David E. Stone
Constance L. Koskinen

Planning and Design for High-Tech Web-Based Training

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To our children, for whom computer technology
is a normal part of everyday life

Contents

Introduction: The Web-based training development model

What is Web-based training?

Web-based training (WBT) refers to on-line learning delivered over the World Wide Web (WWW) via the public Internet or a private, corporate intranet. Although on-line learning is not actually new—it has been around since the 1960s—it is the Internet's user-friendly interface, coupled with improved technology, that has brought the Web into the mainstream of current culture.

WBT is one specific delivery method within the larger category of computer-based training (CBT). Like WBT, the term CBT has evolved along with technological advancements. Originally, CBT encompassed any training delivered via a computer, but that did not mean much, and CBT did not initially develop into the broad category it was intended to become because there were few practical ways to deliver CBT. In practice, corporations relied almost solely on CD-ROM because of its ability to store large, media-rich files, and the term CBT became almost synonymous with training delivered via CD-ROM.

Therefore, you will hear industry professionals refer to technology-delivered training as "e-learning." WBT is one of the most popular forms of e-learning. WBT includes both synchronous and asynchronous instruc-

tion. Synchronous WBT includes real-time interactions between instructors and students in virtual classrooms, chat rooms, or on-line videoconferences. Asynchronous WBT includes the use of on-line lessons that students can use anytime and anywhere. The most effective WBT combines both synchronous and asynchronous elements.

As with other forms of e-learning, the constraints of WBT are diminishing and options are increasing as the Web becomes increasingly easy to use and technology becomes better and less expensive. As the ease of execution increases, corporations are discovering the benefits of delivering training via the Web. Interest in WBT is at an all-time high, and this book assumes that you are already interested in delivering training over the Web. If you need convincing, a number of good books on the subject are listed on our Web site at http://www.dr-david-stone.com.

In discussing what WBT is, it is worth mentioning what it is not. It is not a panacea for all of your training needs. Often it is part of an entire training program that involves other delivery vehicles. In considering WBT, you will need to consider how, when, and where WBT fits into your integrated training solutions.

What is this book about?

This book offers an easy-to-follow, step-by-step guide to creating WBT. Many other books on the market cover certain aspects of WBT in more detail than you will find here. For example, while instructional design is discussed here in terms of how it applies to a Web environment, you can find entire books on that subject alone. Similarly, many books exist on computer graphics, technical documentation, and Web design.

There are also books available that provide broad, conceptual overviews of what WBT is, but they often do not tell you how to put your own WBT together. This book covers all phases of WBT development, explains how all of the pieces fit into a congruent whole, and provides enough detail to guide you through the decisions you must make along the way. For each phase, we alert you to the factors you must consider, discuss your options, and provide specific examples.

Who is this book for?

This book was written with today's training professionals in mind. We assume you know what makes good instruction, but are just now considering or getting started using WBT. At the same time, we realize that many training professionals come from the business world rather than academia. Whether you have a degree in instructional design or come to training with a business background, WBT puts a new twist on traditional instructional design theories and processes. So while this is not an instructional design book, we do discuss the specifics of designing instruction for WBT. We do point out key instructional theories whenever we feel they have particular or new implications for the Web.

How is this book organized?

This book is based on a WBT development model developed by the authors. Chapter 1 shows you where this model resembles a traditional instructional design model, and where it is different. The subsequent chapters follow the logical progression of the WBT model—from front-end analysis to the evaluation and maintenance of the finished product.

Throughout the book, examples, tips, checklists, and illustrations are provided. Appendix A provides sample documents and references for additional reading. Because Web addresses often become outdated as soon as a book is published, an associated Web site is available at http://www.dr-david-stone.com. Here you will find useful links to information on instructional theory, practical tips, case studies, and examples, authoring tools, and updates to information provided in this book.

Why a WBT model?

In their book, *The Systematic Design of Instruction*, Dick and Carey provide an often used model for developing effective instructional systems [1]. This traditional model is an extremely useful map to follow when developing any instruction. Certainly the WBT development model presented in this chapter is indebted to the work of these instructional

theorists; however, this book acknowledges (as do many professionals working within the realm of WBT) that a separate WBT development model is useful for two reasons. First, WBT development requires several additional phases. Second, the technological decisions that must be made force training development phases to be interdependent in unique ways.

This chapter introduces both training design models and shows you how they are similar and how they are different. Chapters 4 and 5 walk you through the implementation of the WBT model in more detail.

After reaching the end of this book, you should be able to follow the step-by-step WBT process to make educated decisions and to design effective WBT that makes the most of this powerful new technology.

The traditional model

Figure I.1 is an adaptation of Dick and Carey's model. All of the phases in this model can be broken into three categories:

1. Analysis;
2. Content development;
3. Evaluation.

The WBT development model

The WBT development model, illustrated in Figure I.2, is broken into six categories:

1. Analysis;
2. Strategic planning;
3. Development;
4. Deployment;
5. Evaluation;
6. Maintenance.

How is the WBT development model different?

As you can see, there are a number of differences between the Dick and Carey model and the WBT model discussed in this book.

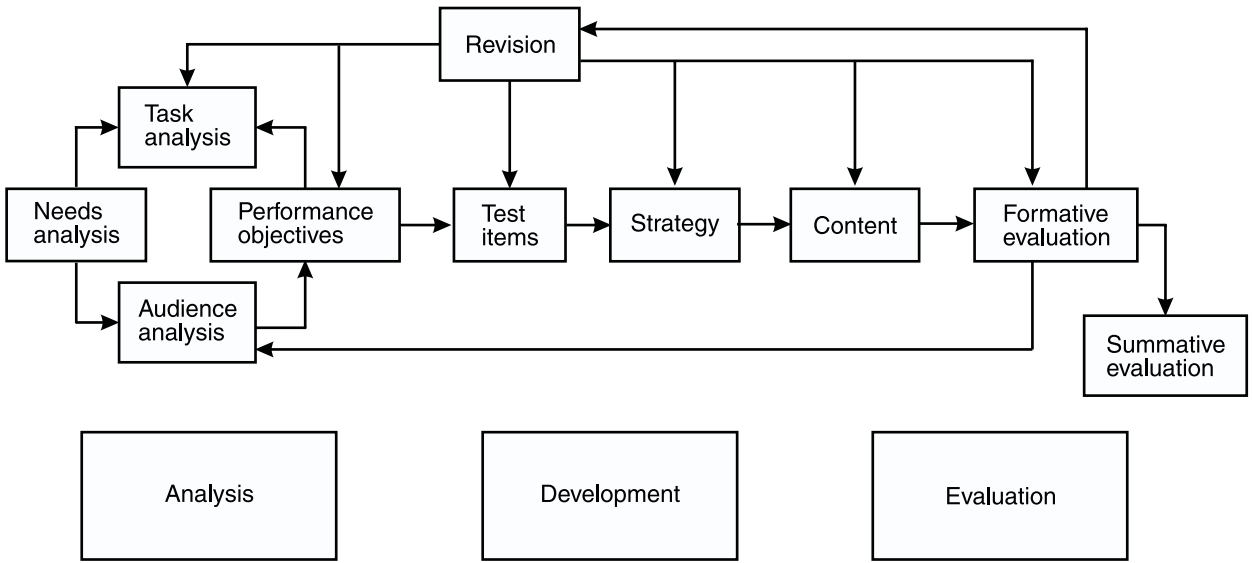

Figure I.1 A traditional instructional design model.

