SP 800-16 Rev 1 (3rd Draft)

A Role-Based Model for Federal Information Technology/Cyber Security Training

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Background

- NIST SP 800-16 *“Information Technology Security Training Requirements: A Role- and Performance-Based Model”* April 1998
- NIST SP 800-16 Rev 1 DRAFT March 2009

Document Development

- Landscape Analysis
- Draft Development
  - 2nd Public Draft October 2013
  - 3rd Public Draft March 2014
    - Comments due April 30
- Final Publication
  - June 2014

Purpose

Provide a comprehensive, yet flexible, training methodology for the development of role-based training courses or modules for personnel who have been identified as having significant IT/cybersecurity responsibilities within Federal Organizations.

Relationships

- SP 800-50 *Building an Information Technology Security Awareness and Training Program*
- FIPS)200 *Minimum Security Requirements for Federal Information and Information Systems*
- NIST SP 800-53 *Security and Privacy Controls for Federal Information Systems and Organizations*
- NIST SP 800-53 *A Guide for Assessing the Security Controls in Federal Information Systems and Organizations*

Management

- Understand the necessity of role-based training
- Plan for the development, implementation and evaluation of role-based training
- Understand how roles with security related responsibilities are identified within their organization

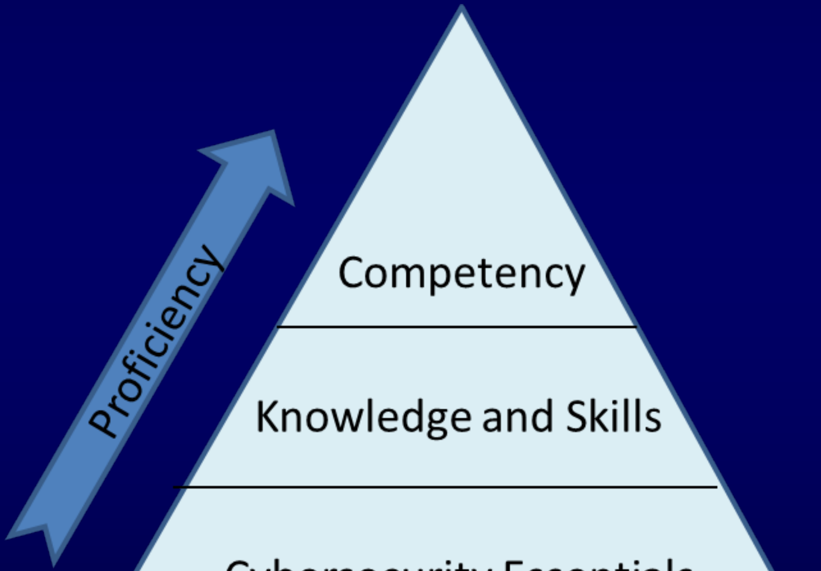
Using SP 800-16

- IT/Cybersecurity Specialist
  - Subject Matter Expert (SME)
  - Identify training courses and training
  - Identify training gaps and needs
  - Develop baseline

Using SP 800-16

- Training Professionals
  - Understand IT security requirements and knowledge/skills required
  - Evaluate course quality
  - Obtain the appropriate courses and materials
  - Develop or customize courses/materials
  - Tailor their teaching approach to achieve the desired Learning Objectives.

