The gap between evaluation theory and practice can be closed through a concrete system for effectively evaluating a training program to ensure that it contributes to an organization's success. The Training Effectiveness Evaluation (TEE) system can be applied to any training program in industry. It consists of three major elements: (1) an effectiveness evaluation plan, (2) tools for measuring training effectiveness, and (3) the evaluation report. The completed plan specifies the tools that will be used to assess whether the training has produced the desired results. The three categories of evaluation tools—satisfaction, learning, and performance—can be presented as three scores, one for each category. The completed report is a powerful tool for communicating the results of a training program. It provides the management decision maker with the necessary information for understanding the impact of a training program. Content includes the employee/organization performance need, the employee/organization performance goal, the approved solution with both training and nontraining component, narrative summarizing training effectiveness, an evaluation summary with visual presentation and/or comparison to performance goal, and an improvement proposal. (Examples and samples are appended.) (YLB)
TRAINING AND DEVELOPMENT RESEARCH CENTER

Project Number Sixteen

TRAINING EFFECTIVENESS EVALUATION

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Abstract*

This article closes the gap between evaluation theory and practice by suggesting a concrete system for effectively evaluating a training program so that training managers can ensure that their programs do contribute to their organization's success. The TEE consists of three major elements: (1) an effectiveness evaluation plan, (2) tools for measuring training effectiveness, and (3) the evaluation report.

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Training Effectiveness Evaluation

Training Effectiveness Evaluation

The gap between evaluation theory and practice is a serious problem for training in industry and business (Swanson, 1982). A recent literature review of the summative evaluation on training noted "the general consensus of the authors is that most summative evaluation of training and development programs is not conducted effectively at the present time. It may be concluded that more attention needs to be given to the components of summative evaluation used as a basis for this review and to upgrade the evaluation competencies of training specialists" (Parker, 1986, p.51).

A paradox facing most practicing managers of training is that their nontraining bosses typically neither ask for nor require formal evaluations. And, when these managers do evaluate, it is usually in response to a crisis and invariably it comes too late. A typical workplace scenario consists of the busy training practitioner doing what the company wants, feeling successful, and not being regularly required to prove the added value that results from training. With a full agenda of important training development and delivery tasks, the busy trainer finds it difficult to evaluate training. However, most important organizational functions regularly evaluate their progress and bottom-line contributions to the enterprise. In addition, it has been clearly established that training effectiveness evaluation data, particularly bottom-line performance results, are the key to gaining support for the training function from nontraining managers (Kusy, 1986). It is clearly irrational to not evaluate training effectiveness.
The purpose of this study was to develop and pilot test a practical Training Effectiveness Evaluation (TEE) system that could be applied to any training program in industry. Training personnel from Control Data Corporation and researchers from the University of Minnesota Training and Development Research Center worked together to achieve this purpose.

Both Parker's (1986) review of literature and Kusy's (1986) study of management support of training evaluation established the need for this study. In addition, the TEE is the heart of the control phase of the comprehensive Training Technology System developed by Swanson & Sisson (1985). The other four phases of the Training Technology System are analyze, design, develop, and implement.

The TEE consists of three major elements: (1) an effectiveness evaluation plan, (2) tools for measuring training effectiveness, and (3) the evaluation report.

Evaluation Plan

In TEE, planning decisions are made about which tools will be used to assess whether the training program produced the desired results. The Effectiveness Planning Sheet presents both evaluation tools and effectiveness questions. The four questions represent levels of training effectiveness and should be asked of every training program. They are:

1. Was the training delivered professionally?
2. Were the learning objectives met?
3. Was the original training need met?
4. Was the training valuable?
Training Effectiveness Evaluation

The evaluation tools, labeled A-F on the effectiveness planning sheet, are used in gathering the information needed to answer the evaluation questions. These tools measure the satisfaction, learning, and performance that result from training and, in the case of Figure 1, focus on basic supervisory training.

An "x" in a cell on the planning sheet indicates that this evaluation tool is required for all training programs. The open cells represent reasonable evaluation options with choices needing to be made in the learning and performance columns. For the knowledge area, the choice of using a knowledge test (2.C), an in-training performance test (2.D), or both, must be made. For performance, the choices focus on either cost-benefit analysis or performance comparisons. The completed plan requires a minimum of four evaluation tools: Two for satisfaction, one for learning, and one for performance. The tools that are selected also address the four effectiveness questions.

