Evaluation of E-Learning
Selection Criteria for Training

October 2015

Prepared for the Department of Energy Labor Training Working Group
Contributors

- Deborah Weinstock, Director, National Clearinghouse for Worker Safety & Health Training Operated by MDB, Inc.
- Anthony Towey, U.S. Director, OSHA Training Institute, Occupational Safety and Health Administration
- Patricia Aldridge, Manager Conduct of Training, Volpentest HAMMER Federal Training Center
- Ted Giltz, NTC/HAMMER Project Manager, Volpentest HAMMER Federal Training Center
List of Attachments

A – NIEHS Minimum Health and Safety Training Criteria dealing with “Advanced Training Technology”

B – OSHA Web Based Training (WBT) Style Guide Excerpts

C - HAMMER Instructional Media Selection Guidance

D -- Costs of Training Development
Executive Summary

The Labor Training Working Group established a task team to evaluate available guidance for use of e-learning or Web-based training materials. The approach taken was to evaluate existing guidance provided by organizations typically involved in safety and health training for DOE workers.

The team reviewed best practices and guidance based on a systematic approach to training development. Positives and negatives of e-learning were reviewed. Cost data for instructor led training and web based training development from the Chapman Alliance LLC was compiled and compared (Attachment D). The three organizations involved provided information on their internal processes and procedures for determination of the delivery modality/media for training (see Attachments A, B and C).

The team concluded that the selection of media and modality for attaining the approved knowledge, skills, and abilities from a training event is not a stand-alone decision and each organization allows the instructional design process to make the determination. If desired this evaluation found that considerations for the use of e-learning can be generated but an absolute set of criteria for use of e-learning is likely not possible.
Requested Action

At the March 2015 Labor Training Working Group (TWG) meeting a task team was established to evaluate available guidance for use of e-learning or Web-based training materials. A task team was formed and consisted of the below individuals. The approach taken was to evaluate existing guidance provided by organizations typically involved in safety and health training for DOE workers.

- Deborah Weinstock, Director, National Clearinghouse for Worker Safety & Health Training Operated by MDB, Inc.
- Anthony Towey, U.S. Director, OSHA Training Institute, Occupational Safety and Health Administration
- Patricia Aldridge, Manager Conduct of Training, Volpentest HAMMER Federal Training Center
- Ted Giltz, NTC/HAMMER Project Manager, Volpentest HAMMER Federal Training Center

Background

Over the last several years organizations are increasingly moving towards technology delivered training. Training organizations are producing increasing numbers of e-learning/Web-based products with varying levels of interactivity and technology in response to management direction and funding pressures. Marketing and management communication articles often advocate e-learning/Web learning as a complete substitution for instructor led delivery. The members of the Labor Training Working Group expressed concern that e-learning is selected due to convenience and reduced cost of delivery rather than as a part of selecting the best combination of adult learning modalities to achieve the desired learning and verification of knowledge, skills, abilities, and proficiency.

The trend occurring in industry, commercial sales, medical, and the military is to deliver orientation, initial training, equipment specific training and refresher or retraining using available technology platforms. As companies and the government have sought to reduce costs, training often is one of the first areas scrutinized. Several commercial companies
and government groups advocate that e-learning is the solution to solving cost challenges and provides the needed training delivery with minimum impact on the organization. This approach downplays the learning value of experiential learning, interactivity with other workers, the instructor, and verification of skill/proficiency. Within DOE this often means training is really a briefing and no or limited verification of mastery of the material occurs (e.g., “check the box” training).

While it is true that delivery technology is improving through the use of more interactive development tools or virtual learning environments training delivery must assure that the appropriate knowledge, skill, ability and proficiency are attained. E-learning for the purposes of this evaluation includes any training technology developed for delivery on a learning management system or through the World Wide Web. E-learning is often delivered in several ways with varying levels of student interactivity. The delivery tool may be different but the training modality reviewed during this evaluation is one where there is no direct student to instructor communications occurring during training. E-Learning courses are typically independently completed on a computer or portable platform. Virtual learning or distance learning (through virtual means) with an instructor is not a part of this evaluation.

