Applying the Guidelines

WHAT'S NEW IN THIS CHAPTER?

This chapter consolidates all the guidelines we have discussed by describing how they apply or are violated in four e-learning examples. Here you have the opportunity to consider all of the guidelines in concert as you read how we apply them to some sample e-lessons. In our update to this chapter, we add new guidelines to our checklist, based on the new research we have included. We also put the checklist on the CD. We compare and contrast the application of our guidelines to the asynchronous database example and counter-example lessons included on the book's CD. We also include a new synchronous e-learning example to illustrate how the guidelines apply to the virtual classroom. In our discussion of a bank loan simulation lesson, we can apply new guidelines regarding games and simulations. Finally, we look back at our predictions about the future directions of e-learning for workforce learning.
Applying Our Guidelines to Evaluate e-Courseware

The goal of our book is to help consumers and designers make e-learning decisions based on empirical research and on the psychological processes of learning. In an ideal world, e-courseware effectiveness should be based on measurement of how well and how efficiently learners achieve the learning objectives. This measurement requires a validation process in which learners are formally tested on their skills after completing the training. In our experience, formal course validation is rare. More often, consumers and designers look at the features rather than at the outcomes of an e-learning course to assess its effectiveness. We recommend that, among the features that are assessed, you include the research-based guidelines we have presented.

We recognize that decisions about e-learning alternatives will not be based on learning theory alone. A variety of factors, including the desired outcome of the training, the culture of the organization sponsoring the training, the technological constraints of the platforms and networks available to the learners, and pragmatic issues related to politics, time, and budget, will shape e-learning decisions. That is why you will need to adapt our guidelines to your unique training situations.

In Chapter 1 we described three common purposes for e-learning: to inform workers, to teach procedural tasks, and to teach far-transfer or strategic tasks. Your technological constraints will determine whether you can only deliver courseware with low-memory intensive media elements like text and simple graphics or whether you can include media elements that require greater technical resources such as video, audio, and animation. If you are planning an Internet or intranet course, you can use collaborative facilities, including email, chats, and message boards.

Integrating the Guidelines

Taken together, we can make a general statement about the best use of media elements to present content and learning methods in e-learning. In situations that support audio, best learning will result from concise informal narration of relevant graphics. In situations that preclude audio, best learning will result from concise informal textual explanations of relevant...
Applying the Guidelines

graphics in which the text and graphic are integrated on the screen. In all cases, learning of novices is best promoted by dividing content into short segments, allowing learners to control the rate at which they access each segment. In addition, in lessons of any complexity, learning is more efficient when supporting concepts are presented prior to the process or procedure that is the focus of the lesson.

Table 16.1 compares the average effect sizes and number of experimental tests for the multimedia principles described in Chapters 3 through 9. Recall from Chapter 2 that effect sizes tell us the proportion of a standard deviation of test score improvement you will realize when you apply that principle. For example, if you apply the multimedia principle, you can expect overall a test score of one and one half standard deviations greater than a comparable lesson without visuals. As a general guideline effect sizes: less than .2 are small, around .5 are moderate, and .8 or above are quite large. Principles with larger effect sizes based on more experimental tests indicate greater potential practical applicability. As you can see in the table, with the exception of the

<table>
<thead>
<tr>
<th>Principle</th>
<th>Effect Size</th>
<th>Number of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia</td>
<td>1.50</td>
<td>9 of 9</td>
</tr>
<tr>
<td>Contiguity</td>
<td>1.11</td>
<td>8 of 8</td>
</tr>
<tr>
<td>Coherence</td>
<td>1.32</td>
<td>11 of 12</td>
</tr>
<tr>
<td>Modality</td>
<td>.97</td>
<td>21 of 21</td>
</tr>
<tr>
<td>Redundancy</td>
<td>.69</td>
<td>10 of 10</td>
</tr>
<tr>
<td>Personalization</td>
<td>1.30</td>
<td>10 of 10</td>
</tr>
<tr>
<td>Segmenting</td>
<td>.98</td>
<td>3 of 3</td>
</tr>
<tr>
<td>Pretraining</td>
<td>1.30</td>
<td>7 of 7</td>
</tr>
</tbody>
</table>
redundancy principles, all effect sizes fall into the large range. Several exceed an effect size of 1! In particular, the multimedia, contiguity, coherence, personalization, and pretraining principles all show large effect sizes based on multiple experiments.