Cybersecurity Proficiency

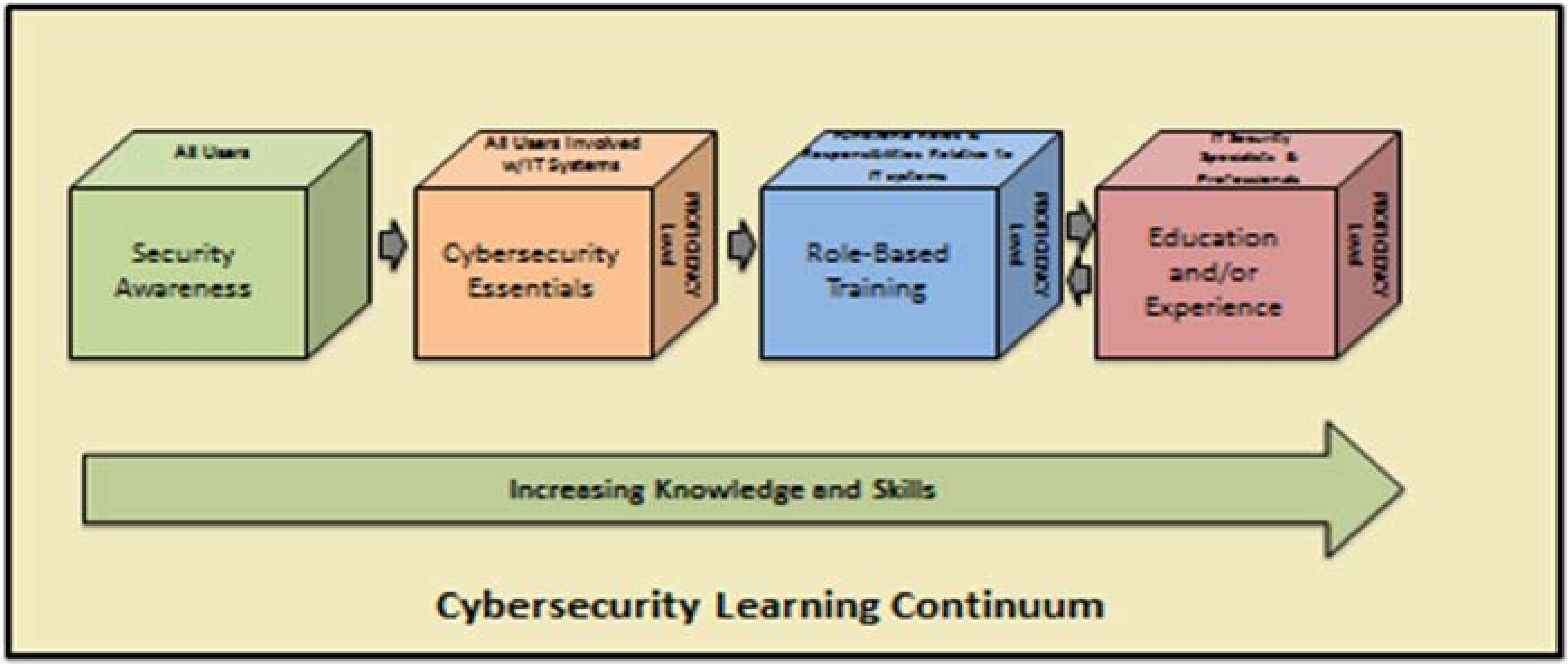


Cybersecurity Essentials

- Technical underpinnings of cybersecurity and its taxonomy, terminology and challenges;
- Common information and computer system security vulnerabilities;
- Common cyber attack mechanisms, their consequences and motivation for use;
- Different types of cryptographic algorithms;
- Intrusion, types of intruders, techniques and motivation;
- Firewalls and other means of intrusion prevention;
- Vulnerabilities unique to virtual computing environments;
- Social engineering and its implications to cybersecurity; and
- Fundamental security design principles and their role in limiting point of vulnerability.