Technology for the development and delivery of e-learning training has improved to the point that instructional developers are specializing in various facets of technology delivered training materials. The most often cited reasons for the expansion of training delivered via e-learning portals or on the World Wide Web are flexibility in delivery, consistency in delivery, and reduced costs of performing training. In addition, many dynamic presentation styles for training delivery can be achieved. There are also many negative effects that occur (see Attachment B) when relying on e-learning. Courses lack ability to verify knowledge transfer, mastery of critical skills, sharing of recent lessons learned, and often become outdated and static. Development of e-learning training is often more expensive (See Attachment D) than development of instructor led training so a clear analysis and understanding of the user population should be performed.

During discussions at the March TWG meeting, observations were made that some training being delivered was developed with improperly placed emphasis for selection of modality on the criterion of training cost (“check the box”/ “just the facts” training) rather
than effective adult learning. The group recommended that the TWG develop a recommendation on when the use of e-learning or computer based training (CBT) delivery of training is appropriate.

NOTE: This evaluation does not evaluate the use or selection of available learning delivery technologies or distance learning technologies but only the criteria for selection of e-learning or CBT delivery of training as the sole modality for adult learning. It is assumed that a systematic approach to training (SAT) model is used for development of training content. The evaluation also does not evaluate the use of electronic media used as a part of blended delivery modalities of adult learning course materials.

Evaluation

The task team reviewed a sample of available guidance provided by organizations frequently involved in training at DOE sites. The documentation found addressed e-learning in the context of overall training development. Organizations recognize that there are times when e-learning as a stand-alone training delivery method or as a part of blended learning is appropriate. While each organization has approached the question differently each has provided information for consideration and use by instructional developers. Each provider reviewed implements a SAT model and strives to align learning objectives with defined knowledge, skills, and abilities (KSA).

As a part of course development, fully defining the desired training outcomes, identifying the target audience and selecting the appropriate delivery media/modality is the general approach for each training organization. The key is that there needs to be a process that makes media/modality decisions based on the analysis, the audience and desired KSA outcomes. A variety of delivery media/modalities connects better with individual’s different learning styles. The delivery decisions must support the student need to learn and achieve success for the topic, including any appropriate skill or proficiency verification.

The goal of training is to achieve the desired outcomes of awareness, knowledge, skill and/or proficiency based on the input from the instructional development team (e.g. subject matter experts, training professionals), and target audience input. To ensure training is attaining the desired results, evaluations must be conducted. Below is a summary of how each organization provides direction.
• National Institute of Environmental Health Sciences (NIEHS) Worker Education and Training Program information:

  o Information is provided in the NIEHS Grant Minimum Health and Safety Training Criteria dealing with “Advanced Training Technology”. NIEHS has conducted two workshops on topics related to this evaluation. NIEHS focused on technology-enhanced training methods including advanced training technologies such as web-based and other computer-based learning methodologies.

  It is assumed that NIEHS grant training programs and instructional staff utilize and effectively integrate whatever technologies are appropriate to achieve the course learning objectives in a manner that assures training effectiveness and learning retention. This is the key to effectively conducting adult learning. The selected training delivery modality must deliver effective adult learning and when appropriate verify mastery of the knowledge or skill with confidence to aid in assuring worker success. Attachment A provides an excerpt and additional information from the NIEHS Worker Education Training Program Section 10.5 Instructional Technologies and a link to full final reports. The final reports contain significant discussion of the benefit and potential weakness with a large variety of training technologies.

  o To achieve the desired quality and effectiveness of training, instructional developers should consider:

