make sure that they serve IBM's future business requirements worldwide.