CHAPTER OUTLINE

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e-Learning to Support Human Learning Processes
In This Chapter we define e-learning as training delivered on a computer (including CD-ROM, Internet, or intranet) that is designed to support individual learning or organizational performance goals. We include e-courses developed primarily to provide information (inform courses) as well as those designed to build specific job-related skills (perform courses). Instructional methods that support rather than defeat human learning processes are an essential ingredient to all good e-learning courseware. The best methods to use will depend on the goals of the training (for example, to inform or to perform); the learner’s related skills; and various environmental factors, including technological, cultural, and pragmatic constraints. We distinguish among e-learning courseware that reflect three views of learning: information acquisition (receptive), response-strengthening (directive), and knowledge construction (guided discovery).
The e-Learning Bandwagon

Will the new educational dot-coms that have proliferated over the past few years revolutionize business and government training? In 1999, Jack Welch, former chairman of General Electric, declared the Internet to be the single-most important event in the U.S. economy since the Industrial Revolution. John Chambers, Cisco Systems CEO, states that the two great equalizers in life are the Internet and education. Sensing the economic potential of marrying education and the Internet, a variety of sites have recently sprung up, offering training in everything from end-user computer skills to medical ethics. Universities also have rushed to tap into the distance learning market. Almost 90 percent of all universities with more than 10,000 students offer some form of distance learning—nearly all of which use the Internet (Svetcov, 2000). According to Gerhard Casper, outgoing president of Stanford University: “How Internet learning will shake out, I really do not know. But I am utterly convinced that over the next ten years we will see shifts from in-residence learning to on-line learning” (p. 284, Muller, 2000). In addition to Internet and university sites, corporate and government organizations that spend large amounts on employee training have developed proprietary computer-delivered courseware as a potential cost-effective alternative to classroom training.

Are the proliferating cyber courses harbingers of a new age in learning or just another overstatement of the expectations that have surrounded nearly everything associated with the World Wide Web? In spite of all the hype, since 1999, the amount of training delivered by computer in business and industry has decreased. In the year 2001, approximately 11 percent of all training was delivered via computer (including the Internet, intranets, and CD-ROM)—down from 15 percent reported in 1999 (Galvin, 2001). It remains to be seen whether in times of economic pressure and travel uncertainty the potential cost savings of desktop learning will reverse this trend.

Annual investments in training are high and growing. Every year between fifty and sixty billion dollars are spent on training workers in corporate and governmental organizations in the United States (Galvin, 2001). And these figures don’t include the most expensive element of training, the salary time
and lost opportunity costs of those taking training. In spite of this investment, during boom times there have been shortages of trained technical staff. Does e-learning offer a potential opportunity to cost-effectively build the skills required for the knowledge-based economy of this century? Part of the answer will depend on the quality of the instruction delivered in the e-learning products you are designing, building, or selecting today.

What Is e-Learning?

We define e-learning as instruction delivered on a computer by way of CD-ROM, Internet, or intranet with the following features:

- Includes content relevant to the learning objective
- Uses instructional methods such as examples and practice to help learning
- Uses media elements such as words and pictures to deliver the content and methods
- Builds new knowledge and skills linked to individual learning goals or to improved organizational performance

As you can see, this definition has several elements concerning the what, how, and why of e-learning.

*What.* e-Learning courses include both content (that is, information) and instructional methods (that is, techniques) that help people learn the content.

*How.* e-Learning courses are delivered via computer using words in the form of spoken or printed text and pictures such as illustrations, photos, animation, or video.

*Why.* e-Learning courses are intended to help learners reach personal learning objectives or perform their jobs in ways that improve the bottom line goals of the organization.

In short, the “e” in e-learning refers to the “how”—the course is digitized so it can be stored in electronic form. The “learning” in e-learning refers to the “what”—the course includes content and ways to help people learn
it—and the “why”—that the purpose is to help individuals achieve educational goals or to help organizations build skills related to improved job performance.