Organizational Responsibilities

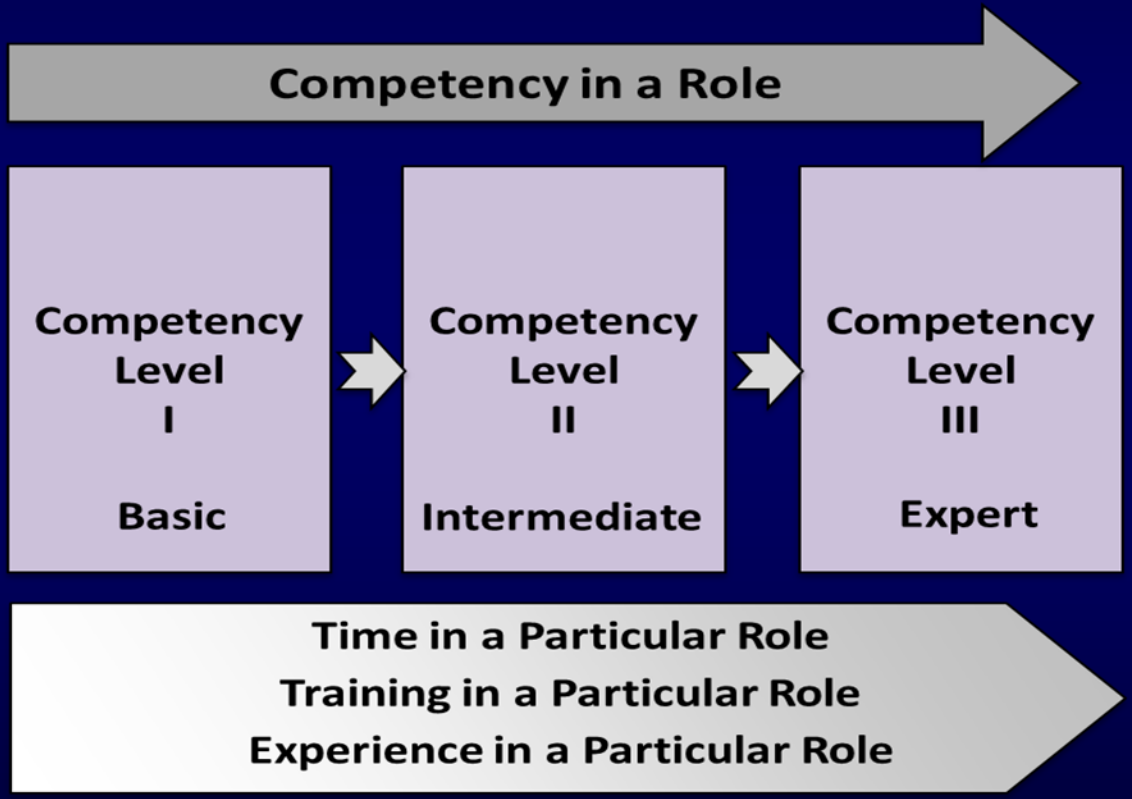
- Organization Head
- CIO
- SAISO
- CLO
- Managers
- Training Developer
- Personnel with Significant IT/Cyber security responsibilities
- Users


All Users
Security Awareness
All Users Involved w/IT Systems
Cybersecurity Essentials
Proficiency Level
Functional Roles & Responsibilities Relative to IT systems
Role-Based Training
Proficiency Level
IT Security Specialists & Professionals
Education and/or Experience
Proficiency Level
Increasing Knowledge and Skills
Cybersecurity Learning Continuum

Competency Levels

- Level I - skill requirements are basic and are usually obtained during the first few years in that role.
- Level II - skill requirements are considered intermediate, and are those skills that have obtained and honed during more years in that role
- Level III skill requirements are considered expert, and are those skills that can only be obtained after many years in the role.

