

NTI Course 30

Electrical Training ALLIANCE
National Training Institute

Course 30

Third Year
Instructor Training

1 Performance Evaluation electrical training

NTI Course 30

Session 1

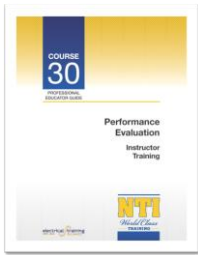
Session 2

Session 3

Session 4

Session 5

Session 6



2 Performance Evaluation electrical training



Goals of Course #30

You should be able to:

1. write quizzes.
2. help improve the Electrical Training ALLIANCE tests.
3. use tests as an instructional tool.
4. evaluate the effectiveness of learning and teaching.



Goals of Course #30 (cont.)

5. interpret test scores and report results.
6. use test outcomes for evaluating performance.
7. select appropriate forms of testing in relation to the types of learning.
8. teach how to take a test.



Session Objectives

As a result of this session, JATC instructors should be able to:

1. List the ways training programs are evaluated.
2. List the basic functions of measurement and evaluation.
3. Identify the basic kinds of measuring instruments.



Session Objectives (cont.)

4. List the characteristics of a good measuring instrument.
5. Explain how measurement "fits" into the instructional process.
6. Describe the limitations of achievement tests.



Ways to Evaluate Training

Training is very important to the social, moral, and economic well-being of our society. We all seem to think that it is important to prepare better electrical workers. If this is true, how do we evaluate its effectiveness?



Evaluating Training

Primary sources of data:

- Reaction to training
- Amount of learning
- Job application
- Results
- Return on investment



NTI Course 30

Evaluating Training (cont.)

Reaction to Training

How did trainees feel about the training program, course content, and the quality of instruction?

- Easy to obtain.
- Most frequently used.
- Most useful for making program modifications and improvements.

7 Performance Evaluation electrical training

NTI Course 30

Evaluating Training (cont.)

Learning

How much learning occurred?

- Invariably involves the administration of either written or performance tests (or both).

8 Performance Evaluation electrical training

NTI Course 30

Evaluating Training (cont.)

Job Application

What changes have happened in the organization?

- Least frequently used and only when other measures are not available.
- Must have management's support.

9 Performance Evaluation electrical training

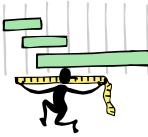
NTI Course 30

Evaluating Training (cont.)

Results

Has training made a difference?

- Is there a reduction in costs, accidents, lost time, turnover, absenteeism, grievances, scrap, etc.?
- Is there an increase in quality, quantity of work produced?




10 Performance Evaluation electrical training

NTI Course 30

Evaluating Training (cont.)

Return On Investment (ROI)

Did the monetary value of the results exceed the cost for the training program?



11 Performance Evaluation electrical training

NTI Course 30

Reasons For Testing (Instructional Setting)

- ✓ Emphasize important points
- ✓ Reveal student's areas of weakness
- ✓ Locate weaknesses in instruction
- ✓ Hold students accountable
- ✓ Provides a basis for grades and advancement

12 Performance Evaluation electrical training



Session Objectives

As a result of this session, JATC instructors should be able to:

1. Identify basic kinds of measuring instruments.
2. Know characteristics of a good test.
3. Know how measurement “fits” into the instructional process.
4. Select the appropriate type of test to use.



Kinds of Achievement Tests

Norm-referenced

Tests designed to differentiate between and among students. Scores are compared to other students.

Criterion-referenced

Tests designed to measure a student’s mastery of objectives. Students normally either “pass” or “fail.”



CHARACTERISTICS OF A GOOD TEST

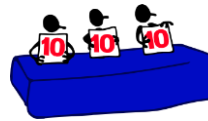


- ✓ Valid
- ✓ Reliable
- ✓ Practical
- ✓ Objective
- ✓ Comprehensive
- ✓ Differentiate



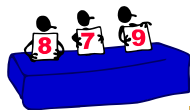
Objective Test Items

- Clearly defined answers
- No interpretation needed
- Can be graded by anyone



Subjective Test Items

- Answers can vary
- Answer can be partially correct
- Different graders can interpret same answers differently