Our definition indicates that the goal of e-learning is to build job-transferable knowledge and skills linked to organizational performance or to help individuals achieve personal learning goals. Although the guidelines we present throughout the book do apply to lessons designed for educational or general interest learning goals, our emphasis is on instructional programs that are built or purchased to build job-specific skills.

e-Learning Development Process

e-Learning that yields a return on investment is developed following a systematic process summarized in Figure 1.1. Since there are many good books on e-learning development, we provide only a brief overview here.

Figure 1.1. The Process of e-Learning Design to Improve Organizational Performance.
**Performance Analysis**

All e-learning projects should begin with a performance analysis to determine a) that training will help meet important organizational goals by filling a gap in knowledge and skills and b) that e-learning is the best delivery solution. Often training is requested to solve organizational problems that are not caused by a lack of knowledge and skills. In these cases, the root cause(s) of the problems should be defined and an expensive solution like training should be avoided. If training is needed, then the analysis should consider the tradeoffs among various delivery alternatives such as classroom, on-the-job, e-learning, or a blend of several of these.

**Defining e-Learning Content**

Following the performance analysis, a team begins the design of the course by defining the content needed to perform the job or achieve the educational objective. In order for training to pay off with improved job performance, an e-learning development effort must start with an analysis of the job tasks and the knowledge needed to perform these tasks. The e-learning development team observes and interviews people who are expert at a job to define the job skills and knowledge. For courseware developed for broader educational purposes, rather than a job analysis, the development team conducts a content analysis to define the major topics and related subtopics to be included. Based on either the job or content analysis, the team categorizes the content of an e-lesson into facts, concepts, processes, procedures, and principles. Table 1.1 defines these content types, which have been described in detail by Ruth Clark (1999). For example, the screen in Figure 1.2 is taken from e-learning designed to teach Dreamweaver, a software product used to build Web pages. The content being illustrated is a procedure. This screen is providing a simulation practice of the steps the user must take to effectively use the software.

At the completion of the job or content analysis, the design team will create a course blueprint that includes outlines and learning objectives. They will then begin to write the detailed course script and to select specific instructional methods to support learning.
Table 1.1. Five Types of Content in e-Learning.

<table>
<thead>
<tr>
<th>Content Type</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact</td>
<td>Specific and unique data or instance</td>
<td>The company log-on screen; My password is John1</td>
</tr>
<tr>
<td>Concept</td>
<td>A category that includes multiple examples</td>
<td>Web page password</td>
</tr>
<tr>
<td>Process</td>
<td>A flow of events or activities</td>
<td>Performance appraisal process</td>
</tr>
<tr>
<td>Procedure</td>
<td>Task performed with step-by-step actions</td>
<td>How to log on</td>
</tr>
<tr>
<td>Principle</td>
<td>Task performed by adapting guidelines</td>
<td>How to close a sale</td>
</tr>
</tbody>
</table>

Figure 1.2. Screen from a Procedural e-Lesson on Use of Dreamweaver.

With permission from Element K.
Defining the Instructional Methods and Media Elements

Instructional methods are the techniques that support the learning of the content. Instructional methods include techniques such as examples, practice exercises, and feedback. In our example screen shown in Figure 1.2 the instructional methods include a simulation practice with feedback. We define media elements as the audio and visual techniques used to present words and illustrations. Media elements include text, narration, music, still graphics, photographs, and animation. In the Dreamweaver course, audio narration presents the words of the demonstration and an animated graphic presents the actions of the demonstration. One of our fundamental tenets is that to be effective, instructional methods and the media elements that deliver them must help guide learners to effectively process and assimilate new knowledge and skills.