The completed plan specifies the tools that will be used to assess whether the training has produced the desired results. Figure 1 is a plan for a basic supervisory training course. The sample plan shows that the effectiveness of this course will be evaluated using the following measures: trainee satisfaction, trainee supervisor satisfaction, knowledge test, performance comparisons, and cost-benefit analysis.
Tools for Measuring Training Effectiveness

The three categories of evaluation tools—satisfaction, learning, and performance—can be presented as three scores, one for each category. The satisfaction score is an indicator of how pleased trainees and their supervisors were with the training; the learning score is an indicator of the amount of knowledge acquired by the trainees during the training course; and the performance score is an indicator of the effects that result from the training. Although there are many options available to professional trainers for constructing evaluation tools, the TEE focuses on a limited number of reasonable options, not every option.

The TEE requires that trainee satisfaction be measured for every training course. Trainee satisfaction is measured by having each trainee complete the Training Program Evaluation Form (Figure 2). The trainee satisfaction score is calculated by tallying all the trainees' responses to questions 1 through 7. Ordinal values are then assigned to the following descriptors: Very good (4), good (3), fair (2), and poor (1). The overall trainee satisfaction score is obtained by averaging the scores and determining the mean satisfaction score which will fall within the 1-4 range. Sub-scores on the individual questions can also be computed this way.

FIGURE 2 ABOUT HERE

The comments written by the trainees on the trainee satisfaction form
Training Effectiveness Evaluation

are not included in the trainee satisfaction score, but instead provide immediate, open-ended feedback for the instructor.

Trainee supervisor satisfaction is measured by using the Management Evaluation Form (Figure 3). This form is completed by each trainee's supervisor. After the responses are gathered, the average supervisor satisfaction score for the training program is computed in the same manner that average trainee satisfaction score and sub-scores are determined. Again, the written comments provide the trainer with immediate, open-ended feedback.

FIGURE 3 ABOUT HERE

The total satisfaction score for the training is computed by averaging the trainee satisfaction score and the trainee supervisor score and dividing this number by 2. This process weights the opinions of both trainees and the supervisors equally. The trainer can report the raw satisfaction score on the 4-point scale or use basic mathematic formulas to express the score as a ratio or percentage.1

Using standard trainee and supervisor satisfaction forms for all training courses allows for the comparisons of training courses with each other and across time, making it easy to identify and document recurring problems and/or successes.

Learning in training is measured by knowledge tests, performance tests, or both. Knowledge tests measure the cognitive information learned.
by trainees. Two types of knowledge test items—multiple choice and matching—are encouraged because they can be scored objectively and are not as susceptible to guessing. In constructing knowledge tests, care must be taken to ensure that the tests produce valid and reliable results. A test is valid when it measures what it is supposed to measure and it is reliable when it produces consistent results. The job aid for constructing knowledge tests (Figure 4) includes sample test items, validity and reliability criteria, and helpful test construction references.

In-training performance tests measure what the trainees can do by examining either the products that the trainees produce or the processes used by the trainees to exhibit learning. An in-training performance test must also be valid and reliable. The job aid for constructing in-training performance tests (Figure 5) provides examples, criteria for validity and reliability, and helpful performance test references.
The scores obtained with the knowledge test, the in-training performance test, or both, are used in calculating the total learning score. When learning information is collected using a single tool, that score becomes the total learning score. When both tools are used, the learning score is calculated by computing the percentage correct score for each test and then adding these scores together and dividing by 2. The trainer can either report the raw learning score or express it as a ratio or percentage (see Footnote 1).

In TEE, the tools for measuring the performance that results from training are performance comparisons and cost-benefit analysis. Performance comparisons contrast the productivity of either the organization or the employee after training with the productivity before training or against a goal. Figure 6 is the job aid for performance comparisons.

Cost-benefit analysis is used to determine the economic value of the training program. The benefit of a training program is determined by subtracting the cost of the training program from the performance value resulting from the program. Figure 7 is the TEE job aid for conducting cost-benefit analysis of training programs.
In situations where there is one measure of performance, that measure becomes the performance score. In situations where both measures of performance are used and a composite score is needed, the total scores for both measures can be translated into like terms, or standard scores, added together, and divided by two. Performance scores can be expressed in a variety of ways including ratios, percentages, dollars, and units produced. It is important to express performance measures in terms that have meaning to the organization.

**Effectiveness Evaluation Report**

TEE also includes systematic reporting of training program evaluations. The report contains the categories of information that training and nontraining managers must know in order to make sound decisions. The content of the report includes the original employee/organization performance need (described in 25 to 75 words), the employee/organization performance goal (summarized in 25 to 50 words), the approved solution with both training and nontraining components (described in 25 to 50 words), narrative summarizing the effectiveness of the training (25 to 50 word descriptions each for the measures of satisfaction, learning, and performance), an evaluation summary with visual presentation and/or comparison to performance goal, and an improvement proposal.
The completed Effectiveness Evaluation Report, as illustrated in the circuit troubleshooting training sample (Figure 8), is a powerful tool for communicating the results of a training program. It provides the management decision maker with the necessary information for understanding the impact of a training program.