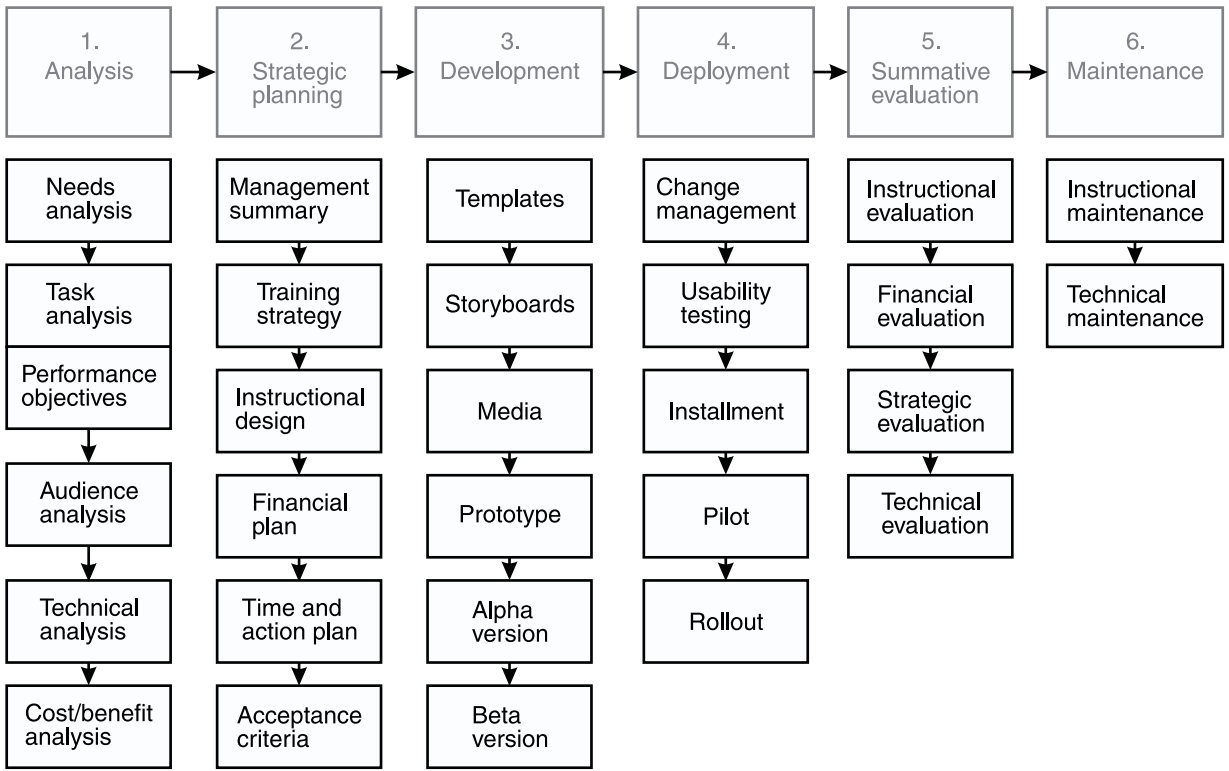

Figure I.2 The WBT development model.

The WBT model adds three categories not contained in the Dick and Carey model: strategic planning, deployment, and maintenance. One could argue that these three phases are implicit in the Dick and Carey model, but with WBT, these phases must be overt, critical phases of the design process because they take on more importance. For example, strategic planning involves more than planning your training strategy; it involves planning your technology strategy as well. Similarly, deployment and maintenance involve more than just deploying and maintaining training when technology is involved. You will need to deploy and maintain the technology as well.

Within each category, the WBT sometimes has additional activities. For example, in the WBT model the analysis category contains an activity called "Technical Analysis." In Chapter 2 you will see why an early technical analysis is critical to the success of your project.

The WBT model sequences its events differently. For example, if you use the WBT development model, you will consider—at least at a high level—your instructional techniques and media much earlier than you would if you were using the traditional instructional design model. While this may seem like blasphemy to many instructional designers, you cannot create WBT in a vacuum. Your instructional techniques will affect your media choices, and your media choices will be affected by what technology your organization can support (thus the technical analysis)—and so on. You will learn more about how these factors fit together throughout this book.

Finally, the development events are even more interdependent in the WBT model than they are in the traditional model. In the traditional model, the instruction drives the delivery in a linear progression. With WBT, it is a question of balance. While the effectiveness of the instruction is always the most important consideration, WBT development is a more iterative process. You cannot consider *what* you are teaching without considering how you are teaching it, and vice versa. In other words, you need to know what your technical constraints are before you can determine what instruction can be delivered via WBT. This does not mean that you throw away an instructional goal that does not fit, or that you bend your goal to fit WBT, but it may mean you need a hybrid solution. In Chapter 2 you will learn more about this iterative planning model.

Reference

[1] Dick, W., and L. Carey, *The Systematic Design of Instruction*, New York: Harper Collins, 1990.

Part I
Phase 1: The analysis

1

Traditional analysis within a Web-based training mode

The Web-based training (WBT) development model (Figure 1.1) begins, like the traditional model, with a thoughtful analysis of current and desired conditions. As in the traditional model, the analysis phase consists of a needs and performance analysis, an audience analysis, and a task analysis. In the WBT model, however, you must also perform a technical analysis and a cost-benefit analysis to ensure that your subsequent strategic plan takes into account the current and desired technical and financial conditions.

Following is the analysis phase of the WBT development model discussed in this book:

- Needs analysis;
- Task analysis;
- Audience analysis;
- Technical analysis;
- Cost-benefit analysis.