How Delivery Platforms Influence Instructional Methods and Media Elements

e-Learning, as we use the term, includes training delivered via CD-ROM, intranets, and the Internet. Approximately forty percent of computer-delivered training uses CD-ROM, while twenty-two percent uses the Internet and thirty percent uses intranets (Galvin, 2001). Your choice of delivery platform can influence which instructional methods and media elements can be included in the courseware. For example, limitations in bandwidth may limit the use of memory-intensive media elements (such as audio) for Internet delivery. In contrast, CD-ROM provides considerably more memory than the Internet but will be more difficult to update and disseminate to users.

Two Types of e-Learning Goals: Inform and Perform

As summarized in Table 1.2, the guidelines in this book apply to e-learning that is designed to inform as well as e-learning that is designed to improve specific job performance. We classify lessons that are designed primarily to build awareness or provide information as inform programs. A new employee orientation lesson that reviews the company history and describes the company organization is an example of an inform program. The information presented
is job relevant but there are no specific expectations of new skills to be acquired. The primary goal is to share information. In contrast, we classify programs designed to build specific skills as perform programs. Some examples of perform e-learning are lessons on software use, marking and labeling of hazardous materials, evaluating a bank loan applicant, and use of quality control tools. Many e-courses contain both inform and perform learning objectives, while some are designed for inform only or perform only.

Near Versus Far Transfer Perform Goals

We distinguish between two types of perform goals: 1) procedural, also known as near transfer, and 2) principle-based, also known as far transfer. Procedural lessons such as the Dreamweaver example in Figure 1.2 are designed to teach step-by-step tasks, which are performed more or less the same way each time. Most computer-skills training falls into this category. This type of training is called near transfer because the steps learned in the training are identical or very similar to the steps required in the job environment. Thus the transfer from training to application is near. More than half of all e-learning is near transfer, devoted to teaching computer skills for end-users and for information technology professionals.
Principle-based lessons, also called far transfer, are designed to teach tasks that do not have only one correct approach or outcome. Thus the situations presented in the training may not be exactly the same as the situations that occur on the job. These tasks require the worker to adapt guidelines to various job situations. Typically some element of problem-solving is involved. The worker always has to use judgment in performing these tasks since there is no one right approach for all situations. Far transfer lessons include just about all soft-skill training, supervision and management courses, and sales skills. Figure 1.3 illustrates a screen from a principle-based course on selling banking products. The screen shows customer reactions to various statements of the salesperson. To apply these new skills to the job, the bank employees must adapt guidelines presented in this training to various situations they will encounter with real customers. Since the worker will always have to use judgment in applying training guidelines to the job, we say that the transfer from training to job is far.

Figure 1.3. Far Transfer Course on Selling Bank Products.

With permission from DigitalThink.
Is e-Learning Better? Media Comparison Research

Contrary to the impression left by recent reports on the use and benefits of e-learning, much of what we are seeing under the e-learning label is not new. Training delivered on a computer, known as computer-based training or CBT, has been around for more than thirty years. Early examples delivered over mainframe computers were primarily text on a screen with interspersed questions—electronic versions of behaviorist psychologist B. F. Skinner’s teaching machine. The computer program evaluated answers to the multiple-choice questions and prewritten feedback was matched to the learner responses. The main application of these early e-lessons was training in the use of mainframe computer systems. As technology has evolved, acquiring greater capability to deliver true multimedia, the courseware has become more elaborate in terms of realistic graphics, audio, color, animation, and complex simulations. But as you will see, greater complexity of media does not necessarily ensure more learning.

Each new wave of instructional delivery technology (starting with film in the 1920s) spawned optimistic predictions of massive improvements in learning. For example, in 1947 the U.S. Army conducted one of the first media comparison studies to demonstrate that instruction delivered by film resulted in better learning outcomes than traditional classroom or paper-based versions. Three versions of a lesson on how to read a micrometer were developed. The film version included a narrated demonstration of how to read the micrometer. A second version was taught in a classroom. The instructor used the same script and included a demonstration using actual equipment along with still slide pictures. A third version was a self-study paper lesson in which the text used the same words as the film, along with pictures with arrows to indicate movement. Learners were randomly assigned to a version and after the training session they were tested to see if they could read the micrometer. Which group learned more? There were no differences in learning among the three groups (Hall and Cushing, 1947).