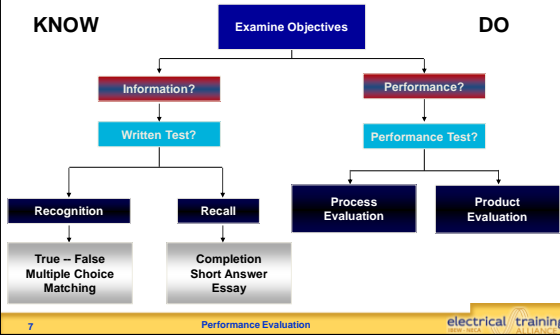


Types of Tests and Measurements

1. Oral tests
2. Observation of students
3. Performance tests
4. Written tests



Determining the Appropriate Type of Test to Use*



NTI Course 30

Session Objectives

As a result of this session, JATC instructors should be able to:

1. State the importance of "Rating Sheet" to conduct performance evaluations.
2. Develop a rating sheet for evaluating the process of completing a task.

1 Performance Evaluation electrical training

NTI Course 30

Session Objectives (cont.)

3. Develop a rating sheet for evaluating a finished product/project.
4. Compare a process and product evaluation instrument.


2 Performance Evaluation electrical training

NTI Course 30

Performance Objectives

"A statement that specifies measurable behavior that a learner should exhibit after instruction, including the conditions and standards for performance."

"They must be written in the language of the occupation so they communicate exactly what is required."



3 Performance Evaluation electrical training

NTI Course 30

Advantages of Performance Objectives

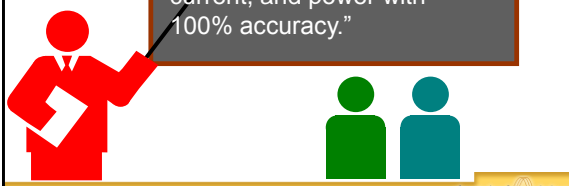
- ✓ Serve as targets for instruction
- ✓ Place emphasis on learners
- ✓ Provide direction for attention
- ✓ Provide standards of performance



4 Performance Evaluation electrical training

NTI Course 30

"Given a hand calculator and a word problem relating to power; in one minute, the student will calculate the known quantities of voltage, current, and power with 100% accuracy."




5 Performance Evaluation electrical training

NTI Course 30

Required Elements of Performance Objectives

1. Performance
2. Conditions
3. Standards



6 Performance Evaluation electrical training



Rating Sheet for “Process” Evaluation

1. Bring your Task Analysis Sheet from Course 32.
2. Review the Course 32 Task Analysis Sheet.
3. Edit as necessary.
4. Identify critical steps or sequence.



Rating Sheet for “Process” Evaluation (cont.)

5. Establish criteria for judging the standard.
6. Decide what type of scale is necessary.
7. Develop the administrative instructions.
8. Try out and make revisions.



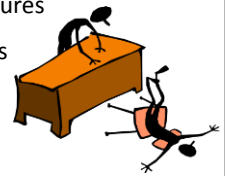
Rating Sheet for “Product” Evaluation

1. Identify critical elements
2. Identify product/project that requires critical skills
3. Differentially weigh each critical element
 - Frequency of use
 - Difficulty level
 - Consequence of error



Rating Sheet for “Product” Evaluation (cont.)

4. Establish criteria for judging
5. Determine scoring procedures
6. Try out and make revisions



Advantages of Performance Testing

1. Communicates needed critical tasks
2. Only way to evaluate psychomotor skills
3. Permits trainees to evaluate their performance
4. Facilitates uniform evaluation
5. Provides a record of “doing skills”



Advantages of Performance Testing (cont.)

6. Multiple trainees may be tested at the same time
7. Allows flexible testing times
8. Facilitates remedial instruction
9. Provides a permanent record of performance



Disadvantages of Performance Testing

1. Limited number who can be evaluated at one time
2. Requires additional planning
3. Evaluators must be present
4. May require training of evaluators
5. Time consuming



Common Problems with "Process" Evaluation

1. Observer subjective
2. Observer presence
3. Subject consistency
4. Observer consistency
5. Recording problems

Common Problems with "Product" Evaluation

1. Same work product required
2. Test integrity over time
3. Assumption regarding performance
4. Consistency of evaluation over time
5. Consistency of evaluation of criteria

Other Design Considerations

1. Determine obtrusiveness of assessment
 - Examinees aware/unaware
 - Amount of evidence needed
2. Who will rate performance?
 - Trainer/instructor, self rating, peer rating or combination
3. Score recording method?
 - Checklist and rating scale, etc.