    ▪ What impact will new training technologies have on the achievement of learning objectives?
    ▪ What is the ability of the training target audience to effectively respond to and use such technologies? Does the application of new training technologies enhance the learning experience? How? Is it documented? Has retention been evaluated?
    ▪ Have training objectives been modified subsequent to the introduction of new training technologies? If so, how well have the new objectives been assessed? Have the results of such assessments been applied to the training program?
• Where self-paced, computer-based learning methods have been applied, what approaches have been used to assure the students attain the knowledge and skills specified in the course learning objectives?
• Where self-paced, computer-based methods have been applied to skills objectives, how has the required skills proficiency been assessed? How have applicable training hours for such methods been determined and applied?
• Has the training provider assigned the necessary personnel and support for a successful introduction of new training technologies?
• Has the training provider effectively and seamlessly integrated new training technologies?

• Occupational Safety and Health Administration (OSHA)
  o OSHA has developed a training style guide (draft) that includes a discussion regarding selection of training modality. The excerpts from the draft guide are provided as Attachment B. The draft guide contains significant information on the positive and negative attributes of different levels of technology in learning.

• HAMMER Federal Training Center
  o HAMMER has incorporated consideration for selection of e-learning into their overall course development procedure (MSC-PRO-TQ-26025). It should be noted that this procedure implements an organizational approach to implementing SAT and assigns clear roles and responsibilities. The HAMMER procedure also implements DOE guidance for development of training and complies with DOE O 426.2, Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities.
  o HAMMER’s procedure requires performance of an evaluation to define and document the need for training based on the need for employees to attain necessary knowledge, skills, and abilities (KSA) to perform their work safely. This ensures decisions to train employees are based on valid, documented requirements or skill performance needs or to address proficiency and knowledge deficiencies that should be addressed by training. Where training is directed by management for other reasons the
analysis must document the management expectations for the training course.

- Prior to starting the design phase and after approval of the training analysis the HAMMER procedure requires review of criteria to apply when making decisions regarding the instructional media you may chose for training. Appendix D provides a copy of the criteria used by HAMMER staff.

- Examples of other items to consider include impacts to the current computer system requirements to effectively run new e-learning, CBT products; training on mobile devices, etc.

**Conclusion**

The selection of media and modality for attaining the approved knowledge, skills, and abilities from a training event is not a stand-alone decision and each organization allows the instructional design process to make the determination. If desired this evaluation found that considerations for the use of e-learning can be generated but an absolute set of criteria for use of e-learning is likely not possible.

The decision to use a specific delivery modality/media is based on what is available, SAT defined training outcomes, the target audience and organizational preferences. As with any training, the learning must be evaluated to assure the desired outcome is achieved and mastery of the learning objectives is attained. E-learning is often best for background or basic knowledge of a topic. Simple knowledge verification is routinely done with e-learning tools.

Each organization has incorporated guidance, suggestions and criteria into their respective development processes. The direction is inclusive and focuses on achieving defined knowledge, skills and abilities with appropriate verification of learning.

This evaluation determined that selection of e-learning modalities is a part of the decision process used prior to pursuing design and development of adult training. It is recommended that the design process incorporate specific attributes similar to those identified during NIEHS workshops on this topic. A starting point for attributes endorsed by the Labor Training Working Group might include:

- Does the selected training technology support the approved KSA for achievement of learning objectives?
• What is the ability of the training target audience to effectively respond to and use such technologies?
• Does mastery of a skill require actual performance or simulated performance?
• Do the KSA require participation with other workers to achieve success?
• Does the application of new training technologies enhance the learning experience? How? Is it documented?
• When self-paced, computer-based learning methods have been applied, what approaches have been used to assure the students attain the knowledge and skills specified in the course learning objectives?
• When self-paced, computer-based methods have been applied to skills objectives, how has the required skills proficiency been assessed?
• Do students have access to and proficiency with the computer systems/tools used for delivery of e-learning? For multi-site delivery did the SAT process verify each delivery system provided appropriate consistency? Often additional training on use of the training delivery tool is needed prior to delivery of the actual course.
Sections from NIEHS Minimum Health and Safety

Training Criteria dealing with “Advanced Training Technology”

Attachment A

Section 6 DEFINITIONS:

**Technology-enhanced training methods** — often referred to as advanced training technologies such as web-based and other computer-based learning methodologies. It is assumed that training programs and instructional staff will utilize and effectively integrate whatever technologies are appropriate to achieve the course learning objectives in a manner that assures training effectiveness and learning retention.