THE FIRST MEDIA COMPARISON STUDY

In 1947 the U.S. Army conducted research to demonstrate that instruction delivered by film resulted in better learning outcomes than traditional classroom or paper-based versions. Three versions of a lesson on how to read a micrometer were developed. The film version included a narrated demonstration of how to read the micrometer. A second version was taught in a classroom. The instructor used the same script and included a demonstration using actual equipment along with still slide pictures. A third version was a self-study paper lesson in which the text used the same words as the film, along with pictures with arrows to indicate movement. Learners were randomly assigned to a version and after the training session they were tested to see if they could read the micrometer. Which group learned more? There were no differences in learning among the three groups (Hall and Cushing, 1947).
comparisons with the hypothesis that film teaches better than classroom instructors (see box for details). Yet after fifty years of research attempting to demonstrate that the latest media are better, the outcomes have not supported that hypothesis.

With few exceptions, the hundreds of media comparison studies have shown no differences in learning (Clark, 1994; Dillon and Gabbard, 1998). As in the Army experiment summarized in the box, the lessons delivered by various media were similar in the instructional methods they used. Therefore, the learning was the same whether the lesson was read in a book or on a computer screen. What we have learned from all the media comparison research is that it’s not the medium, but rather the instructional methods that cause learning. When the instructional methods remain essentially the same, so does the learning, no matter how the instruction is delivered. Nevertheless, as we will discuss in the following sections, each medium offers unique opportunities to deliver instructional methods that other media cannot. It’s a common error to design each new medium to mirror older ones. For example, some e-lessons appear to be books transferred to a screen. To exploit the media fully, the unique capabilities of the delivery media should be used in ways that effectively support human learning.

**What Makes e-Learning Unique?**

Can we conclude from the media comparison research that all media are equivalent? Not quite. Not all media can deliver all instructional methods. For example, the capability of a paper document to deliver animation is quite limited. Three potentially valuable instructional methods unique to e-learning are 1) practice with automated tailored feedback, 2) integration of collaboration with self-study, and 3) use of simulation to accelerate expertise.

**Practice with Feedback**

On the Dreamweaver screen shown in Figure 1.2 the learner has an opportunity to try a hands-on practice using a simulation of the Dreamweaver software. Prior to this hands-on practice, the learners have seen an animated, narrated demonstration of the steps required to format text in Dreamweaver.
What is special about the computer’s role in learning is that the learner’s actions taken in the simulation are evaluated by a program that responds with hints or feedback supporting immediate correction of errors. Chapter Nine in this book describes what to look for in effectively designed practice in e-learning.

**Collaboration in Self-Study**

If you take a close look at the left-hand navigation panel of the DigitalThink course (Figure 1.3), you will notice another feature that distinguishes e-learning from previous computer-delivered instruction—the ability to communicate with others. The first CBT lessons were for solo learning. There was little or no interaction with others. But the power of the Internet erases that limitation. Learners can communicate by computer in real time through chats or at different times by e-mail and discussion boards. Despite this collaborative capability, according to the 2001 Industry Report, few organizations make use of it. The vast majority of e-lessons (77 percent) are pre-programmed tutorials that involve only the learner and a computer (Galvin, 2001). One exception occurs in the academic institutions and services segment, in which 43 percent of courses build in interactions with other learners and with instructors. There is a growing research base on the benefits of learning together versus solo. Chapter Eleven specifically reviews that research and provides guidelines for ways to harness the collaborative facilities of the Internet for learning purposes.