Assignment: Develop a Performance Check Sheet

Using the information provided and the list of steps to complete a process and a product previously developed, design and develop:

1. a process evaluation instrument
2. a product evaluation instrument



Session Objectives

As a result of this session, JATC instructors should be able to:

1. Recognize guidelines for developing test items.
2. Recognize advantages and disadvantages of each type of test item.
3. Identify flaws in each type of test item.



Guidelines for Developing Written Tests

Tests should have:

1. an identification heading
2. explicit and clear directions
3. a common format for writing
4. completed items on one page
5. numbered items



Guidelines for Developing Written Tests (cont.)

6. numbered pages, i.e., 1 of 5, 2 of 5, etc.
7. totally independent test items
8. grouped like-type items
9. explanation of point values if (differential weighing) is assigned to test items
10. importance and need to the student



Examples of "Simple" True/False Test Items

Directions: Some of the statements below are true and others are false. If the statement is true, circle the T. If the statement is false, circle the F.

- T F** 1. Specific determiners should be avoided when writing T--F test items.
- T F** 2. True statements usually are more discriminating than false statements.
- T F** 3. Reliability of a test is increased when the test is lengthened.



Suggestions for Construction of True-False Items

1. Make crucial parts obvious (i.e., no, not).
2. Avoid direct quotes from textbooks.
3. Avoid double negatives.
4. Provide random distribution of correct responses.



Suggestions for Construction of True-False Items (cont.)

5. Avoid using the same proportion of true and false responses.
6. Give complete test directions.
7. Develop an answer key.

NTI Course 30

Suggestions for Construction of True-False Items (cont.)

8. Each statement should be clearly true or false.

Example:

T F 4. $2/3 = 0.7$

9. Recognize determining characteristics: (known as specific determiners) and use them to your advantage.

7 Performance Evaluation electrical training

NTI Course 30

What are the Most Likely True or False Responses When the Following Determiners are Used?

T F -- long sentence -----

T F -- "all" -----

T F -- "always" or "never" -----

T F -- "no" or "none" or "nothing" -----

T F -- "only" or "alone" -----

T F -- "generally" or "usually" -----

8 Performance Evaluation electrical training

NTI Course 30

True-False Test Items

Advantages:

1. Easier than most to construct
2. Familiar to students
3. Answered quickly
4. Easy to score
5. Scored objectively

Limitations:

1. Trainees can guess correctly 50% of the time

9 Performance Evaluation electrical training

NTI Course 30

Multiple-Choice Test Items

Worded as a question:

_____ OSHA mandates a full body harness be worn when a person is at risk of falling _____ feet?

A. 4
B. 6
C. 8
D. 10

(Note ascending order)

10 Performance Evaluation electrical training

NTI Course 30

Multiple-Choice Test Items (cont.)

Worded as an incomplete thought:

_____ The definition of power is:


- A. energy applied to make electrons flow
- B. the electrical energy rate
- C. the rate of electron flow
- D. the opposition to electron flow

11 Performance Evaluation electrical training

NTI Course 30

Most Common Types of Multiple-Choice Test Items

1. One right answer
2. Best answer



12 Performance Evaluation electrical training



One Right Answer Type

Directions: In each of the following questions, draw a circle around the letter selected as the correct answer.

- When testing a medium voltage cable, how many minutes must you wait before grounding?
 - 1 minute per 1000 V
 - 2 minutes per 1000 V
 - 3 minutes per 1000 V
 - 4 minutes per 1000 V



Best Answer Type

Directions: In each of the following questions, draw a circle around the letter selected as the BEST answer.

- Mercury is used in thermometers because it _____.
 - expands uniformly.
 - does not freeze.
 - does not boil.
 - is highly visible.
 - is plentiful.



Advantages of Multiple-Choice Questions

- Measure a variety of objectives.
- Can be scored objectively.
- Less chance of guessing.
- Can yield a highly reliable test.



Limitations of Multiple-Choice Items

- Requires more skill and time to construct.
- Requires more time to answer.
- Requires more space per item on test.



List Alternatives in Logical Order (Alphabetically or Numerically)

Example:

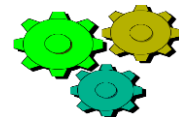
- _____ 6. A 480 Volt feeder to a second building is installed overhead, outdoors with 60 foot spans of insulated copper conductors. What is the minimum size copper conductors permitted?
- 12
 - 10
 - 8
 - 6



Matching Items

Definition:





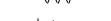

Where two or more sets of items are prepared and arranged so that they permit a meaningful association between or among items to be made.