The first three analyses—needs, task, and audience analysis—are not new, but they take a different twist with WBT; this chapter discusses their

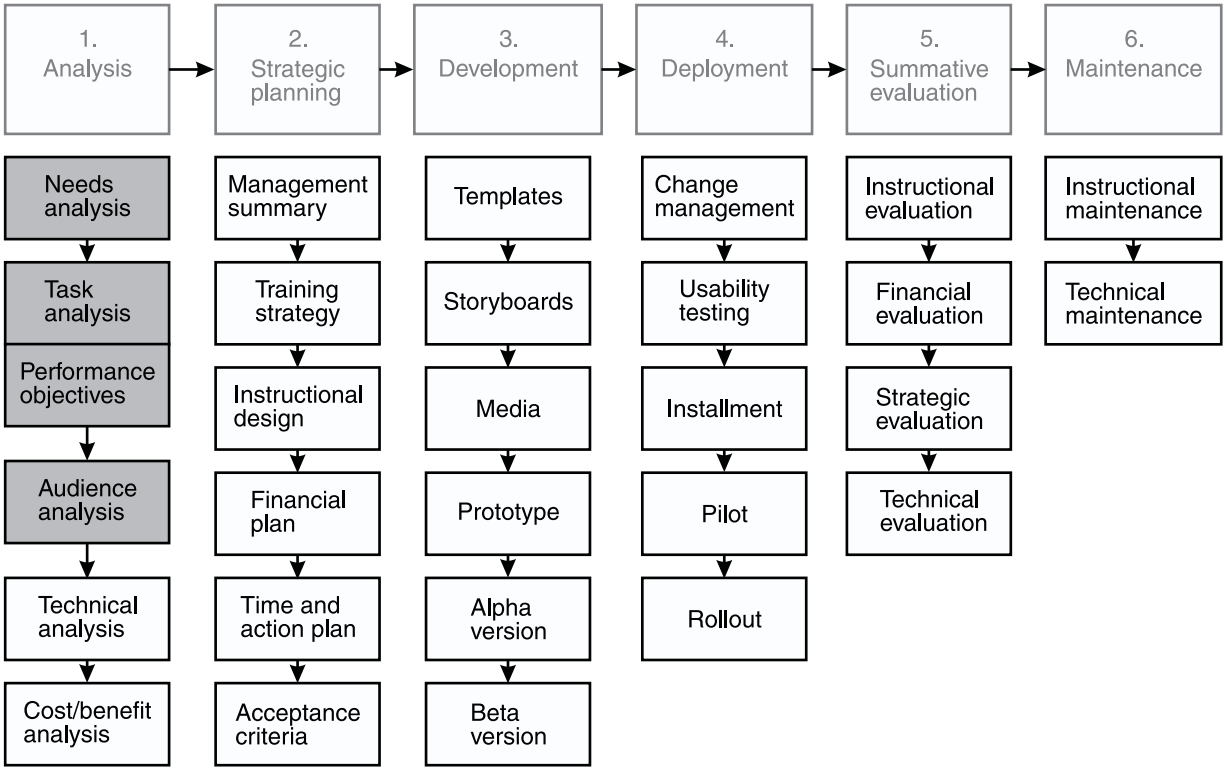

Figure 1.1 A new slant on traditional analysis.

implications in that context. The last two analyses—technical and cost-benefit analyses—are new phases included in the WBT model. These two additional analyses are the subject of Chapter 2.

1.1 The needs analysis

When conducting a needs analysis, the designers should keep two goals clearly in mind:

- Identify the gaps between current and desired performance;
- Define the final performance objective.

In this early phase of analysis, a customer presents a goal or desired outcome to the training developers. The customer can be external if, for example, you are a consultant or contract training provider; however, the customer is often internal. When a business unit within your organization approaches your training department with a request for training, it becomes an internal customer. The same thorough needs analysis should be conducted whether the customer is internal or external. The customer has a need already in mind or would not approach you in the first place, but it is your job to validate and define that need.

1.1.1 The performance gap

The first step in a needs analysis is to determine what, if any, gaps exist between the desired state or goal and the current state. Traditionally, training professionals have most often thought of these gaps as "human" performance gaps: What is the gap between the current human performance and the desired human performance? The needs analysis, however, should look for other possible disconnects. For example, there may be a technological performance gap, a financial performance gap, a strategic performance gap, or any combination of these—all of which are pertinent to the consideration of WBT.

Exercise

What kinds of performance gaps can be found in these statements?

- "We need to train our sales associates better. They are not performing to our standards."

WBT can deliver training anytime and anywhere at the preferred pace. This can provide new sales associates a way to learn and review content until they meet your standards.

- "We have an effective training program, but it costs too much. We cannot afford to send trainers out on the road every time there is a change. We have spent a tremendous amount of money establishing an underutilized intranet. We want to leverage that resource and use it to deliver training."

  WBT provides the ability to deliver training anywhere, reducing the need to send trainers on the road. WBT also makes it possible to change training content easily in one place (the server) and make it available worldwide immediately.

- "We like our CBT programs, but CD-ROMs are too costly and too difficult to distribute, maintain, and access."

  Web delivery of e-learning content eliminates the need to distribute CD-ROMs physically and replace them when they become obsolete. Access to the World Wide Web (the Web) is becoming easier every day, and PCs connected to the Internet can be found in airports, hotels, and virtually every business office.

- "We have a diverse mix of training materials—everything from CD-ROMs to self-paced workbooks to standup training. Our users are confused about where to go for information. We would like to integrate our resources."

  Learning management systems (LMSs) are used to maintain student records, manage access to instruction, organize and deliver instruction, deliver tests, and track student performance. A WBT LMS can manage all your training resources, including the scheduling of classrooms and instructors. WBT can provide a single place for all learners to access all the training they need from anywhere in the world.

- "We have vast amounts of product information that we need to get out to our users, but the problem is that our product mix changes so often."

  While WBT is sometimes considered to include only direct instructional content, the reality is that documents and other reference

materials are usually a part of the WBT package. New product information in the form of illustrated brochures that describe features and benefits can be distributed to a sales force on-line quickly and inexpensively.

WBT can be a potential solution for a variety of needs—not just instructional ones. The use of electronic documents providing new product information as part of a WBT program for sales people is just one example. Instructional effectiveness, however, is ultimately the deciding factor; it is "where the rubber meets the road." Even if your customer specifically requests WBT, you will need to evaluate carefully whether or not it is a viable solution from an instructional standpoint—whether it can be used to assist the learner in reaching the final human performance objective.

1.1.2 The final performance objective

During the needs-analysis phase, training designers must first confirm that a training goal does indeed exist and then define that goal. This training goal becomes the final performance objective, or the "final destination." Because the learners need to be competent in real-life situations—and not merely in the training environment—the final performance objective must be reality-based. Furthermore, it is widely accepted that good instruction is competency based, and that the desired competency should also be based in reality. In other words, the final performance and the competency measurement are integrated. In essence, a reality-based final performance objective becomes your reality-based competency measurement.

For example, your objective may be to teach student pilots to land a plane successfully. This is a final performance objective based in reality. This objective will drive the competency. Before you can attest that the student is competent to land a plane, that student must be able to land a real plane successfully under real conditions: That is your ultimate performance objective and your ultimate competency measurement.

The final performance objective has a great deal of bearing on whether WBT can be effective. Sometimes WBT alone cannot prepare the learner to perform successfully in the real world. Many organizations use WBT as part of a "hybrid solution," meaning that WBT forms part of an integrated solution that includes other methods of delivery.