Because the research underlying the multimedia principles was conducted in the same laboratory and used similar instructional materials (Mayer 2001a; Mayer, 2005b, c, & d), we can make these comparisons among the results. Regarding the principles summarized in Chapters 10 and beyond however, we do not have data to make a similar comparison.

**e-Lesson Reviews**

In this chapter we offer three brief examples of how the guidelines might be applied (or violated) in e-learning courses. We do not offer these guidelines as a "rating system." We don't claim to have included all the important variables you should consider when evaluating e-learning alternatives. Furthermore, which guidelines you will apply will depend on the goal of your training and the environmental considerations mentioned previously. Instead of a rating system, we offer these guidelines as a checklist of research-based indicators of some of the psychological factors you should consider in your e-learning design and selection decisions.

We have organized the guidelines in a checklist in Exhibit 16.1 by chapters and according to the technological constraints and training goals for e-learning. Therefore guidelines 1 through 17 apply to all forms of e-learning. Guidelines 18 through 26 apply to e-learning designed to teach specific job tasks. Guidelines 27 through 31 apply to e-learning with facilities that can engage learners in collaborative work. Guidelines 32 through 35 apply to design of navigational elements that apply primarily to asynchronous forms of e-learning. Last, guidelines 36 through 43 apply to e-learning designed to build problem-solving skills and to simulations and games. The checklist is also on the CD that accompanies this edition. The commentaries to follow the checklist reference the guidelines by number, so we recommend you print out the copy of Exhibit 16.1 on your CD to reduce split attention as you read the rest of this chapter. We will discuss the following e-lesson
samples: Asynchronous directive example and counter-example lessons on How to Design a Database from our CD, a synchronous directive lesson on Constructing Formulas in Excel, and an asynchronous simulation guided discovery course on bank loan funding analysis.


Three Types of e-Learning:

<table>
<thead>
<tr>
<th>Type</th>
<th>Best Used for</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show-and-Tell—Receptive</td>
<td>Inform</td>
<td>New hire orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product updates</td>
</tr>
<tr>
<td>Tell-and-Do—Directive</td>
<td>Procedural Tasks</td>
<td>Computer end-user training</td>
</tr>
<tr>
<td>Problem Solving—</td>
<td>Far-Transfer or</td>
<td>Bank loan application analysis</td>
</tr>
<tr>
<td>Guided Discovery</td>
<td>Problem-Solving Tasks</td>
<td>Sales skills</td>
</tr>
</tbody>
</table>

Chapters 3 through 9. Multimedia Guidelines for All Types of e-Learning

If Using Visual Mode Only:

1. Use relevant graphics and text to communicate content—Multimedia Principle.
2. Integrate the text nearby the graphic on the screen—Contiguity Principle.
3. Avoid covering or separating information that must be integrated for learning—Contiguity Principle.
5. Write in a conversational style using first and second person—Personalization Principle.
6. Use virtual coaches (agents) to deliver instructional content such as examples and hints—Personalization Principle.
7. Break content down into small topic chunks that can be accessed at the learner’s preferred rate—Segmentation Principle.
8. Teach important concepts and facts prior to procedures or processes—Pretraining Principle.

(Continued)

If Using Audio and Visual Modes:

9. Use relevant graphics explained by audio narration to communicate content—Multimedia and Modality Principles.
10. Maintain information the learner needs time to process in text on the screen, for example, directions to tasks, new terminology—Exception to Modality Principle.
11. Avoid covering or separating information that must be integrated for learning—Contiguity Principle.
12. Do not present words as both on-screen text and narration when there are graphics on the screen—Redundancy Principle.
15. Script virtual coaches to present instructional content such as examples or hints via audio—Personalization Principle.
16. Break content down into small topic chunks that can be accessed at the learner’s preferred rate—Segmentation Principle.
17. Teach important concepts and facts prior to procedures or processes—Pretraining Principle.