NTI Course 30

Unbalanced Matching

Directions: Each of the devices in the left-hand column is represented by a symbol in the right-hand column. Select the proper symbol for each device, then write the letter of the symbol in the blank preceding the device.

Device	Symbol
___ 1. Resistor	A. 
___ 2. Diode	B. 
___ 3. Capacitor	C. 
___ 4. Inductor	D. 
___ 5. N/O Contact	E. 
	F. 

19 Performance Evaluation electrical training

NTI Course 30

Advantages of Matching Exercises

1. Highly efficient
2. Well suited for making a rapid survey of a field of subject matter.
3. Measures learning that involves associations and relationships.
4. Can be highly objective and easily scored.

20 Performance Evaluation electrical training

NTI Course 30

Suggestions to Follow for Matching Exercises

1. Place a label above the questions and alternatives.
2. Place all alternatives on the same page and list in logical order.
3. Include at least **5**, but no more than **15** questions in each matching set.

21 Performance Evaluation electrical training

NTI Course 30

Suggestions to Follow for Matching Exercises (cont.)

4. Reduce the chance of guessing by:
 - (a) including more alternatives
 - (b) allowing alternatives to be used more than once.
5. Include an example for purposes of illustration where this procedure will help clarify directions.

22 Performance Evaluation electrical training

NTI Course 30

Criteria For Evaluating Objective Tests

- A. Correct grammar & punctuation
- B. Clear directions
- C. Questions represent an adequate sample

23 Performance Evaluation electrical training

NTI Course 30

Examples Of Sentence Completion

1. The number of multi-wire branch circuits permitted to be counted for a 120/240 volt, single phase, 3 wire, multi-wire branch circuit is _____.
2. One horsepower is equal to _____ watts.

24 Performance Evaluation electrical training



The Completion Test

Uses and Advantages

1. Can be used to measure the retention of specific points.
2. Relatively easy to construct.
3. Can sample a wide range of subject matter.
4. Valuable for measuring mathematical computations, use of formulas, measuring instruments, and similar achievements.



Completion Test Items

Limitations

1. Scoring is likely to become subjective.
2. Items may be time consuming to complete.



Suggestions for Constructing Completion Test Items

1. Think of the answer first, then write a question.
2. Place the blanks near or at the end of the statement.
3. Do not copy statements directly from textbooks.



Suggestions for Constructing Completion Test Items (cont.)

4. Be sure item can be answered only one way.
5. Limit the number of things listed to four or five.
6. Make a grading key before the test is given.
7. Make all blanks about the same length.



The Essay Test

Types of Items

Restricted response item - response limited in content and form.

Example:

1. Instructors have many responsibilities. Discuss your responsibilities related to testing.



The Essay Test (cont.)

Extended response item - response limited in content and form.

Example:

2. Discuss all of your responsibilities as a JATC instructor.

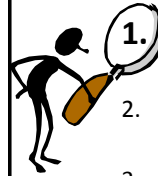


Suggestions for Constructing Essay Test Items

1. Restrict to topics which cannot be measured by objective test questions.
2. Specify structure, organization, and degree of comprehensiveness.
3. Phrase each item so the task is clearly indicated.



Suggestions for Scoring Essay Examinations



1. Prepare an outline of expected answers.
2. Be consistent in scoring tests (point & rating method).
3. Give written and oral feedback.
4. Convert raw scores to standard scores for assigning grades.



Session Objectives

As a result of this session, JATC instructors should be able to:

1. Identify common flaws in each type of test item.
2. Objectively review and evaluate Electrical Training ALLIANCE tests.



Session Objectives (cont.)

3. Know and be able to use recommended procedures and practices for communicating test score errors.
4. Identify errors in test items and report to the Electrical Training ALLIANCE.