Competency Levels



Competency in a Role

Competency Level I

Basic

Competency Level II

Intermediate

Competency Level III

Expert

Time in a Particular Role

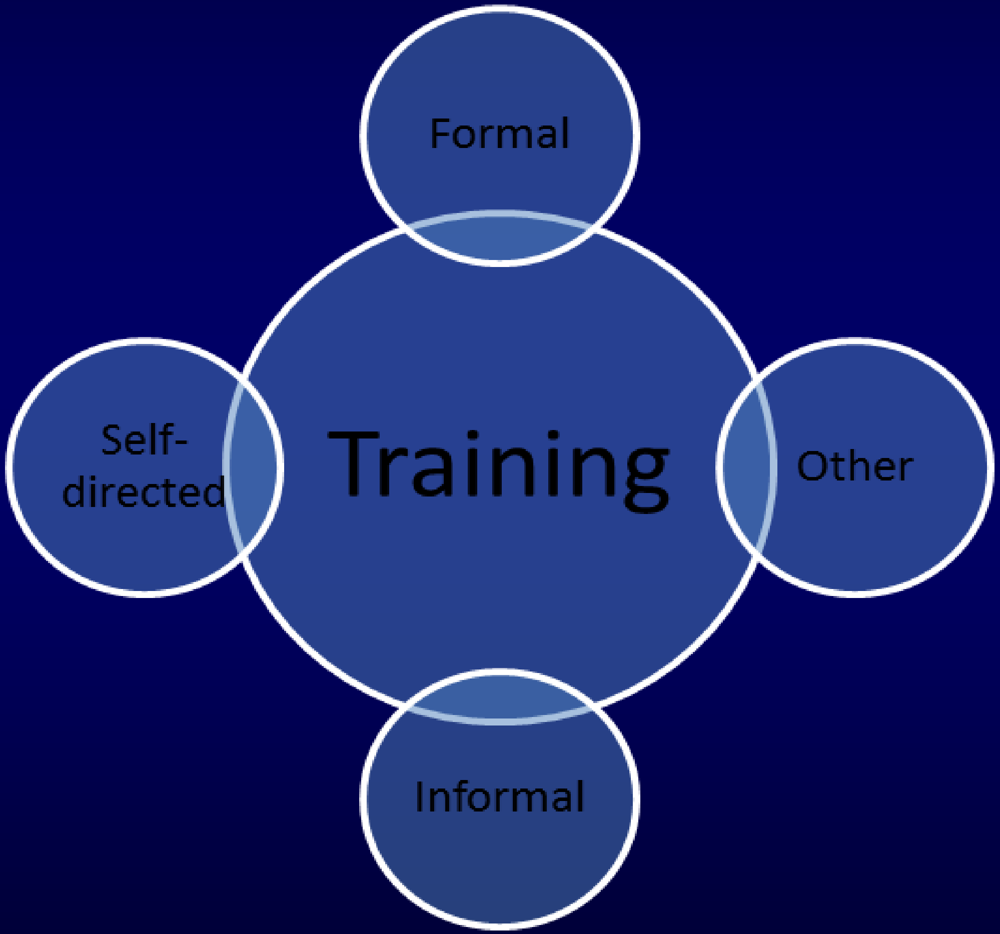
Training in a Particular Role

Experience in a Particular Role

Functional Perspectives

- Manage
  - Program or technical aspect of a security program
  - Overseeing the lifecycle of a computer system, network or application;
  - Responsibilities for the training of staff
- Design
  - Scoping a program or developing procedures, process and architecture
  - Design of a computer system, network or application;
- Implement
  - Putting programs, processes, polices into place;
  - Operation/maintenance of a computer system, network or application
- Evaluate
  - assessing the effectiveness of any of the above actions.

Training Methods Diagram



Overview

- Chap 6 Worked Example
- Chap 7 Evaluation Methodology
- Appendices
  - Appendix A: Functions
  - Appendix B: Knowledge and Skills Category
  - Appendix C: Roles
  - Appendix D: Sample Evaluation Forms
  - Appendix E: Glossary
  - Appendix F: Acronyms
  - Appendix G: References

Appendix A: Functions

- Functions and roles should be identified as candidates for role-based training
  - **Function Area**: Identifies a security function area;
  - **Roles Areas**: Identifies various roles that are covered by the function. These roles are guidelines and may exist under different names within a particular Agency;
  - **Definition**: Provides a definition of the function; and
  - **Outcome(s):** Identifies the various outcomes that the training module should strive to meet for each of the functions and their associated roles.

Appendix B: Knowledge and Skills Category

- Knowledge unit and the associated knowledge and skills

	INDUSTRIAL CONTROL SYSTEMS
ICS-1	Knowledge of risk(s) specific to Industrial Control Systems (ICS)
ICS-2	Knowledge of ICS unique performance and reliability requirements
ICS-3	Skill in restricting logical access to the ICS network and network activity
ICS-4	Skill in restricting physical access to the ICS network and devices
ICS-5	Skill in protecting individual ICS components from exploitation
ICS-6	Skill in maintaining functionality during adverse conditions
ICS-7	Skill in restoring ICS after incident quickly

Appendix C: Roles

- Competency/knowledge unit and associated Knowledge and Skills required by a particular role
  - Function Area: This area corresponds with Appendix A: Function Area.
  - Role Area: This describes the overall role;
  - Roles: Identifies various roles that are covered by the function
  - Responsibility: Defines the activities, tasks and/or responsibilities of that particular role;
  - Knowledge Unit: Identifies the competencies associated with the role.
  - Corresponding Knowledge and Skills Table: Functional perspectives for tailoring.
    - Manage – responsible for management (e.g., managers, team leads, project managers)
    - Design – responsible for design activities (e.g., system developers, engineers)
    - Implement – execute implementation (e.g., system administrators, network administrators)
    - Evaluate – evaluation activities (e.g., testers, security analysts)
- Flexibility is required for most role-based training

Appendix D: Sample Evaluation Forms

- The forms that will assist in the evaluation of the training are located within this appendix
- Important to the overall process

Appendix E, F and G

- These appendices are the glossary, acronyms and references
- Glossary and Acronyms do not include all Federal Organization – will have to tailor to your organization
- References provide NIST, FIPS and NICE documents that can provide additional guidance

Worked Example
Step 1

- Conducting the Agency-Wide Needs Assessment
  - Identify any gaps in the current training program, and/or identify those roles which require training
  - Federal Organization to use their own process
  - NIST SP 800-50 to provide guidance

Worked Example
Step 1 - Continued

- For example, the Needs Assessment of Organization X determined that the contracting individuals have not been trained in security areas.
- This would be a training gap

Worked Example
Step 2

- Identify the functions, using Appendix A
- Outcomes are also listed in Appendix
  - Learning Objectives(s) should be in the forefront
- Important: Just because a function or role is listed within the appendices; it does not mean that a training course or module must be built for that role.