Section 10.5 INSTRUCTIONAL TECHNOLOGIES:

There has been a dramatic expansion in the use of new instructional technologies for safety and health training. The WETP awardees have been at the forefront of pioneering these technologies for worker training and evaluating the results. They conducted two national workshops to develop guidance, which should be used as the initial basis for evaluation. The reports, NIEHS/WETP “Hazwoper Training: Utilizing Advanced Training Technologies” Workshop report (8) and the “Development of an Integrated WETP ATT Program: Final Report” (9), can be found at www.wetp.org. The quality and effectiveness of training programs when utilizing such technologies should be considered including:

- What impact will new training technologies have on the achievement of learning objectives?
- What is the ability of the training target audience to effectively respond to and use such technologies? Does the application of new training technologies enhance the learning experience? How? Is it documented? Has retention been evaluated?
- Have training objectives been modified subsequent to the introduction of new training technologies? If so, how well have the new objectives been assessed? Have the results of such assessments been applied to the training program?
- Where self-paced, computer-based learning methods have been applied, what approaches have been used to assure the students attain the knowledge and skills specified in the course learning objectives?
- Where self-paced, computer-based methods have been applied to skills objectives, how has the required skills proficiency been assessed? How have applicable training hours for such methods been determined and applied?
• Has the training provider assigned the necessary personnel and support for a successful introduction of new training technologies?
• Has the training provider effectively and seamlessly integrated new training technologies?

Resources:

Hazardous Waste Operations and Emergency Response (HAZWOPER) Training: Utilizing Advanced Training Technologies, NIEHS Technical Workshop "Computer and Internet-Based Learning Methods for Safety and Health Training"(298KB) September, 1999 - 61 pages. These proceedings of the April 1999 Estes Park, Colorado workshop on Advanced Training Technologies provide the deliberations of a national gathering of the NIEHS worker safety and health training experts to discuss the role computer-based and web-based training should play in providing critical safety and health information to hazardous waste workers.

Attachment B
U.S. Department Of Labor
Occupational Safety and Health Administration
Office of Training and Education

Web Based Training (WBT)
Style Guide
(Excerpts for TWG Evaluation)

Draft 7.0
July 29, 2002
1.0 Introduction to the Style Guide

1.1 Purpose

The Office of Training and Education (OTE) is responsible for providing occupational safety and health training programs for Federal and State OSHA compliance personnel, consultation staff, other Federal agency personnel, and private sector employers and workers. OSHA training programs emphasize the recognition, avoidance, prevention, and abatement of unsafe and unhealthful working conditions. As such, OTE consists of the following components:

- OSHA Training Institute (OTI)
- Division of Training and Educational Development
- Division of Training and Educational Programs
- Division of Administration and Training Information

With Congressional emphasis on employer/employee training, as well as expected increases in internal training requirements to promote a continual learning environment and provide comprehensive competency-based training for supervisors, managers, and executives, OTE is pursuing DL technologies to augment their current classroom-based training. This pursuit of DL technologies will effectively incorporate the mission, vision, and goals of the Department of Labor (DOL) as identified in the Information Technology Strategic Plan (FY2000-FY2004). Specifically, the implementation of an OSHA DL program will promote and foster:

- The improvement and extension of the services provided to the American Public and OSHA employees.
- The enhancement of opportunities for America’s workforce by providing training virtually “anytime and anywhere”.
- The promotion of a secure workforce by providing essential training designed to foster quality workplaces that are safe and healthy.
- The promotion and facilitation of learning opportunities to ensure DOL’s workforce is adequately trained.