Here is an example derived from the experience of one of the authors. The need was "Product Managers need to learn a new import-tracking system." The final performance objective was "Product Managers will be able to apply the generic process to their specific business." It was determined that how the import-tracking system was used varied from one type of product to another. In the hybrid solution the generic process was taught electronically, and individual workshops were conducted to help each product group apply the generic process to its specific business need. The hybrid solution resulted in more effective learning and more cost-effective training operations.

If you are considering a hybrid solution, bear in mind that the more closely WBT mimics real conditions, the more effectively it can contribute to the overall performance objective. For example, you may be able to provide WBT instruction in a simulated environment that closely mimics reality so that the learner only needs on-the-job practice—perhaps under the supervision of a mentor—to become proficient in the desired skill.

Simulated environments can be particularly useful when learners need to learn within a risk-free environment. Student pilots may benefit from learning certain aspects of piloting a plane within a simulated environment where they can learn from their mistakes without safety concerns. Employees may benefit from the ability to experiment on a simulated system where errors do not affect real data. Different methods of creating reality-based WBT are discussed in Chapter 4.

In these examples, the hybrid approach focuses on bridging the gap between classroom learning and job performance. The hybrid solution is driven by the final performance objective. Hybrid solutions can also be driven by technological needs. The technical needs are revealed in the technical analysis, which is the subject of Section 2.1.

Practical tip: *In analyzing the final performance objective, you may determine that your learners will not be able to rely solely on WBT to meet that objective. In that case, you will need to determine the final performance objective for the entire training program and the final performance objective for the WBT component within that program.*

1.1.3 How to conduct a needs analysis

To identify the performance gaps and final performance objective, you need to interview the customer. Start with the stakeholders—or leadership—to understand the big picture and align your strategies with the

company's goals. What does management consider to be the cause of the performance gap?

Once you understand the objectives from the corporate point of view, validate, compare, and test that information against information gathered from line workers.

- Do the line workers understand and buy into the corporate objectives?
- What do they see as the root causes of the performance gap?
- What are their objectives?

If you find a needs gap between management and the line workers, address it in your strategic plan. As you continue to refine your analysis and subsequent strategy, keep line managers informed of your conclusions and get them to buy into your strategies. Training cannot be effective without line management support.

The level of information you must obtain in your needs analysis depends on the level at which the customer has engaged you. A training need can run the gamut from a single course to a fully integrated training program, and the complexity of the needs analysis is directly related to the complexity of the need. As the level of sophistication of your training program increases, so does the level of learner participation and the level of system interconnectivity.

Will the trainees self-register, manage their own career objectives, and interact with a variety of performance support tools? For each component that is added to the training objective, you will need to analyze the objectives for that specific component and the objectives for all of the components as an interconnected whole—both from the corporate and user point of view.

- Level 1: You are developing one course.
- Level 2: You are developing an entire program.
- Level 3: You are integrating current and future programs with an LMS (Figure 1.2).
- Level 4: You are integrating your programs and LMS with an enterprise resource planning (ERP) system, such as SAP or PeopleSoft. (Figure 1.3).

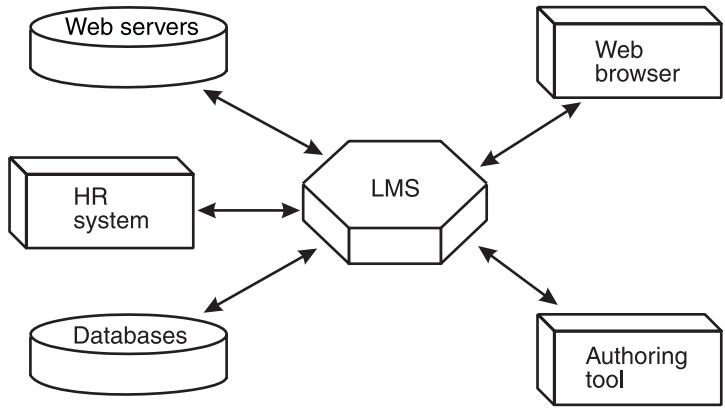

Figure 1.2 Level 3, LMS integration.

- Level 5: You are integrating the training programs, LMS, ERP, and other facets of training communication, such as electronic performance support systems (EPSS), charge transactions, and collaboration to build a virtual university (Figure 1.4).

Whether you are designing one course or part of a team working on an entire integrated system, the strategic plan should be consistent with your customer's existing—or planned—courseware, technical infrastruc-

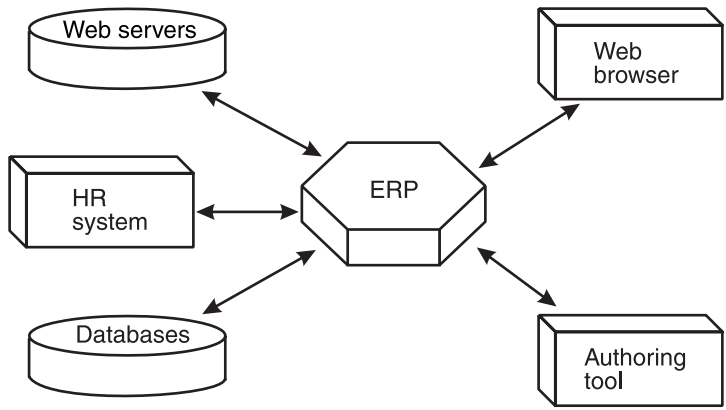

Figure 1.3 Level 4, ERP integration.

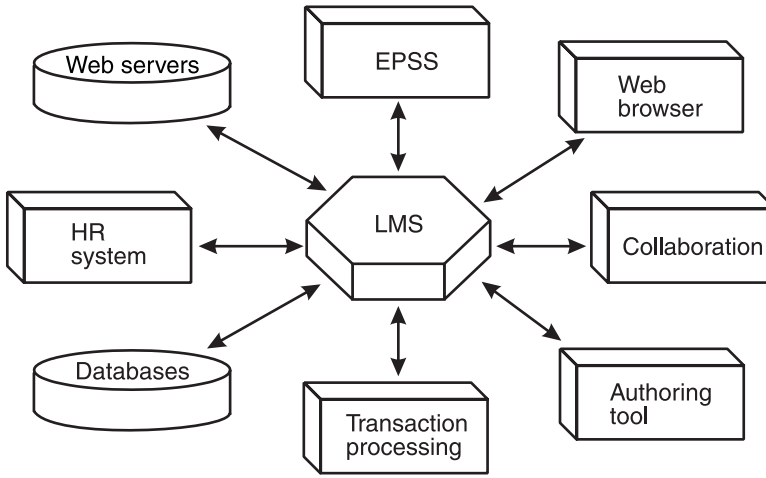

Figure 1.4 Level 5, virtual university. (Courtesy of: click2learn.com, Inc. Resource Planning.)

ture, and LMSs and processes. To do that, you will have to interview the customer to ascertain current and desired training conditions.