Function Area: **Oversight, Management and Support**

Role Areas:

- Legal Advice and Advocacy
- Strategic Planning and Policy Development
- Awareness, Education and Training
- Privacy
- Management
- Procurement
- Personnel Security
- Physical and Environmental Security
- Security Program Management

Definition — Provides oversight and support so that others may effectively conduct Cybersecurity work.

Learning Objectives —An individual should be able to successfully complete one or all of the following, depending on the role(s):

- Provide legally sound advice and recommendations to leadership and staff on a variety of relevant topics within the pertinent subject domain.
- Advocate legal and policy changes and make a case on behalf of client via a wide range of written and oral work products, including legal briefs and proceedings.
- Apply knowledge of priorities to define an entity's direction, determine how to allocate resources, and identify programs or infrastructure that are required to achieve desired goals within domain of interest.
- Develop policy or advocate for changes in policy that will support new initiatives or required change/enhancements.
- Conduct training of personnel within pertinent subject domains.
- Develop, plan, coordinate and evaluate training courses, methods, and techniques as appropriate.
- Oversees the security baseline and associated activities of an information system in or outside the network environment.
- Provides contractual, procurement and/or acquisition support for IA purchases.
- Manage IT/cybersecurity implications within the organization, specific program, or other area of responsibility, to include strategic, personnel, infrastructure, policy enforcement emergency planning, security awareness, and other resources.
- Ensures that privacy impact assessments are conducted and appropriate controls are implemented.
- Ensures physical controls are correctly implemented.

Provides personnel security policies, implements security controls and handles all personnel issues.

Worked Example
Step 3

- Annotate the associated training outcomes and learning objectives
- Appendix C will provide some associated role areas and roles and help shape the learning objectives
- Using the appropriate role, the corresponding knowledge and skills can be identified using Appendix B

Worked Example
Step 3 - Continued

- Role is identified in Appendix C – Tailor to organization
- Role tasks that the employee executes determine the level to which he/she needs to be trained.
  - Contracting Officer has 10 years of experience in contracting, but has only within the last two years moved into IT/Cybersecurity contracting. Therefore, with only two years in IT/Cybersecurity contracting, the employee is at a Competency Level I.
- This competency level determines the Knowledge Units that will be used to develop the training module.

Worked Example
Step 3 - Continued

- Knowledge Unit is based on the competencies identified for that role and the knowledge and skills required to successfully execute the activities associated with the role
- In addition to the Competency levels, the functional perspective of the role must be considered. There are four (4) functional perspectives: Manage, Design, Implement and Evaluate.

Function Area: Oversight, Management and Development

Role Area: Procurement

Roles:

- Authorizing Official
- Acquisition Official
- Procurement Officer
- Management
- Contracting Officers
- System Owner
- Mission/Business Owner
- Program Manager
- Project Manager
- Budgeting Officer

Responsibility – Procures resources as needed. Develops and executes contracts to include security controls. Ensures deliverables are compliant with Federal and Organizational security control requirements.

Knowledge Units:

- Procurement
- Management
- Compliance

Knowledge Unit	All	Manage	Design	Implement	Evaluate
Procurement	PROC 1 - 2	PROC 6 - 9 PROC-11 - 12	N/A	PROC-3 - 9	PROC-4 PROC-10
Management	PM-37	PM-1 - 4 PM-8 PM-10 PM-12 PM-14 PM-16 PM-22 - 23 PM-25 PM-32 - 33	N/A	PM-4 PM-6 - 8 PM-32 - 33	N/A
Compliance		COMP-1 COMP-3 - 5 COMP-7		COMP-2 - 5	

Worked Example
Step 3 - Continued

- After the function and role area have been identified, review Appendix B
- Using our example, PROC-6 means that the training module should provide the employee with knowledge about how to execute secure acquisitions.