**Use of Simulation to Accelerate Expertise**

Look at the screen sample in Figure 1.4 for another example of what makes e-learning unique. In this course, bank loan agents can learn an effective process to analyze and recommend funding for a commercial loan applicant. They learn by solving job-realistic cases. After receiving a new commercial loan to evaluate, the learner can access the various objects in the office such as the fax to request a credit check in this screen. They can also visit the loan applicant to conduct an interview. Once the learners have collected sufficient data, they indicate whether the loan is approved or denied. Thus, a new loan agent can experience in a short time a number of real-world loan situations in
the safety of a controlled environment. The bank loan course illustrates the power of simulation in which realistic job problems are compressed into a short timeframe. We summarize what we know about using simulations to accelerate expertise in Chapter Thirteen.

Besides interactivity and simulations, computers can now deliver a diverse range of media elements to present words and graphics, including text, audio, video, and pictures. In fact, the variety and number of media elements that a lesson can deliver can easily exceed human cognitive capacity. In Chapters Three through Eight we summarize research-based guidelines for the most effective use of text, audio, and graphics to promote learning. We call these the **media elements principles** and they apply to any of the various types of e-learning designed for educational, individual, or business and industrial goals.
e-Learning: The Pitfalls

Despite these impressive capabilities of computer-delivered instruction, we see three primary barriers (summarized in Table 1.3) to the realization of the potential of online learning. These are: 1) transfer failure due to lack of job analysis, 2) failure to accommodate human learning limits and strengths, and 3) high attrition rates.

<table>
<thead>
<tr>
<th>Pitfall</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Failure to Define Job Knowledge and Skills</td>
<td>Lessons do not build knowledge and skills that transfer to the job</td>
</tr>
<tr>
<td>2. Failure to Accommodate Learning Processes</td>
<td>Lessons overload cognitive processes and learning is disrupted</td>
</tr>
<tr>
<td>3. Attrition</td>
<td>Learners do not complete their instruction</td>
</tr>
</tbody>
</table>

Pitfall One: Failure to Base e-Learning on a Job Analysis

To design powerful learning environments whose lessons both transfer to the workplace and improve the performance of the organization is not easy, no matter whether planned for classroom or multimedia delivery. To teach higher order problem solving skills like the one illustrated in the bank loan program (Figure 1.4), the designer must first define what those skills are. Research on expertise shows that these skills are job-specific. In other words, the knowledge base underlying a great physician is different from one that makes a master programmer. There is no one set of skills that support expertise across the diverse contemporary workforce.

Adding to the challenge of defining job-specific skills for each career field, many of the most important skills underlying knowledge-based work are
cognitive skills that are not readily observable. For example, if your goal is
to build training for a systems analyst, you will learn little by watching an
experienced analyst at work, since the important work is going on internally.
And an interview will often yield disappointing results. This is because experts
typically cannot easily articulate how they accomplish mental tasks since their
well-practiced skills have resulted in unconscious competence. In the case of
near transfer training, visible procedural skills like the use of a new software
system are relatively easy to define through observations and interviews. But
even then, it is a time-consuming task to specify all the skills and knowledge
needed to use a software product effectively.

In other words, whether planning for near or far transfer learning, a
detailed job and task analysis is a prerequisite and a labor-intensive process.
e-Lessons that bypass the job analysis process run the risk of presenting
knowledge and techniques out of context. As you will see in Chapters Nine
and Ten, lack of job context risks transfer failure. In the end, teaching knowl-
edge and skills that do not result in job performance changes will not yield a
return on investment.

**Pitfall Two: Failure to Accommodate Human Learning Processes**

Once valid skills and knowledge are defined through the job analysis, the
appropriate instructional methods must be used that will both accommo-
date human psychological processes and exploit the capabilities of the tech-
nology. When the limits of human cognitive processes are ignored,
e-learning that utilizes all of the technological capabilities to deliver text,
audio, and video can actually depress learning. As you will see in Chapter
Two, this is because humans have a limited capacity for the amount of
information they can simultaneously process. To translate the content of
the job into effective e-lessons, a range of expertise on the design team is
required. This includes instructional psychology, multimedia production,
graphics, programming, and interface design. Experienced multimedia devel-
opers acknowledge that it takes from ten to twenty times more labor and
skill to produce good courseware for e-learning than for traditional class-
room materials.
Pitfall Three: e-Learning Dropout