The implementation of a DL capability will also support OSHA’s Strategic Plan. Implementing this capability supports the following goals:

- **Goal** - Change workplace culture to increase employer and worker awareness of, commitment to, and involvement in safety and health.
  - **Strategy** – Increase the use of technology-based training delivery systems (e.g., computer based training and distance learning) to expand training opportunities for employers and workers.

- **Goal** - Secure public confidence through excellence in the development and delivery of OSHA’s programs and services.
  - **Strategy** - Continue to develop employees’ skills to ensure that OSHA staff is well trained, knowledgeable, and delivering services in a fair, consistent, and effective manner.
This style guide supports OSHA’s development of Web-based Training (WBT) and sets the standards for the design, development, and production of OSHA WBT.

1.2 Definition of WBT

WBT is defined as a group of predominantly interactive, training and training support products delivered over the Worldwide Web. WBT products include instructional software and software management tools used in support of instructional programs.

1.3 Levels of Interactivity

OSHA recognizes four levels of interactivity for WBT products. Table 1 (below) defines each level:

Table 1. Levels of Interactivity

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I—Passive</td>
<td>The student acts solely as a receiver of information. The student is required to read the text on the screen or view graphics such as illustrations, charts, and graphics and use the navigational buttons to progress forward through the program or move back. An example of this type of WBT product may also contain pop-ups and hyperlinks to Web sites, materials, and other information interspersed between the text and graphic presentations.</td>
</tr>
<tr>
<td>Level II—Limited Interaction</td>
<td>The student makes simple responses to instructional cues. The WBT product includes learning activities listed in Level I as well as multiple choice, drop-down lists, and labeling. An example would be a WBT product that includes these types of test items at the end of a unit of instruction to test the student’s grasp of the information.</td>
</tr>
<tr>
<td>Level III—Complex Participation</td>
<td>The student makes a variety of responses using varied techniques in response to instructional cues. The responses would include those listed for a Level II—Limited Interaction as well as text entry boxes and manipulation of graphic objects to test assessment of the information presented. An example of this type of WBT product would be desktop software training that requires the student to perform as if the student was actually using the program.</td>
</tr>
<tr>
<td>Level IV—Real-Time Participation</td>
<td>The student is directly involved in a life-like set of complex cues and responses. This involves engaging the student in a simulation that mirrors the work situation with stimuli-and-response coordinated to the actual environment. An example of this type of WBT product would use artificial intelligence similar to computer games and flight simulators.</td>
</tr>
</tbody>
</table>

For all OSHA WBT products, Level II/III interactivity will be required.
1.3.1 Interactivity

1.3.1.1 Interactivity Overview

Interactivity is measure of student involvement required for the instructional activity. Interactivity strategies should be selected based on the following learning criteria:

- Type of learning (e.g., knowledge, skill, and attitude)
- Level of learning (e.g., fact, rule, procedure, or discrimination learning)

The type and level of learning affects the instructional strategy, lesson assessment strategy, level of interactivity, and performance measurement. The level of interactivity should match the level of learning associated with each learning objective (LO). The required level of interactivity then determines the appropriate category of WBT presentation. Categories of WBT presentation are detailed in Table 3 (below).

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1—Low Grade Presentation</td>
<td>This is the lowest (baseline) category of WBT development. It is a knowledge or familiarization lesson, provided in a linear format (one idea after another). Category 1 is used to introduce an idea or concept. The student has little or no control over the sequence and timed events of the lesson material. This category can include simple developed graphics and/or clip art icons customer provided video and audio clips.</td>
</tr>
</tbody>
</table>

| Category 2—Medium Grade Presentation | This category involves the recall of more information than a category 1 presentation and provides the student with more control over the lesson scenario through screen icons and other peripherals, such as light pens or touch screens. Typically category 2 is used for non-complex operations and maintenance lessons. Simple emulations or simulations are presented to the student. As an example, the student is requested to rotate switches, turn dials, make adjustments, or identify and replace a faulted component as part of a procedure. This category can also include simple graphics and/or clip art, and customer-provided video and audio clips. |