Chapters 10 and 11—Guidelines for e-Learning Designed to Teach Job Tasks

In addition to the above guidelines:

18. Transition from full worked examples to full practice assignments using fading—Worked Example Principle.
20. Add explanations to worked out steps.
21. Provide a worked example using realistic job tools and situations in the form of demonstrations for procedural skills—Encoding Specificity Principle.
22. Provide several diverse worked examples for far-transfer skills—Varied Content Principle.
23. Provide job-relevant practice questions interspersed throughout the lessons—Practice-Encoding Specificity Principles.
24. For more critical skills and knowledge, include more practice questions—Practice Principle.
Exhibit 16.1. (Continued).

26. Design space for feedback to be visible close to practice answers—Contiguity Principle.

Chapter 12—Guidelines for Use of Collaboration in Internet/Intranet e-Learning

27. Assign collaborative projects or problem discussions to heterogeneous small groups or pairs.

28. Use asynchronous communication tools for projects that benefit from reflection and independent research.

29. Use synchronous communication tools for projects that benefit from group synergy and social presence.

30. Make group assignments and assign participant roles that promote deeper processing.

31. Provide structured assignments such as structured argumentation to minimize extraneous cognitive load.

Chapter 13—Guidelines for e-Learning Navigation—Learner-Control Principles

32. Allow learners choices over topics and instructional methods such as practice when:
   - They have related prior knowledge and skills and/or good self-regulatory learning skills
   - Courses are designed primarily to be informational rather than skill building
   - Courses are advanced rather than introductory
   - The content topics are not logically interdependent so sequence is not critical
   - The default option leads to important instructional methods such as practice

33. Limit learner choices over topics and instructional options when:
   - Learners are novice to the content, skill outcomes are important, and learners lack good self-regulatory skills

34. Use adaptive diagnostic testing strategies when:
   - Learners lack good self-regulation skills and the instructional outcomes are important
   - Learners are heterogeneous regarding background and needs and the cost to produce tests pays off in learner time saved

35. Always give learners options to progress at their own pace, review prior topics/lessons, and quit the program

(Continued)

Chapter 14—Guidelines for e-Learning to Build Thinking Skills

36. Use real job tools and cases to teach job-specific problem-solving process
   Encoding Specificity Principle.

37. Provide worked examples of experts’ problem-solving actions and thought
   Worked Examples Principle.

38. Provide learners with a map of their problem-solving steps to compare with
   expert map—Feedback Principle.

39. Base lessons on analysis of actions and thoughts of expert practitioners
   Encoding Specificity Principle.

Chapter 15—Guidelines for Simulations and Games

40. Align the goals, rules, activities, feedback, and consequences of the game
    simulation to desired learning outcomes.

41. Provide structure and guidance to help learners reach instructional goals.

42. Avoid open-ended games and simulations that require unguided exploration.

43. Manage goal and interface complexity to minimize extraneous cognitive load.

Asynchronous Samples One and Two: Design of Databases

Description of the Samples

Figures 16.2 through 16.10 are screen captures from our example and course
example lessons included on the book’s CD. If you have not viewed these,
you may want to look at them in conjunction with this section. The major le
objectives are:

- To distinguish between records and fields in a database
- To distinguish between parent and child tables in a database
- To use primary and foreign keys to define relations in tables
- To design a relational database from an existing flat file system

We designed these lessons as asynchronous directive e-learning tutorials ass
sing learners are new to databases. We imagine placing this lesson in a cours
how to use database tools such as Access. In Figure 16.1 we show the con
Figure 16.1. Content Outline of Example and Counter-Example Database Lessons.