A third potential pitfall to the promise of e-learning is student attrition. Dropout rates have been estimated at 35 percent and above (Svetcov, 2000). It is difficult, however, to know what these statistics really mean. In many cases, a learner may only need a segment of the training and never intends to complete the full course. Dropouts give a variety of reasons that range from boring lessons to technological glitches. Unlike the classroom in which the learner is a captive audience and a live instructor can stimulate attention, an online learning environment requires individual discipline and commitment in a world full of competing alternatives for worker time and attention. To ensure successful self-directed learning, you must consider factors ranging from how you might deploy online learning in the workplace to how engaging the courseware is. Some courseware designers try to stimulate interest by adding motivational elements in the form of games or interesting graphics and stories to the training. However, as you will see in Chapters Seven and Nine, using these kinds of techniques to seduce learners may backfire and depress learning.

What Is Good e-Courseware?

A central question for our book is, “What does good courseware look like?” Throughout the book we provide specific courseware features to look for or to design into your e-learning. However, you will need to adapt our recommendations based on three main considerations—the goal of your training, the prior knowledge of your learners, and the environment in which you will deploy your training.

Training Goals

The goals or intended outcomes of your e-learning will influence which guidelines are most appropriate for you to consider. Earlier in this chapter we made distinctions among three types of training designed to inform the student, to perform procedures, and to perform principle tasks. For inform e-lessons, you should apply the guidelines in Chapters Three through Eight regarding the best use of media elements, including visuals, narration, and text to present information. To train for procedural skills, you should
understand these guidelines and also apply relevant suggestions regarding the design of examples and practice sessions in Chapters Nine and Ten. If, however, your goal is to develop principle-based or far transfer skills, you will want to apply the guidelines from all the chapters (including Chapter Thirteen on teaching problem-solving skills).

Learner Differences

In addition to selecting or designing courseware specific to the type of outcome desired—that is, whether you wish to inform learners, develop procedural skills or support principle-based performance—effective courseware should include instructional methods appropriate to the learner’s characteristics. While various individual differences such as learning styles have received the attention of the training community, research has proven that the learner’s prior knowledge of the course content exerts the most influence on learning. Learners with little prior knowledge will benefit from different instructional methods than learners who are relatively experienced.

For the most part, the guidelines we provide in this book are based on research conducted with adult learners who were new to the course content. If your target audience has greater background knowledge in the course content, some of these guidelines may be less applicable. For example, Chapter Four suggests that if you integrate your text into your graphics, you reduce the mental workload required of the learner and thereby increase learning. However, if your learners are experienced regarding the skills you are teaching, overload is not as likely and they will probably learn effectively whether the text is integrated or separated.

Training Environment

A final factor that affects e-learning is the environment—including such issues as technical constraints of the delivery platform or network, cultural factors in institutions such as the acceptance of and routine familiarity with technology, and pragmatic constraints related to budget, time, and management expectations. We focus in this book on what works best from a psychological perspective, but we recognize that you will have to adapt our guidelines in response to your own unique set of environmental factors.
Three Types of e-Learning

Although all e-learning is delivered on a computer, different courses reflect different assumptions of learning. During the past one hundred years, three views of learning have evolved, and you will see each view reflected in courses available today. The three views, summarized in Table 1.4, are learning as information acquisition, learning as response strengthening, and learning as knowledge construction. The lesson designs that stem from these views are called architectures of instruction (Clark, 2000).

Table 1.4. Three Types of e-Learning.