The following questions can help you get started. They are questions you might ask during the needs-analysis stage. These questions are for illustrative purposes only; they are by no means all-inclusive. You may need to edit or add to the list of questions to serve your particular situation.

Top 10 training needs

1. *What are your primary corporate objectives for this year?* If your WBT offering will directly contribute to achieving primary corporate objectives (rather than simply replacing existing instructor-led training), cost-justification will be much easier.
2. *What are your primary training objectives for this year?* Your training objectives should be derived from your primary corporate objectives. Are they?
3. *How do your goals differ from the current status?* What changes are needed to achieve these training goals? WBT may be able to help you achieve these new objectives.

4. *What do you see as the reasons for the difference between the two?* What factors are driving changes in your training needs? It is common to find that employees are being asked to learn something new everyday in order to keep ahead in a competitive global marketplace. WBT can make learning more accessible at work, while traveling, and at home.
5. *How often are training requirements submitted?* WBT may be able to make your organization more flexible and responsive to changing business conditions.
6. *Are training requirements broken out by geographic region, by job category, or by organizational unit?* The structure of your training requirements will be a factor in determining the best solution. For example, you will need to provide reports of student performance to managers at different locations and at different levels of your organization. You may also need to consider the requirement to provide WBT and reports of student performance in several languages.
7. *In order of importance, what are your top five objectives for this project?* It is important to know what these objectives are, that management buys into them, and to have a plan in place for measuring the performance of the entire training system in meeting these objectives.
8. *What is the project deadline?* Is this schedule dependent upon another event, such as a product rollout? Designing and developing WBT for a product that has not been completed is very challenging. For example, the new product might be a software application, and changes may be made to key screens and functions late in the development cycle. You will need to negotiate your development schedule with your management so that your deadlines are tied to the actual dates that milestones are reached in the development of the product, rather than to specific calendar dates.
9. *Have you provided a high-level organizational chart showing all business units that require training support?* An organizational chart that shows all these business units will make it clear who the "stakeholders" are in this effort. You will need to ensure that the

leaders of these business units buy into or your plan or your WBT will encounter resistance when it is time for implementation.

10. *Do you expect the organizational structure outlined above to stay consistent for the foreseeable future?* If not, what impacts on training flow do you anticipate from an organizational change? Changes in organizational structure may have direct or indirect consequences on the design and development of WBT. Indirect impacts might include changes in how the WBT is implemented in your organization. Direct impacts might include changes to content, such as a WBT that serves as a new employee orientation.

Top 10 learning management needs

1. *What courses do you currently offer?* Most companies offer instructor-led courses, self-study courses (workbooks), instructional videos, and some WBT. An LMS can manage the distribution of all these types of training experiences, report the results to a central location, and generate the kinds of reports needed by managers at different levels within the organization.
2. *What courses would you like to offer in the future?* In the future, the company may want to have international videoconferences or other training experiences, and a good LMS can be used to schedule these types of experiences, too.
3. *What kinds of delivery methods are you currently using or would you like to use in the future?* (Ask how, why, and when they are used.)
   - Stand-up;
   - Internships/mentoring;
   - CBT;
   - WBT;
   - Web conferencing;
   - EPSS;
   - Other (explain).

   LMSs can coordinate all of these delivery methods and launch electronic media directly from a single on-line location.

4. *How is your content created?*
   - Internally;
   - By a third party off the shelf;
   - By a third party customized.

   Your LMS will need to support "interoperability" of e-learning content; that is, the LMS must be able to launch, track, and report on e-learning courses developed using a variety of authoring tools. Standards organizations, such as the AICC (http://www.aicc.com), work toward ensuring that interoperability of LMS and e-learning content prevails; however, many commercial LMS systems do not support these standards. Be sure to check on this issue.
5. *What tools do they use?* For example:
   - Programming languages;
   - Authoring tools (programmable or nonprogrammable versions);
   - Third-party systems;
   - Other (explain).

   As noted above, you must be sure that your LMS can launch, track, and report on e-learning content developed in a variety of tools.
6. *At what location(s) do you hold training, and who manages the locations for each type of training?*
   - Classroom, instructor-led;
   - Self-paced, learner-centered;
   - Web conferencing, instructor-led.

   Different LMSs offer different levels of administrative and management functionality. Do you need to have local assignment of courses in a branch office? Do you want all courses assigned from corporate headquarters? Answers to these questions are material to your selection of an LMS.

7. *How are your organization's business units distributed geographically?* Your LMS may need to support the use of Unicode (see Chapter 11). Do you need to support Japanese (double-byte characters) or Arabic (leftward writing)? While you may not need it today, will you need that capability in two years when only 32% of the people on the Internet will be able to read English [1]?
8. *Is there a training-requirements database or an LMS currently in use in your organization?*
   - If yes, do you foresee the need to replace the existing system? (If yes, what is the anticipated timetable for this?)
   - If no, do you see the need to establish a central system? (If yes, what is the anticipated timetable for this?)

   Defining the information requirements is a key step in determining what you need in the way of an LMS: What members of the management team require reports on student performance? When must these reports be available? What must be in these reports?
9. *Who is responsible for each of the following learning activities, and where are they located?*
   - Individual course assignments;
   - Prerequisites;
   - Registration;
   - Curriculum (including multiple-source courseware);
   - Certification;
   - Managing training centers;
   - Conducting training classes;
   - Creating course content;
   - Identifying and purchasing off-the-shelf course content;
   - Test administration;
   - Recording and reporting performance data and test results;
   - Analyzing training effectiveness.

Your LMS will need to support these activities in a way that is not disruptive of your business process. This is a key requirement to be considered in selecting an LMS.

10. *How do you currently track and manage the learning management activities listed above?*

    Do not be too surprised to learn that many global companies are not able to track and manage learning at all. Global corporations that have grown rapidly by acquisition usually have a wide range of training activities with no central records of what is taught or actually learned. One company known to the authors reported that it was spending over $100 million every year on training, but had no idea of what it was getting for that investment. An LMS can help manage those training dollars.

Practical tip: *It is critical to remain focused on the human performance objectives as the primary driver of the instructional system, not vice versa.*

1.2 The task analysis and performance objectives

The task analysis breaks the final performance objective down into more detailed tasks and objectives: In order to achieve the final objective, the learner must be able to do this, this, and this. In other words, while the needs analysis determines the final objective, the task analysis identifies what tasks are involved in reaching that final objective.

Each task is then analyzed to determine the following:

- What procedural tasks or performances are required to master the final objective successfully?
- What internal cognitive abilities and skills are required of the user to obtain the desired performance?
- Which of these user skills do the learners already possess (as determined by the audience analysis) and which will need to be learned?

According to the Dick and Carey model, performance objectives are written after the task analysis, but Gagne, Brigges, and Wager argue in their *Principles of Instructional Design* that they are actually written during the task analysis. Certainly, they are so closely related that it is difficult to

think about one without the other. Therefore, the WBT development model in this book shows them occurring simultaneously as one process.