<table>
<thead>
<tr>
<th>Example Lesson</th>
<th>Counter-Example Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>1. Introduction</td>
</tr>
<tr>
<td>2. Entities and Tables</td>
<td>2. Did you know?</td>
</tr>
<tr>
<td>- Fields and records</td>
<td>3. Select Entities</td>
</tr>
<tr>
<td>- Primary keys</td>
<td>- Fields and records</td>
</tr>
<tr>
<td>- Foreign keys</td>
<td>- What is a primary key?</td>
</tr>
<tr>
<td>4. Entity-Relationship Diagram</td>
<td>5. Assign Primary Keys</td>
</tr>
<tr>
<td></td>
<td>- What is a primary key?</td>
</tr>
<tr>
<td>5. Full Worked Example with Questions</td>
<td>6. Did you know?</td>
</tr>
<tr>
<td>6. Faded Worked Example</td>
<td>7. Assign Foreign Keys</td>
</tr>
<tr>
<td>7. Full Practice Exercise</td>
<td>- What is a foreign key?</td>
</tr>
</tbody>
</table>

outlines for the two courses. Note that in the example lesson, we apply Guideline 8 as we sequence the important concepts first, followed by the steps to construct the database. In addition we apply Guideline 18 by starting with a full worked example and fading to a full practice assignment. The counter-example lesson embeds concept topics into procedure steps sections, does not use worked examples, and includes extraneous information in the “Did You Know” topics.

Application of Guidelines

Figures 16.2 and 16.3 illustrate an ineffective and effective application of the multimedia principles on screens presenting the topic of entity relationship diagrams. The counter-example (Figure 16.2) violates Principles 1, 4, and 6. Rather than explaining the concept with a visual and brief text, it uses a large block of text. In addition, there is no learning agent. In contrast, the example screen in Figure 16.3 uses an explanatory visual and applies Principle 9 by describing the visual with audio narration. Note that arrows and circles are used to signal the relationships among the tables and the keys.
In the case of Sally's video store, a "One-to-Many Relationship" exists between the Rentals table and the Customers and Movies tables. In essence, this means that a particular customer can be listed multiple times in the Rentals table (once for each time they rent a movie), but will only be listed once in the Customers table. Likewise, an individual movie can be listed multiple times in the Rentals table (once for each time it is rented), but will only be listed once in the Movies table.

In other words, unlike with primary keys, the data in foreign key fields can be repeated. Since the Rentals table is a child of both the Customers table and the Movies table, the customer and movie information contained in the Rentals table is stored in the two foreign key fields (namely CustomerID and MovieID).
In Figure 16.4 we illustrate a violation of Guideline 3 in the counter-example. Applying the contiguity principle requires an integration of words and visuals on the screen. The example version includes a visual of the spreadsheet and places the text under it. Figure 16.5 illustrates effective practice feedback. When the learner answers incorrectly, the explanatory feedback shown not only tells the learner he is incorrect but gives a brief explanation to lead to a correct answer on a second try. In contrast, the counter-example lesson only tells the learner that he is incorrect. The feedback is presented in on-screen text rather than audio. Feedback in text allows the learner to review the feedback repeatedly in preparation for a second try at the question.

Figures 16.6 and 16.7 illustrate ineffective and effective presentation of examples. Compare the text used to present the step. Note that the text in the example (Figure 16.7) applies Principles 14 and 15 by using the first person pronoun. Figure 16.7 ensures that learners will study the step by including a question in accordance with Guideline 19. In addition, the visual includes an arrow and labels to draw attention to the primary keys in both tables.
Figure 16.5. Feedback Offers an Explanation in the Example.

Designing a Relational Database
Table Construction

<table>
<thead>
<tr>
<th>Name</th>
<th>Last Name</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>Smith</td>
<td>123 Main St.</td>
<td>555-1234</td>
<td><a href="mailto:annesmith@gmail.com">annesmith@gmail.com</a></td>
</tr>
<tr>
<td>Janet</td>
<td>Brown</td>
<td>456 Oak Ave.</td>
<td>666-2345</td>
<td><a href="mailto:janetbrown@gmail.com">janetbrown@gmail.com</a></td>
</tr>
<tr>
<td>Martin</td>
<td>Maria</td>
<td>789 Pine St.</td>
<td>777-5678</td>
<td><a href="mailto:martinvillar@gmail.com">martinvillar@gmail.com</a></td>
</tr>
</tbody>
</table>

Sorry, that is incorrect. Remember, records are analogous to rows in a spreadsheet. Try again.