Summary

The TEE provides tools for planning evaluations, gathering the effectiveness information, and reporting the information. Through systematic analysis and reporting of effectiveness evaluations, training managers can ensure that their programs contribute to their organization's bottom line.
Training Effectiveness Evaluation

References


Author Notes

The researchers wish to acknowledge Robert J. Prifrel and Control Data Corporation of Minneapolis, Minnesota, for supporting this research and development project. They also wish to thank Scott W. Johnson and Brian P. Murphy for critically reviewing the manuscript.
Footnotes

It should be noted, however, that a composite score is questionable unless the individual test scores that comprise it come from tests with similar score units, standard deviations and levels of difficulty for test items. The composite score for two dissimilar tests is computed by determining the z-score for each test, combining the scores, and dividing by 2. Additional discussion of z-scores, including the methods for computing them, can be found in Fundamental Research Statistics for the Behavioral Sciences (Roscoe, 1975).
Figure Captions

**Figure 1.** Basic supervisory training program effectiveness plan.

**Figure 2.** Instrument for trainee to evaluate training.

**Figure 3.** Instrument for trainee supervisor to evaluate training.

**Figure 4.** Knowledge test job aid.

**Figure 5.** Performance test job aid.

**Figure 6.** Performance comparison job aid.

**Figure 7.** Cost-benefit analysis job aid.

**Figure 8.** A sample effectiveness evaluation report.
Swanson is Professor and Director and Sleezer is Research Assistant, Training and Development Research Center, University of Minnesota, St. Paul, MN 55108.
"Basic Supervisory Training Program Effectiveness Plan"

This planning sheet helps to specify the evaluation tools that will be used to answer the four questions about the training effectiveness of each training program. The questions represent four levels of training effectiveness. The x's in the planning sheet cells indicate the evaluation tools that are required of all training programs. The open cells represent reasonable effectiveness evaluation options with two choices needing to be made. In terms of learning, the choice of using a knowledge test (2.C), a performance test (2.D), or both needs to be made. For performance, the choice is within cells 3.E, 3.F, 4.E, and/or 4.F.

At minimum there should be one evaluation tool each for satisfaction, learning, and performance. Additionally, the selected tools must minimally address the four questions.

<table>
<thead>
<tr>
<th>PROGRAM TITLE</th>
<th>EVALUATION TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Supervisory Training</td>
<td>SATISFACTION</td>
</tr>
<tr>
<td></td>
<td>A. Trainee Satisfaction</td>
</tr>
<tr>
<td></td>
<td>B. Trainee Supervisor Satisfaction</td>
</tr>
<tr>
<td></td>
<td>F. Cost-benefit Analysis</td>
</tr>
</tbody>
</table>

**EFFECTIVENESS QUESTIONS**

1. DELIVERY. Was the training delivered professionally?
   - X

2. OBJECTIVES. Were the learning objectives met?
   - X

3. NEED. Was the original need met?
   - X

4. VALUE. Was the training valuable?
   - X

**REQUARED**

- X = required of all training programs

**CHOICE #1**

- O = choices for this program

**CHOICE #2**
"Please answer the following questions to help us improve future training programs."

<table>
<thead>
<tr>
<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Quality of instructor's presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Quality of the information presented</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Amount of time to practice new material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Quality of feedback on your performance during training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Quality of training environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Usefulness of the course content to your job</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Was attending this training program a good use of your time?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What was the most valuable part of this course for you?

What was the least valuable part of this course for you?

If you rated any item "poor", please provide some additional explanation.

Additional comments would be appreciated.
"Please answer the following questions to help us improve future training programs."

Now that your employee has completed training and is back on the job, what is your impression of the effectiveness of the training program?

1. Employees have performed better at their old job or have been able to perform a new job following training.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Attending the training was a good use of the employee's time.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional comments would be appreciated.

------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------------

20
KNOWLEDGE TEST

TYPES OF ITEMS:
1. Multiple choice (samples):
   To speed up nut turning on tasks where space is limited or
   where bolts with long threads prevent the use of sockets,
   use the ______ wrench.
   A. crescent  B. combination  C. ratchet  D. allen

2. Matching (samples):
   For each item, write a number to indicate that
   the statement applies to:
   1. Norm-referenced assessment
   2. Criterion-referenced assessment
   3. Both norm and criterion-referenced assessment
   4. Neither norm nor criterion-referenced assessment
   □ Assessment in mastery-based.
   □ Some people must fail; otherwise assessment is too easy.
   □ Assessment is useful for making predictions.