<table>
<thead>
<tr>
<th>Type</th>
<th>Builds Lessons That</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive: Information</td>
<td>Include lots of information with limited practice opportunities</td>
<td>Inform Goals</td>
</tr>
<tr>
<td>Directive: Response</td>
<td>Require frequent responses from learners with immediate feedback</td>
<td>Perform-Procedure Goals</td>
</tr>
<tr>
<td>Guided Discovery: Knowledge</td>
<td>Provide job-realistic problems and supporting resources</td>
<td>Perform-Principle Goals</td>
</tr>
</tbody>
</table>

Learning as Information Acquisition

According to the information acquisition view (which we also call the information delivery view), learning involves adding information to one’s memory. In this view, a useful instructional method is to present as much information as efficiently as possible—such as through lots of onscreen text. The instructor’s job is to deliver information and the learner’s job is to receive it. A common metaphor characterizes the learner as a sponge and the instruction as a jug of water. We refer to instruction designed on this premise as receptive instruction or show-and-tell. e-Courses built on this view often provide
information in various media but may be guilty of overloading learners’ cognitive systems and of not providing opportunities for learning through practice exercises. Courses of this type are common in e-learning that is designed for inform rather than perform goals.

Learning as Response Strengthening
According to the response-strengthening view, learning involves strengthening or weakening of associations between a stimulus (such as \(2 + 2 = \_\)) and a response (such as 4). In this view, a useful instructional method is drill and practice, in which the instructor asks a question, and then gives a reward for the correct answer or a punishment for the wrong answer. The instructor’s job is to provide short content segments followed by questions accompanied by corrective feedback. The learner’s job is to respond accurately to the questions and revise answers based on the feedback. We refer to this type of training as directive or “show-and-do” courseware. This type of instruction is characterized by small step sizes, demonstrations or examples, and frequent practice with corrective feedback. This approach is common in courses designed to teach procedures such as end-user software skills. The screen shown in Figure 1.2 is drawn from this type of courseware.

Learning as Knowledge Construction
According to the knowledge construction view, learning occurs when a learner builds a coherent mental representation. In this view, a useful instructional method is guided performance, in which a learner tries to accomplish an authentic job task (such as cross-selling banking products) with guidance from the instructor about how to process the incoming information. The instructor’s job is to serve as a cognitive guide and the learner’s job is to make sense of the presented material often in the context of solving a job-related problem. We call this approach to instruction guided discovery. This type of e-learning is most effective for far transfer performance goals, in which the guidelines presented in the training will need to be adapted to unpredictable situations on the job. Figure 1.4 is a screen drawn from this type of e-learning.

We find some merit in each view, and each seems to be best suited to support certain learning situations as summarized here. However, whichever
approach to instruction is taken, we believe that knowledge construction must occur. Furthermore, for knowledge construction to occur most effectively, instructional methods must support the cognitive processes of learning.

**e-Learning to Support Human Learning Processes**

The challenge in e-learning, as in any learning program, is to build lessons in ways that are compatible with human learning processes. To be effective, instructional methods must support these processes. That is, they must foster the psychological events necessary for learning. While the computer technology for delivery of e-learning is upgraded weekly, the human side of the equation—the neurological infrastructure underlying the learning process—is very old and designed for change only over evolutionary time spans. In fact, technology can easily deliver more sensory data than the human nervous system can process. To the extent that audio and visual elements in a lesson interfere with human cognition, learning will be depressed.

We know a lot about how learning occurs. Over the past twenty years hundreds of research studies on cognitive learning processes and methods that support them have been published. Much of this new knowledge remains inaccessible to those who are producing or evaluating online learning because it has been distributed primarily within the research community. This book fills the gap by summarizing research-based answers to questions that multimedia producers and consumers ask about what to look for in effective e-learning.

**COMING NEXT**

Since instructional methods must support the psychological processes of learning, the next chapter summarizes those processes. We include an overview of our current understanding of the human learning system and the processes involved in building knowledge and skills in learners. We provide several examples of how instructional methods used in e-lessons support cognitive processes. In addition, we present some guidelines to help you understand and evaluate research evidence presented throughout the book.
Suggested Readings