Figure 16.6. An Example from the Counter-Example Lesson.

Designing a Relational Database
Assign Primary Keys

Step 3
Assign primary keys to parent tables

Customers Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Last Name</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>Smith</td>
<td>123 Main St.</td>
<td>555-1234</td>
<td><a href="mailto:annesmith@gmail.com">annesmith@gmail.com</a></td>
</tr>
<tr>
<td>Janet</td>
<td>Brown</td>
<td>456 Oak Ave.</td>
<td>666-2345</td>
<td><a href="mailto:janetbrown@gmail.com">janetbrown@gmail.com</a></td>
</tr>
<tr>
<td>Martin</td>
<td>Maria</td>
<td>789 Pine St.</td>
<td>777-5678</td>
<td><a href="mailto:martinvillar@gmail.com">martinvillar@gmail.com</a></td>
</tr>
</tbody>
</table>

Movies Table

The next step in the process of building a relational database is to assign primary keys to each of the parent tables. In this case, the Customers table and the Movies table are both parent tables.
Figure 16.7. An Example from the Example Lesson.
From e-Learning and the Science of Instruction CD.

Figure 16.8 is taken from the counter-example lesson and shows one of three brief discussions about the use or abuse of databases. These types of add-ons are intended to sustain interest in the lesson. However, based on Guideline 13 and the coherence principle on which it is based, in many cases, they only serve to depress learning. You will not find these types of additions in the example lesson. Additionally, the counter-example lesson includes background music throughout — yet another violation of coherence.

**Synchronous Sample Three: Constructing Formulas in Excel**

**Description of Sample**

Figures 16.10 through 16.12 are taken from a virtual classroom demonstration lesson on How to Use Excel Formulas. Synchronous e-learning has become a major player in e-learning solutions since our first edition, and we wanted to show how to apply our principles to it. If you are new to the virtual classroom, refer to our description of synchronous e-learning features
Figure 16.8. Violation of Coherence in the Counter-Example.
From e-Learning and the Science of Instruction CD.

Did you know...?

Databases are often instrumental tools for information. As we become a more technologically advanced society, personal information such as income, credit card information, and social security numbers are being stored in more and more databases throughout the world. This represents a huge security threat if these databases are not properly safeguarded. Before giving out any personal information, one should consider what security measures the organization has taken to safeguard their database system.

Figure 16.9 shows a content outline. In applying Guideline 8 based on the pretraining principle, the procedural part of the lesson is preceded by important concepts. Before learning the steps to input a formula in Excel,

Figure 16.9. Content Outline of Synchronous Excel Lesson.

Example Lesson
1. Introduction
2. What is a formula?
   - Formula formatting
3. How to input a formula?
   - Full worked example with questions
   - Faded worked example
   - Full practice exercise

Concepts

Procedure
the lesson teaches the concept of a formula, including its formatting conventions. When teaching the procedures, the lesson follows guidelines for worked examples by starting with a full worked example accompanied by questions and fades to a full practice exercise.

Although virtual classroom tools can project a video image of the instructor, in this lesson the instructor used audio alone. Research we reviewed in Chapter 8 showed that it was the voice of a learning agent—not the image—that was most instrumental in promoting learning. Since the main instructional message is contained on the whiteboard slides, we deliberately decided to minimize the potential for split attention caused by a second image. The introductory slide is shown in Figure 16.10. The instructor places her photo on this slide to implement Guideline 6, based on the personalization principle. In addition, the instructor builds social presence by inviting participants to use their audio as they join the session.

Figure 16.10. Introduction to Synchronous Excel Lesson.

Application of Guidelines

In Chapter 13, we discussed various forms of learner control. Figure 16.11 shows the application of Guideline 34 with a pretest to help learners define
which virtual classroom session they should attend. Asynchronous e-learning can dynamically tailor training to individual needs and progress. However, virtual classrooms are instructor-led and therefore offer few opportunities for dynamic learner control. But a pretest administered prior to the event should help ensure a good match between learner prior knowledge and lesson objectives.