CONTENT VALIDITY:
(Does the test measure what it is supposed to measure?)
1. Make sure that the test matches the content taught and its relative emphasis.
2. Use a matrix with content breakdown on one axis. Use low & high level thinking
   on the other axis. Weight the distribution of items according to trainee time-on-task
   or importance.

<table>
<thead>
<tr>
<th>Content</th>
<th>Level</th>
<th>Low</th>
<th>High</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(# and % of test items)</td>
</tr>
<tr>
<td>Unit #1</td>
<td></td>
<td>6</td>
<td>6</td>
<td>12 30%</td>
</tr>
<tr>
<td>Unit #2</td>
<td></td>
<td>4</td>
<td>2</td>
<td>6 15%</td>
</tr>
<tr>
<td>Unit #3</td>
<td></td>
<td>3</td>
<td>5</td>
<td>8  20%</td>
</tr>
<tr>
<td>Unit #4</td>
<td></td>
<td>7</td>
<td>7</td>
<td>14 35%</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td>20</td>
<td>20</td>
<td>40 100%</td>
</tr>
</tbody>
</table>

RELIABILITY:
(Does the test yield consistent results?)
1. Use at least 25 test items for any one test.
2. Use as many items as possible being careful that the test time does not become
   unreasonable.

REFERENCES:
IN-TRAINING PERFORMANCE TEST

TYPES:
1. Process Checksheet (samples):

   **PERFORMANCE CHECKLIST**

   **TERMINAL PERFORMANCE OBJECTIVE:**
   GIVEN: a torque screwdriver, Phillips head up, #1/2 Phillips head screw, 1/2 inch washers.
   PERFORMANCE: Familiarize the employee to the stationary workplace.
   STANDARD: per the following torque specifications of 30 inch-pounds.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Procedural Steps</th>
<th>Saucer</th>
<th>Washer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determine torque specifications</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Locate the adjustment knob</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. Lock the torque adjustment screw</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Turn adjustment knob</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5. Line up torque indicator line</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. Lock the adjustment knob</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. Turn Phillips head up into position</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8. Position the screw</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9. Position the washer</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10. Position the washer</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11. Position the washer</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12. Position the washer</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13. Tighten the screw</td>
<td>1 0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

   **CONTENT VALIDITY:**
   (...does the test measure what it is supposed to measure?)
   1. Make sure that the process checksheet contains all the critical steps specified by the work behavior analysis.
   2. Make sure that all the product specifications, quality and quantity, are included in the evaluation criteria.

   **RELIABILITY:**
   (...does the test yield consistent results?)
   1. Have trainees exhibit the process at least twice and produce at least two products.
   2. If #1 is not possible, have trainee talk through the process while doing it or describe the specifications to insure correct rating.

   **REFERENCES:**
PERFORMANCE COMPARISON

TYPES:
1. Employee Job Performance (samples):
   ... (same information as presented on the Performance Test)

2. Organization Performance (samples):

   The training staff decided to evaluate the effectiveness of the needs discovery training program by considering whether training made an impact on 1985 sales. To conduct this evaluation, they utilized a design which examined sales volume per month across each sales district before and after training phases contingent on the Sales District of which the sales representative was a member. The staggered line represents the actual training program which occurred over a two day period. The following figure illustrates this method.

   Figure. Sales per month before and after training

<table>
<thead>
<tr>
<th>Time (months) for 1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
</tr>
<tr>
<td>Sales (in millions)</td>
</tr>
<tr>
<td>5.0</td>
</tr>
<tr>
<td>Before Training</td>
</tr>
<tr>
<td>After Training</td>
</tr>
</tbody>
</table>

   COMPARATIVE MANUFACTURING PRODUCTIVITY

<table>
<thead>
<tr>
<th>Superior A</th>
<th>Superior B</th>
<th>Superior C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>163</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>149</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>118</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>108</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>106</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>93</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>57</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>42</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>20</td>
</tr>
</tbody>
</table>

   Average 92.6  Average 99.8  Average 98.4

CONTENT VALIDITY:
(...does the test measure what it is supposed to measure?)
1. Determine if the organization regularly collects data on the performance of the work group in the area under investigation.
2. Make sure that unit of performance selected is the same or a good approximation of the performance need specified in the original needs assessment.