For example, if the final objective is to land a plane successfully, the task analysis may identify "locating the target airport" as one of the tasks that must be performed to achieve that objective. To perform the task of locating the airport, the learner must be able to use the instrument panel correctly. Is correctly using the instrument panel a task or a performance objective? Call it what you will, a perfectly legitimate performance objective would be "The learner will be able to use the instrument panel to locate the target airport."

Note: Of course, the above objective still needs work. It needs to be flushed out with "real" conditions and measurement standards. An example of a thorough performance objective is provided in Section 1.2.1.

1.2.1 Reality-based performance objectives

It is not the purpose of this book to enter an academic debate regarding where performance objectives stop and task analysis begins. Rather, it is the intent of this book to discuss the importance of defining powerful objectives that reflect reality—the real performance that will be required of the learner in the real world.

The most effective instruction simulates the real-world conditions under which the task is performed and bridges the gap between training and job performance. Effective performance objectives also reflect this modeling of real-world situations. If learners have job aids available to them on the job, these job aids should be integrated into the learning performance objectives. If the real job requires 100% accuracy in a given task, the final performance objective should require that level of accuracy as well.

The detailed performance objectives that build to the final competency must be designed with that final competency in mind. For example, let's say your customer is your accounting division. The company has a new system in place that streamlines the creation of financial plans for its customers and uses historical models to create accurate projections. Your job is to train the users on the new system. Your performance objectives might look like those provided in Table 1.1.

These performance objectives are reality based. A reality-based WBT would provide a variety of scenarios, simulate the system on a laptop (or

TABLE 1.1 Performance Objectives

Final performance objective	The learner must be able to create financial plans independently for outside customers within a maximum of the 7 days allotted for turnaround time.
Specific performance objective	The learner must correctly input the required data into various financial plans.
Target skills	1. Able to work independently; 2. Gathers data based on a variety of customer interviews; 3. Uses the new financial planning system; 4. Uses his or her laptop and the available job aids; 5. Maintains 90% accuracy.

interface with the real system), allow the students to use their job aids, time the learners, and measure for 90% accuracy.

Practical tip: *Reality-based performance objectives are always written with the following question in mind: What must the learner do on the job, under what conditions, and at what level?*

1.2.2 The task hierarchy

Of course, further analysis of a task or performance usually reveals even more substeps. In the above example, your task analysis may reveal that in order to correctly input the data, the learner must know what kind of data is entered and how and where it is entered. The task analysis and related performance objectives begin at a very high level and become increasingly more detailed until everything the learner will need to do in order to perform the final objective successfully has been identified. Your task analysis builds a task-performance hierarchy.

Somewhere in that hierarchy you must draw a line between the required entry-level skills, or prerequisites, and skills that will be included in the instruction. Once prerequisites have been determined, skill assessments or pretests can be administered to determine the trainees' current skill level.

During the final, or summative, evaluation of the program, post-training skills can be measured against pretraining skills as a useful benchmark of the effectiveness of the instruction. You can design the skill measurements, or there are a number of skills assessment software programs.

Links to skills assessment software companies are provided on our associated Web site (http://www.dr-david-stone.com).

Note: Summative evaluation is discussed in more detail in Section 10.1.2.

The next logical step is to group the tasks and performance objectives into meaningful units of instruction. At the end of the task analysis you should have a task hierarchy grouped into logical units of instruction, as shown in Figure 1.5.

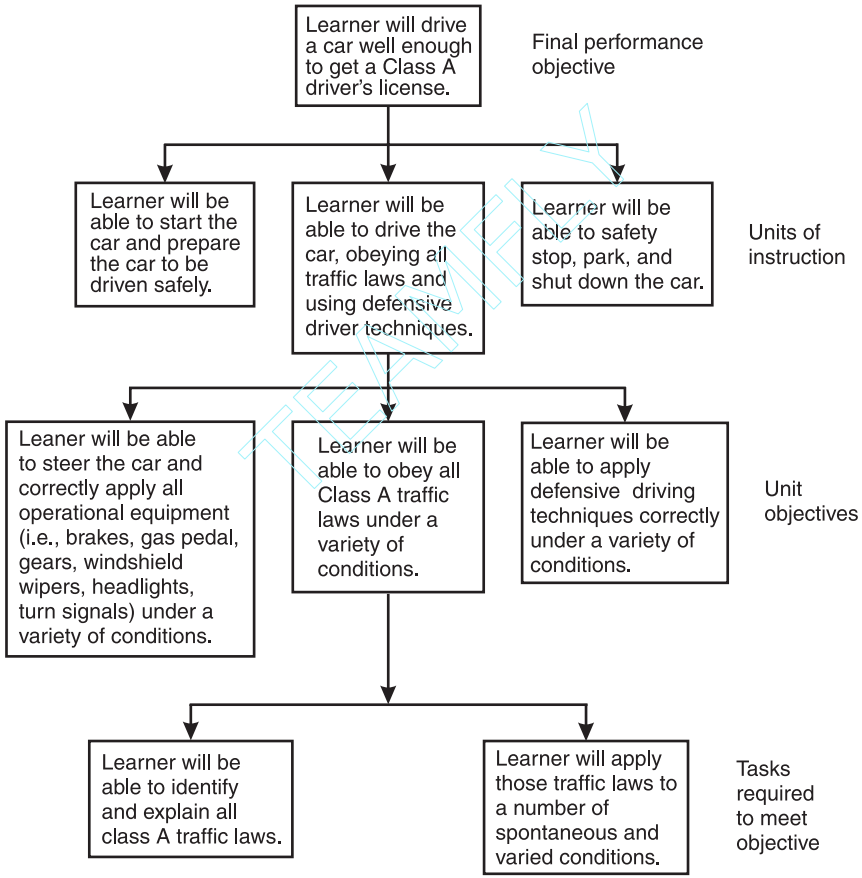

Figure 1.5 A task-performance hierarchy.

Later, as part of the instructional strategy, the instructional units are sequenced in such a way as to maximize the impact of the learning event. Instructional sequencing, or the course structure, is discussed in Section 3.1.

While you are gathering information during the needs and task analyses, you can also begin to process that information in terms of effective WBT. In order for WBT to be effective, you must be able to simulate the real task, measure the successful completion of the real task, chunk the information into digestible pieces, and create opportunities for meaningful interaction. As you define the tasks, you begin to hold each one up to those standards to see if it can be effectively trained within a WBT environment.

Example

In the performance hierarchy illustrated in Figure 1.5, two identified tasks required to meet the objective include that the learners be able to understand the traffic laws and to apply them to a variety of conditions. This scenario provides a perfect opportunity for a blended solution—one that combines e-learning with hands-on practice. Certainly, in an e-learning environment, the learner can learn the laws and be asked to apply those laws correctly when presented with a variety of scenarios. This gives the student driver a place to practice cognitive processing before hitting the road.