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
### Category 3—High Simulation Presentation

This category involves the recall of more complex information than categories 1 and 2 and allows the student an increased level of control over the lesson scenario through peripherals such as light pen, touch screen, track ball, or mouse. Video, graphics, or combinations of both are presented to simulate the operation of a system, subsystem, or equipment to the student. The lesson scenario training material typically is complex and involves more frequent use of peripherals to affect a transfer of learning. Operation and maintenance procedures are normally practiced with category 3 scenarios and students might be required to alternate between multiple screens to keep pace with the lesson material. Multiple software branches (two to three levels) and rapid response are provided to support remediation. Simulations are an integral part of this presentation. This category can also include complex developed graphics and/or clip art, and customer-provided video and audio clips.

### Category 4—Real-Time Simulation Presentation

This WBT category involves more in-depth recall of a larger amount of information than categories 1, 2, and 3 and provides the students with an increased level of control over the lesson. Every possible subtask is analyzed and presented with full, on-screen interaction, similar to the approach used in aircraft simulator technology. The lesson material is extremely complex and involves more frequent use of peripherals to affect the transfer of learning. This category normally supports certification, recertification, or qualification requirements.

Complicated operation and maintenance procedures are normally practiced with category 4 and such practice involves all of the elements of categories 1, 2, and 3 presentations in addition to the following:

- High degree of interactivity
- Extensive branching (four or more levels)
- Levels of sophistication—short of artificial intelligence

### 1.3.1.1 Interactivity Guidelines

It is important to incorporate interactivity into WBT programs. Interactive elements should be used to support the LO. Table 4 (below) provides guidelines for interactivity.

<table>
<thead>
<tr>
<th>Guideline Description</th>
<th>Rationale</th>
</tr>
</thead>
</table>

---

1.3.1.1 Interactivity Guidelines

It is important to incorporate interactivity into WBT programs. Interactive elements should be used to support the LO. Table 4 (below) provides guidelines for interactivity.
Provide opportunities for interaction at least every three or five screens. However, mandatory interaction with the computer should not be superficial.

Without interaction, the program is just a fancy electronic page-turner. However, if an action required is unnecessary, the student could be distracted by it and become frustrated. Students prefer not to have unnecessary interactions.

<table>
<thead>
<tr>
<th>Group the content into small segments and build in questions (with feedback), periodic reviews, and summaries for each segment.</th>
<th>Grouping content into smaller units and providing opportunities for interaction (e.g., questions) within each information segment allows students to interact with the program more frequently.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask as many relevant questions as possible without interrupting the continuity of the instructional flow.</td>
<td>Provide immediate feedback to students regarding their own performance. Sustain student attention by keeping them mentally active in the learning process.</td>
</tr>
<tr>
<td>Ask questions at the application level rather than at the memory level.</td>
<td>Application questions enhance attention and comprehension and facilitate transfer of learning.</td>
</tr>
<tr>
<td>Guideline Description</td>
<td>Rationale</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Use rhetorical questions (questions that do not require students to provide an answer) during WBT to get students to think about the content or to stimulate their curiosity. Also use them as a natural transition between frames.</td>
<td>It invites students to mentally interact with the content. Used as a transition aid, it can direct students’ attention to what is coming up next.</td>
</tr>
<tr>
<td>Consider designs where the student is not presented with information in a linear format, but rather can discover information through active exploration in the program.</td>
<td>This adds variety, challenges students, and maintains their interest.</td>
</tr>
</tbody>
</table>
APPENDIX D
INSTRUCTIONAL MEDIA SELECTION GUIDANCE
As part of the instructional design process, the decisions regarding which media to use for presenting the training need to be determined based on the learning objectives. The following guidance shall be followed to select and document the instructional media for presenting training. The primary media for presenting training are:

- On-the-job training
- Classroom training
- Laboratory training
- Individualized instruction (self-study, CBT, interactive video, etc.)
- Simulator training
- Combination of above.