Figure 16.12 illustrates example fading in the virtual classroom. Most virtual classroom tools allow the instructor to share desktop applications for demonstration and practice purposes. The spreadsheet window in the middle of the virtual classroom interface is being projected to the learners through application sharing. In the first example, shown in Figure 16.12, the instructor has completed the first step in the procedure by typing the equal sign into the correct spreadsheet cell. The instructor asks participants to finish the example by typing the rest of the formula in the chat window. Note that in applying Guideline 10, the directions are kept on the screen in text, since participants need to refer to them as they work the exercise. The second example (not shown) is a full practice assignment that requires participants...
Applying the Guidelines

Figure 16.12. Faded Worked Example. From Clark and Kwon, 2007.

To enter the formula. The fading process gradually assigns more work to the learners, ending with a full practice assignment.

From this brief look at some virtual classroom samples, you can see that just about all of the principles we describe in the book apply. Because the class proceeds under instructor rather than learner control, it is especially critical to apply all guidelines that reduce extraneous mental load. Lesson designers should create effective visuals to project on the whiteboard that will be described verbally by the instructor, applying the multimedia and modality principles. The instructor should use a conversational tone and language and incorporate participant audio to apply personalization. Skill-building classes can apply all of our guidelines for faded worked examples and effective practice exercises. The presence of multiple participants in the virtual sessions lends itself to collaborative projects. Most virtual classroom tools offer breakout rooms in which small teams can carry out assignments. Apply Guidelines 27, 29, and 30 as you plan collaborative activities. As with asynchronous e-learning, instructors should minimize irrelevant visual effects, stories, themes, or audio in accordance with the coherence principle.
Asynchronous Sample Four: Simulation Course for Commercial Bank Loan Analysis

Description of Sample

Figures 16.13 through 16.16 are from a guided discovery simulation designed to teach bank loan officers how to use a structured process to review and evaluate commercial loan applicants. The course is presented on CD-ROM or via the intranet and includes video, text, and various other graphic elements. The learner starts with a point of view perspective in an office equipped with a computer, telephone, fax machine, file cabinet, and other common tools. The case begins with a video assignment from the learner's manager (Figure 16.13). Typical of guided-discovery learning environments, the learner is free to use various resources in the office to analyze the loan. For example, in Figure 16.14 the learner makes a request for a credit report on the applicant. Other data collection options include interviews of the loan applicant, industry publications, and applicant references. An agent coach is available for advice and offers links to structured lessons related to the loan re...
process shown in Figure 16.15. At the end of the research, the learner makes recommendations, along with supporting rationale to the loan committee, and receives feedback from the online agent. The learners can also view the steps they took to solve the case (Figure 16.16) and compare them to expert steps. As the learners progress through the simulation and gather case data, all data is stored in the file cabinet located to the left of the desk in Figure 16.13.

Application of Guidelines

This lesson effectively applies the multimedia Guidelines 7 through 13. It also applies Guidelines 36 through 43 applicable to e-learning to build problem-solving skills and to games and simulations. By situating the learner in a typical office, the designer gives access to the tools and resources needed on the job. The goal, rules, activities, and feedback of the simulation are all aligned to the desired learning outcome, that is, to teach the process associated with commercial loan analysis. Learners can see maps of their steps and compare their maps with an expert approach. Thus the lesson focuses not only on obtaining the correct answer but on how the answer is derived. There are several sources
Figure 16.15. Help from an Agent Offers Advice and Access to Lessons.
Courtesy of Moody's Financial Services.

Figure 16.16. Learners Can View Their Steps Taken.
Courtesy of Moody's Financial Services.
of structure and guidance available congruent with Guideline 41. For example, the agent is always available for advice, and learners can access a series of directive tutorial lessons. The file cabinet reduces mental load by providing memory support. Other than paper documents, there is no on-screen text. Human interactions such as the manager’s assignment are presented in video.