Practical tip: *Validate your task analysis with input from subject matter experts (SMEs) and line managers. Be sure to focus them on determining the least amount the learners need to know to perform at the desired level. You always want to be sure that you are not overwhelming the reader with unnecessary information. This is a critical point within a WBT environment.*

1.3 The audience analysis

In a typical audience analysis, the designers learn everything they can about the learners, such as the following:

- Their preexisting knowledge;
- Their abilities;
- Their learning strategies and styles;

- Their traits (motivation, anxiety, sense of control, self-confidence);
- Their special needs (visional, auditory).

All of these characteristics have a bearing on the form WBT must take to be effective—or whether it can be effective at all. The last three points take on new meaning within WBT, however. For example, the learning strategies and styles of your learners will tell you if they like to explore or prefer a linear program, whether they are independent learners or prefer human interaction, whether they are effective readers, and so on. There are surveys that you can administer to determine preferred learning styles, and sometimes you can deduce some learning-style preferences by the job descriptions of your audience.

If the members of your audience are motivated and have a strong sense of control, they are likely candidates for WBT. If they are anxious about learning or computers, they may need help adjusting to WBT. If you have an audience with special needs, you will need to take those needs into account in your WBT design.

Practical tip: *The last point is important. Even if your users do not have specific disabilities, your design decisions may be influenced by population demographics. For example, "By 2010, when the last baby boomers turn 45, the number of Americans reporting some sort of vision impairment will climb to 20 million. Those same baby boomers currently make up the greatest percentage of Internet users, and the fastest-growing segment of the Internet consists of 55 and older" [2]. The WBT audience checklist below will help you determine what issues you need to address so that WBT can be an effective training tool for your audience.*

WBT audience checklist

- Are the users technology savvy or PC phobic?
- Are they self-motivated, or do they need direction?
- Do they all have the same skill level and training needs, or do their skill levels and needs vary?
- What are their preferred learning styles?
- Do any users have a learning disability or vision or hearing impairment?

On-line exercise

- Go to the Center for Teaching and Learning's "Learning Styles" home page at http://www.isu.indstate.edu/ctl/styles/ls1.html.
- Click on "On-line Inventories of Learning Styles." There you will find descriptions of the major approaches to learning styles and links to on-line inventories.
- Click on "On-line Inventories."
- Click on "Felder's Learning Style Page." There you will find the "ILS Questionnaire—Web Version," which allows you to complete a Web-based learning-style inventory and submit it for scoring.

Additional links to learning-style information and resources are provided on our associated Web site (http://www.dr-david-stone.com).

1.3.1 The audience analysis and logistics

When considering technology-delivered instruction, it is worth examining audience logistics. Although it is too early to begin designing the instruction, you will need to consider the influence of logistical factors, such as location, access to equipment, and work environment, when you do begin to strategize.

For example, there have been many debates as to whether users should access WBT from their workstations or from a central location. It is recognized that many learners multitask at their workstations (answering e-mail is a perfect example), and the debate includes whether learning can be effective when the learner tunes in and out. This book makes the point that how and where the learner accesses WBT depends on the learners themselves and on the learners' location, equipment, and environment. Here is a checklist to help you determine the logistical needs of your audience.

Audience logistics checklist

- Are the learners in common locations or individual locations?
- Do they have dependable Internet or intranet access at their work locations?
- Do they have multimedia PCs at their work locations?

- Are their workstations and environments conducive to learning?
- What job-related equipment will they need for the training?

Exercises

At various points in this book we have provided exercises designed to give you the opportunity to interact with the content to explore different possibilities. This first such exercise calls for you to randomly mix and match items from each of the three columns. You might, for example, start with the "Need to work better in teams," match that with "Sailors on a submarine," and match that with "Global."

This case might arise if your company manufactures new sonar equipment for use in submarines used by the navies of the United States, Taiwan, and Spain. In such a case, you might deploy the training on CD-ROMs, but allow wireless connection to the Internet when they return to port for purposes of collecting student performance data. The fact that the students would be speakers of other languages would mean that it would be best to develop the WBT using tools that support the use of multiple character sets (such as Chinese) and support the use of content management software that allows maintenance of multiple-language courses as content changes. (See Chapter 11 for more details about multiple-language WBT.)

Audience analysis Randomly mix and match items from each of the three columns in Table 1.2. What can you surmise about your WBT training options?

TABLE 1.2 Audience Analysis

NEED	AUDIENCE	LOGISTICS
Need to operate a new piece of equipment located at the job site	Sailors on a submarine	All in one location
Need to work better in teams	College students	Spread across the United States
Need to learn a spreadsheet application	Plant supervisors	Global (English is often a second language.)
Need to be able to access current government rulings and apply them to business decisions	Stock market analysts	Travel often

1.3.2 Bandwidth

What if the prospective audience does not have reliable, high-bandwidth Internet access? WBT is still an option in this environment (which is often found in many parts of the world). In such cases, it is common to use the intermittent, low-bandwidth Internet connection to provide students with low-bandwidth course management information, while delivery of courses is done locally on CD-ROM. Student performance data is uploaded from individual PCs when the Internet access is restored. This methodology is also used to support "nomadic" learning, such as from laptops that are only occasionally connected to the Internet.

1.4 Summative evaluation

A summative evaluation is focused on the effectiveness of the instruction and the usability of the technology. Summative evaluation takes place after WBT goes into production. The intention is not to correct the existing program, but to use what you learn from your summative evaluation to compare and improve future programs. Because summative evaluation looks at all aspects of your WBT, it also includes some elements not assessed during the development stage: the cost-benefit and strategic value of the WBT.

The summative evaluation is composed of an instructional, technical, financial, and strategic evaluation:

1. How well has the instruction worked?
2. How well has the technology worked?
3. How well has the program met the strategic objectives?
4. Have the performance problems identified earlier been overcome?
5. Are the benefits worth the cost?

1.5 Acceptance criteria

The acceptance criteria document specifies the deliverables, test criteria, quality standards, checkpoints, and payoffs agreed upon by the your team and the stakeholders. The document serves two purposes. It acts as a primary quality control (QC) measurement and as a contractual agreement

TABLE 1.3 Acceptance Criteria Example

Deliverable	Lesson 1, alpha version
Content	Does the content provided include all elements necessary for the student to master the lesson objective?
	Does the lesson test include valid and reliable test items that measure mastery of the lesson objective?
Quality	Does the lesson content meet our standards for good writing and effective use of media?
Test criteria	Ten users simultaneously accessing and using the WBT through the intranet testing site according to the specified test plan.
Standards	All system responses must take less than three seconds.
	All links must function correctly.
	All video must load and begin to play within 10 seconds.
Checkpoints	Testing to be conducted upon completion of alpha version. Beta version will not commence until alpha standards are met.

between you and your customer. In other words, it outlines how you and your customer define success.

Table 1.3 shows a hypothetical example of one deliverable and its corresponding acceptance criteria.