RELIABILITY:
(...does the test yield consistent results?)
1. If using organizational records, inquire about the reliability of the data collection methods.
2. Use controls such as comparison of group performance during earlier time periods before and after the program.

REFERENCES:
COST-BENEFIT ANALYSIS

TYPES

1. Cost Analysis

COST ANALYSIS WORK SHEET

<table>
<thead>
<tr>
<th>Forecaster</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Needs Analysis/planning
   - Staff
   - External consultant costs
   - Materials
   Subtotal $500

2. Work behavior analysis
   - Staff
   - External consultant costs
   - Materials
   Subtotal $600

3. Design
   - Staff
   - External consultant costs
   - Materials
   External support costs
   Subtotal $700

4. Development
   - Staff
   - External consultant costs
   - Materials
   Subtotal $800

5. Implementation
   - Trainee
   - Facilities
   - Tuition/fees
   - Staff
   - Materials
   Subtotal $900

6. Evaluation
   - Staff
   - External consultant costs
   Subtotal $1000

7. Total costs
   (sum of all subtotals)
   Total $5,500

2. Performance Valuing

NET PERFORMANCE VALUE CALCULATION WORK SHEET

A. Data Required for Calculations
   (a) What is the desired performance as a result of worker training?
   (b) What unit(s) of measure will be used to describe the performance?
   (c) What is the dollar value that will be assigned to each unit of measure?
   (d) What is the estimated training time to reach the goal?
   (e) What is the current level of worker performance?
   (f) How many workers will participate in the training?
   (g) What is the estimated performance level during training? Will trainee produce during training?
   $600

B. Calculations to Determine Net Performance Value
   (h) What is the estimated performance level during training? Will trainee produce during training?
   $400

   No = 0
   Yes = $400

   (i) What is the estimated total number of units (b) that will be achieved during training? [d x g]
   (j) What is the estimate of the total individual performance for the training period? [(h - d) x a] + l
   (k) What is the value for the total performance for the evaluation period? [c x j]
   (l) What is the net performance value gain?
   [(k - (e x c x h))]
   (m) Do you want to calculate the total net performance value of all trainees?
   $200
   Yes = $200
   No = Net Performance Value of one trainee which is value of "1"

3. Cost-Benefit Model

Performance Value
- Cost
- Benefit

REFERENCES:


EFFECTIVENESS EVALUATION REPORT

Program Title: Circuit Troubleshooting
Program Date(s): 2/20/86
Department: Technical Training Department
Prepared By: Mark Baber
Distributed To: James Birt, Mark Olser, Rob Drew

1. ORIGINAL EMPLOYEE/ORGANIZATION PERFORMANCE NEED

The timeliness of repairs in the circuit areas was not sufficient to meet the schedule demands: average thru-put time was 115 hours. The first-fix repair rate was 68% and the additional repair process resulted in equipment being unnecessarily damaged.

2. EMPLOYEE/ORGANIZATION PERFORMANCE GOAL

Training goals were a first-fix rate of 80% and an average thru-put time of 59 hours. Availability of CE-4 insertion tools was expected to improve the thru-put time by 4 hours and the revised part ordering system was expected to improve thru-put time by 2 hours.

3. APPROVED SOLUTION (TRAINING AND NON-TRAINING COMPONENTS)

Peters approved circuit troubleshooting training for the 61 test technicians and indicated that CE-4 insertion tools would be available for all trainees. She also approved the implementation of the revised system for part ordering. (Memo 1/86)

4. EFFECTIVENESS OF TRAINING

The effectiveness of the Circuit Troubleshooting Training was measured from the perspectives of satisfaction, learning, and performance.

Satisfaction measurements were obtained from the trainees and from their supervisors. The trainees mean rating for delivery effectiveness was 62%, the quality of information presented rating was 50%, and the usefulness of this training to their jobs rating was 90%. The overall management rating of this course was 70.5%.

Learning during training was measured by a knowledge test and by performance in-training. The comparison of the pre and post test of knowledge showed an increase of 57.6% for the group. The in-training performance was measured with lab tests. The average trainee score was 96%.

Performance measurements showed a 15% improvement for first-fix efficiency and a 57 hour improvement on thru-put time. Cost-benefit analysis showed a training benefit of $715,365.
The data represented in the graphs was obtained from the SQC records of the test department. The time period for the "before training" data is 30 days and the time period for the "after training" data is 45 days.

6. IMPROVEMENT PROPOSAL

1. Trainees indicated that they want more feedback on their performance during training. Instructors will respond to this suggestion.
2. CE-4 insertion tools are still needed for approximately 10 test technicians.