Since the structure of the case study is guided discovery, it emphasizes learning during problem solving. Regarding navigation, there was a high level of learner control in the case study segment. However, in the tutorial part of the course (not shown), a pretest is used to give advice regarding which lessons to study. Overall, we feel this course offers a good model for game and simulation environments that are most likely to achieve workforce learning goals.

The Next Generation of e-Learning

What differences will we see in e-learning developed for organizational training in the next few years? In the following section, we first review our predictions from the first edition, followed by our observations four years later.

Prediction One: e-Learning for Job Payoff

Because e-learning developed for workers in organizations is an expensive commitment, we predict more examples of online training that apply guidelines proven to lead to return on investment. Specifically, we believe that there will be:

- Fewer Las Vegas-style courses that depress learning by over-use of glitz and games. Instead, the power of technology will be leveraged more effectively to support acquisition and transfer of job-related skills.

- More problem-centered designs that use job-realistic problems in the start of a lesson or course to establish relevance, in the body of the lesson to drive the selection and organization of related knowledge and skills, and at the end of the lesson to provide practice and assessment opportunities.

- More creative ways to blend computer technology with other delivery media so that the features of a given medium are best used to support ongoing job-relevant skill requirements.
Four Years Later. As we look back over the past few years, we find this prediction to be valid, although it is perhaps not being realized exactly as we anticipated. We do see a continued and growing focus on e-learning that pays off in job performance. Job-related e-learning has been achieved by an increased integration of e-learning into the work environment and increased blending of media, as predicted in the fourth bulleted point. e-Learning implementations have broadened to include knowledge management resources workers can access during job task completion. For example, if a sales person is writing a first proposal, the company website offers industry-specific information, sample proposal templates, links to mentors, recorded mini lessons on proposal success, and other similar resources.

Prediction Two: e-Learning to Build Problem-Solving Skills

The majority of e-learning currently on the business and industry market is designed to build near-transfer or procedural skills such as end-user software training. However, the increasing economic dependence on knowledge workers, coupled with a shrinking workforce, will drive more courses that focus on building problem-solving skills in specific work domains. Specifically, we believe that:

- e-Learning will increasingly make use of the unique technological features that can support simulations and guided opportunities to learn from them. The current lesson designs that use text, audio, and graphics to describe content will survive. However, these will be supplemented by lessons that encourage the building of mental models and problem-solving skills.

- e-Learning will increasingly be used to make invisible processes and events visible. Learners will be able to see maps of their own problem-solving activities and compare them to expert maps. Additionally, learners will be able to “see” invisible processes, such as how equipment works internally or how to know what a customer is thinking.

- Alternative representations will be used to help to see dynamic relationships in ways that can only be described in other media.
For example, in training of food professionals, a “germ meter” can be used to illustrate the effects of various methods of preparation and handling of food. The relationship between germ density and heat can be illustrated by a dynamic chart that graphs the number of germs as a function of temperature and time of cooking.

- Collaborative e-learning features will be used more extensively and more effectively. Teams of learners will work asynchronously to solve case problems and contribute to ongoing corporate lessons learned about issues relevant to a specific industry or cross-industry profession.

Four Years Later. We have not seen much evidence that e-learning designed to build problem-solving skills has evolved much beyond our first edition. Trainers remain hard pressed to produce training that teaches the basic tasks of the job and lack time and resources to focus on problem-solving or thinking skills. However, the new interest in games and simulations may offer a window of opportunity for strategic problem-solving e-learning.

Our last point in the second prediction focused on greater use of collaborative e-learning features. The emergence of the Web-2 with social software tools such as blogs and wikis supports this prediction. We hope that the next few years will provide a more cohesive set of research-based guidelines for the application of collaborative tools for learning than we can offer at the present time.

In Conclusion

We have been gratified by the response to the first edition of our book. We believe that workforce learning is moving beyond a crafts approach based on fads and folk wisdom toward a true profession. Professionals base their decisions on many factors, one of which is evidence. We hope the guidelines and supporting evidence in this second edition will support the professional evolution of workforce learning.
REFERENCES