Develop a table that lists each learning objective and the possible instructional media to use for presenting the training. Determine the best instructional media for presenting the training and document the decision in the table. Use the following factors in making selections. Weigh each factor as it applies to your training function's situation and priority.

- Audience location
- Audience size
- Availability of the media
- Consequence of task error
- Cost
- Customer requirements and expectations
- Human factors
- Learner abilities (verbal and physical)
- Instructor/Expertise availability
- Time (implementation and completion deadlines)
- Any other considerations specific to the training activity or the facility.

Make a final decision with a justifying statement. For example, “Computer based, self-paced media was chosen based on the capability to reach a dispersed audience with a consistent message and the ability of the learner to control the speed of the training.”
Attachment D
Costs of Training Development

Based on the 2010 Chapman Alliance LLC research study *How Long Does it Take to Create Learning?* The chart below shows the cost for development of instructor led training and e-learning.

### Instructor Led Training Development

<table>
<thead>
<tr>
<th>Ratio of Development Hours to Instructional Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22:1</td>
<td>Low Range – rapid development, simple content, possible repurposing from existing source material, minimal print-based learning support materials</td>
</tr>
<tr>
<td>43:1</td>
<td>Average – most typical instructor lead training development projects</td>
</tr>
<tr>
<td>82:1</td>
<td>High Range – complex projects, often very custom, extended time spent on formatting during production</td>
</tr>
</tbody>
</table>

Average cost of development for one finished hour of Average level (ratio 43:1) development training content is $5,934

### E-learning Training Development

Level 1 Basic – content pages, text, graphics, perhaps simple audio, perhaps simple video, test questions.

<table>
<thead>
<tr>
<th>Ratio of Development Hours to One Hour of Finished eLearning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>49:1</td>
<td>Low Range – rapid development, simple content, specialized authoring tools (e.g. PowerPoint to e-learning)</td>
</tr>
<tr>
<td>79:1</td>
<td>Average – most typical Level 1 development projects</td>
</tr>
<tr>
<td>125:1</td>
<td>High Range – complex projects, difficult to produce, more media production</td>
</tr>
</tbody>
</table>

Average cost of development for one finished hour of Average (ratio 79:1) development training content is $10,054
Level 2 Interactive – includes Basic content plus 25% (or more) interactive exercises. Allows learners to perform virtual “try it” exercises, liberal use of multimedia (audio, video, animations)

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Ratio of Development Hours to One Hour of Finished E-learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Range – rapid development through template interactions. Simple animation, efficient or low-end media production</td>
<td>127:1</td>
</tr>
<tr>
<td>Average – most typical interactive learning projects</td>
<td>184:1</td>
</tr>
<tr>
<td>High Range – advanced and custom interactions, embedded simulation activities and lots of media</td>
<td>267:1</td>
</tr>
<tr>
<td>Average cost of development for one finished hour of Average (ratio 184:1) development training content is $18,583</td>
<td></td>
</tr>
</tbody>
</table>

Level 3 High Range (Advanced) -- highly interactive, possibly simulation or serious game based, use of avatars, custom interactions, award winning caliber courseware

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Ratio of Development Hours to One Hour of Finished E-learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Range – template interactions, games and simulations, efficient simulation development practices (rapid development)</td>
<td>217:1</td>
</tr>
<tr>
<td>Average – most typical, highly interactive courses, simulations and/or games</td>
<td>490:1</td>
</tr>
<tr>
<td>High Range – complex projects, advanced learning simulations and games, extensive media production</td>
<td>716:1</td>
</tr>
<tr>
<td>Average cost of development for one finished hour of Average (ratio 490:1) development training content is $50,371</td>
<td></td>
</tr>
</tbody>
</table>

Source Citation: Chapman, B. (2010). *How Long Does it Take to Create Learning?* [Research Study]. Published by Chapman Alliance LLC. www.chapmanalliance.com