NTI Course 30

Session Objectives

1. Recognize recommended procedures for preparing, administering, and scoring written tests.
2. Recognize the reasons for using item analysis.
3. Compute item analysis indices from hypothetical data.
4. Interpret completed item analysis and identify effective and ineffective questions.

electrical training

NTI Course 30

Table of Specifications

STEPS

1. List objectives to be covered by the test.
2. Assign weights to the objectives.
3. Identify total number of questions (points).
4. Calculate a "multiplier."
5. Determine the number of questions per objective.

electrical training

NTI Course 30

Table of Specifications

Date _____
 Unit Name _____
 Evaluator _____

UNIT OBJECTIVES	IMPORTANCE WEIGHT	NUMBER OF QUESTIONS
1. Identify materials by the Code for use on conductor insulation.	5	13
2. Define properties of good insulating materials.	3	7
3. Identify Code markings on conductor insulation.	5	13
4. Discuss the effect heat has on insulation.	2	5
5. Apply information contained on Table 310-313.	3	7
6. Distinguish between dry, damp and wet locations.	2	5
Totals	20	50
Desired Total Number of Questions _____ 50		
Multiplier = Desired / Weight	Multiplier = x 2.5	

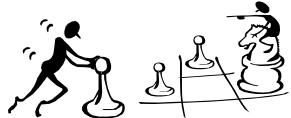
electrical training

NTI Course 30

Building a Test

STEPS

1. List all major objectives.
2. Examine content for minor objectives and define measurable outcomes.
3. Establish a "Table of Specifications."



electrical training

NTI Course 30

Building a Test (cont.)

4. Construct one or more test items for each objective listed.

Make the student:

- interpret
- explain
- solve
- state why
- determine the significance
- express understanding
- show how

electrical training

NTI Course 30

Building a Test (cont.)

5. Assemble the test.
 - A. Group by question type.
 - B. Arrange related items together.
 - C. Place easy and quickly answered questions at the beginning of the test.
 - D. Avoid patterns of correct or wrong answers.
 - E. Prepare a test heading.

electrical training



Building a Test (cont.)

6. Write clear and concise directions. (KISS)
7. Assemble and study test.
8. Take the test and make a scoring key.
9. Administer the test.



Rules for Test Administration

1. Tell students in advance.
2. Ensure test security.
3. Have a cheating policy.
4. Ban smartphone/tablet use during testing.
5. Have a policy regarding student questions.
6. Stay in the room!
7. Control the environment.



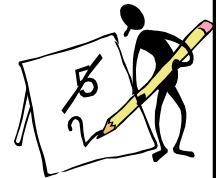
Rules for Test Administration (cont.)

8. Correct any errors.
9. Take up tests in an orderly fashion.
10. Score the test.
11. Analyze the answers.
12. Review test results.
13. Revise and/or replace poor questions.
14. File for future use.



Additional Hints for Scoring Tests

1. Blind Scoring
2. Predetermined
 - answers
 - point values
3. Score Types of Items Separately
4. Score Essay Items Independently
 - all of each set of answers at the same time



Reasons for Using Item Analysis

- A. Identifies poor test questions.
- B. Identifies topics needing additional instruction.
- C. Quantifies your feedback to students and the Electrical Training ALLIANCE.



Types of Item Analysis

1. **Difficulty index:** the percentage of students who answer a question correctly.
2. **Discrimination index:** the difference between the difficulty indices for the high-scoring group and the low-scoring group.

NTI Course 30

SAMPLE DISTRIBUTION OF TEST SCORES BY GROUPS I - VI

Groups	I	II	III	IV	V	VI
	132	136	132	132	132	135
	125	131	13	131	132	131
	122	124	124	129	129	130
	120	114	122	128	129	128
	117	113	113	128	128	128
	108	112	112	125	124	125
	107	111	107	122	122	125
	103	103	104	122	121	122
	100	99	99	121	120	121
	91	95	90	116	120	120
				111	108	120
				106	108	119
				105	107	105
				105	105	105
				103	101	101
				98	98	99
				96	96	99
				95	95	95
				94	93	92
				92	92	90

13 Performance Evaluation electrical training

NTI Course 30

Example Of Item Analysis

Note: Assume a class of 20 trainees

	A	B	C	D	RIGHT	Diff. Index	Disc. Index
n = 10 Upper	1		8*	1	8	11/20 X 100 = 55%	80%-30% = 0.5 8 - 3/10 = .50
n = 10 Lower	3	2	3	2	3		

* Indicates correct response

14 Performance Evaluation electrical training

NTI Course 30

Questionable Difficulty Indices

Type of Question	Questionable Difficulty Indices
True/False	0% to 65% and 95% to 100%
Multiple-Choice or Matching	0% to 40% and 95% to 100%
All Short-Answer Types	0% to 20% and 90% to 100%

15 Performance Evaluation electrical training