	PROCUREMENT
PROC-1	Knowledge of applicable business processes and operations of customer organizations
PROC-2	Knowledge of capabilities and requirements analysis
PROC-3	Knowledge of system software and organizational design standards, policies, and authorized approaches relating to system design
PROC-4	Skill in conducting capabilities and requirements analysis
PROC-5	Skill in interpreting and translating customer requirements into operational cyber actions
PROC-6	Knowledge of secure acquisitions
PROC-7	Knowledge of Export Control regulations and responsible Federal Organizations for the purposes of reducing supply chain risk
PROC-8	Knowledge of critical IT procurement requirements
PROC-9	Knowledge of functionality, quality, and security requirements and how these will apply to specific items of supply (i.e., elements and processes)
PROC-10	Skill in evaluating the trustworthiness of the supplier and/or product
PROC-11	Knowledge of processes to allocate resources in business process planning
PROC-12	Skill in ensuring the proper allocations of resources in business process planning

Worked Example
Step 4

- Tailor the training module to the appropriate level of expertise for the audience.
- Tailor also for your particular organization

Now the training modules can be developed

Worked Example
Step 4 - Continued

- The employee is trained specifically to his/her role as well as the corresponding responsibilities of that role.
  - Keep in mind the competency level
- Remember, as the training module is developed, these knowledge and skills must be included with the outcome as defined for the function.

Worked Example Evaluations

- Appendix D provides samples forms to assist with evaluating the training
- Any areas of training that were confusing or did not provide the desired outcome can be identified through the evaluation process
- Areas identified need to be improved prior to the next training session

Evaluation Objectives				
Levels of Evaluation Student	**Level 1: Satisfaction**	**Level 2: Learning Effectiveness**	**Level 3: Performance Effectiveness**	**Level 4: Training Program Effectiveness**
Type of Training **CyberSecurity**	How well did the student think he/she grasped the security concepts? For CBT, how many attempts did it take for the student to pass the test?	How did the majority of students perform on the test, (e.g., do aggregated post-test answers show sufficient improvement over pre-test answers)?	How well is the student using the core skill set in his or her daily activities routine?	Did the number and severity of security incidents go down as a result? Did the cost of security compliance go down? If so, how much?
Training	How well did the training program fit the student's expectations?	Did the training program demonstrably and sufficiently increase the scope and/or depth of the student's skill set?	How well is the student applying the new security skills to functional job requirements?	Did the number and severity of security incidents go down as a result? Did the cost of security compliance go down? If so, how much?
Education	Did the course of study advance the student's career development or professional qualifications in IT/cybersecurity?	Could the student apply the increased knowledge to a real world situation adequately?	How well is the student's acquired IT/cybersecurity knowledge being used to advance agency goals & objectives?	Did the number and severity of security incidents go down as a result? Did the cost of security compliance go down? If so, how much?

Sample Questionnaire — Level 1 Evaluation Training Assessment by Student

1. Indicate your highest level of education:

   High School graduate or less   Bachelor's Degree
   Some college/technical school   Master's Degree
   Associate degree or technical certification   Doctorate

2. Indicate the total number of courses you have completed in subject areas related
   to this training:

   0   1-4   5-10   11-15   More than 15

3. Indicate how long it has been since you took a course in the subject area of this

   training: This is my first course in this subject   4-6 years
   Less than 1 year   More than 6
   years 1-3 years

4. Indicate the extent of your work experience in the general subject areas of this training:

   None   1-3 years   More than 6 years
   Less than 1 year   4-6 years

5. For my preparation and level of knowledge, the training was:

   Too elementary   Somewhat difficult   About right
   Somewhat elementary   Too difficult

6. The pace at which the subject matter was covered was:

   Too slow   Somewhat fast   About right
   Somewhat slow   Too fast

7. For what I got out of this training, the workload was:

   Light
   Abou
   t
   right
   Heav
   y

8. Considering my previous experience with this subject matter, the course content

   was: Out of date
   Somewhat
   current
   Current

Tailoring

- Concentrate the training on the skill and knowledge areas that are harder to grasp
- Concentrate on those areas that have been identified as weak
- Use organizational terms
- Adjust skills/knowledge as needed to meet specific organizational roles
- The purpose is to keep the audience engaged in the training.

Participate

Public Review and Comment

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