While Table 1.3 illustrates the measurement and acceptance criteria for one deliverable, there should be quality assurance checks on all of the deliverables throughout the project. These checks should define the standards for functionality, instructional design (ISD), user interface and editorial quality, and any other standards important to you and your client. The project plan should provide for reviews of deliverables at each step of the development process and include time for a thorough review by the client of each deliverable with an official sign-off provided by an authorized member of the client's team. A statement that delays in the reviews by the client will result in corresponding delays in subsequent delivery dates should be included in any agreement with the client.

Acceptance criteria focus on the functionality of the WBT being developed, not on the success of that WBT in addressing the business objective for which it was created. Evaluation of the WBT in those terms can only take place only after it has been successfully implemented.

Also, throughout the project, both project and customer team members should be integrally involved in reviewing and approving the deliver-

ables for each phase. It is imperative that both the supplier and the client take the necessary steps to ensure that each deliverable is satisfactory before further development continues.

Based on the approach suggested in this chapter, a thorough strategic plan includes the following:

1. Management summary;
2. Training strategy;
3. ISD document;
4. Financial plan;
5. Time and action plan;
6. Acceptance criteria.

The documents themselves are the concrete deliverables resulting from the actual strategic planning process, and this chapter has outlined a number of key factors to consider in developing your plan. These factors are all interrelated: Your learning objectives affect instructional techniques, techniques affect media, media affects development time and expense, development time affects the time and action plan, and the ISD affects the acceptance criteria. Often the path is not linear. At any point in your planning, you may need to circle back. For example, you may have considered a media that upon further analysis does not fit your time or financial budget. As a result, you will need to reconsider your techniques and media options.

Your strategic plan is complete only when all of the components fit together into an integrated solution and you have obtained approval from the key decision makers within both your organization and your customer's. Once you have obtained approval, you are ready to begin development. Development is the subject of Chapter 3.

On-line exercises

- Go to "Advice and Tools—CBT Cost Justification" at http://www.caicbt.com/roi.html. There you will find tips on estimating your WBT return on investment (ROI) and a downloadable "Project Estimator."
- Go to the University of Colorado's "Instructional Design Models" at http://www.cudenver.edu/ ~mryder/itc_data/idmodels.html. for an

excellent compilation of writings by top ISD theorists. In the table of contents, under "Instructional Design Systems, ISD", click on "ISD glossary." There you will find definitions for many of the terms and concepts discussed in this chapter.

References

[1] http://www.transwareplc.com.

[2] Williams, M., "Access Ability," *Adobe Magazine*, Summer 1999.

2

Technical analysis

In the traditional ISD model, a technical analysis and a cost-benefit analysis are not explicit, and they are certainly not conducted during the analytical stage of the project planning. In the WBT development model, however, the technical and the cost-benefit analyses are specific steps that must be taken to complete the analysis phase of your WBT project, because both cost and technology have a direct bearing on your training strategy (see Figure 2.1). Your analysis and your training strategy are, in practice, more interdependent than linear.

2.1 Technical analysis

The technical analysis defines the customer's current hardware and software environments and the technical infrastructure necessary for meeting the project goals.

Why conduct a technical analysis? Because you cannot develop a strategic plan without knowing your technological resources, constraints, and requirements. Furthermore, Web technology—specifically WBT—is still new to many corporations, and there is much confusion regarding what technology is required. Although your customer can define its current

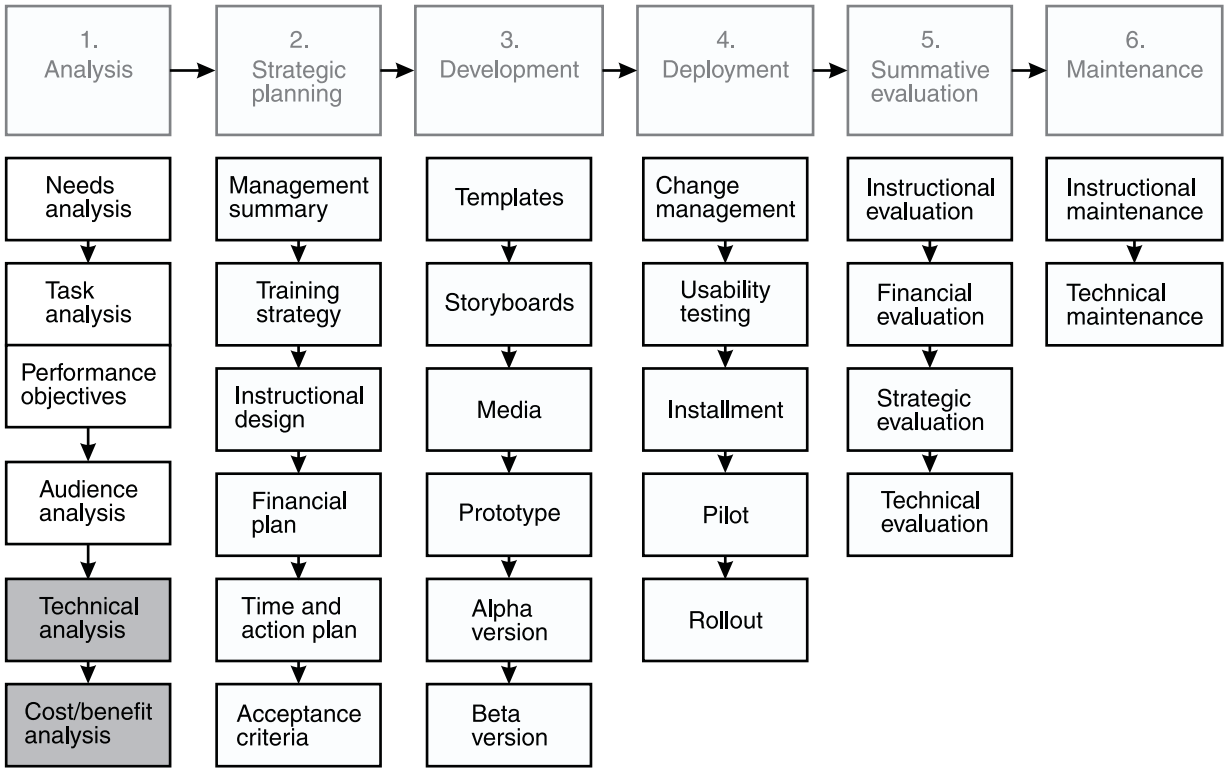

Figure 2.1 Technical and cost-benefit analysis.

infrastructure for you, your team is responsible for defining the requirements of the project and ensuring that there is a good marriage between the two. Therefore, your development team must not assume that the necessary infrastructure exists; nor can you afford to accept second-hand information. Because you are ultimately responsible for the success of the project, you must perform your own technical analysis.

Here is an example: Let's assume that you work for a large, international hotel chain. Your company opens one or two new hotels every week, and your employees collectively speak more than 18 languages, although English is primary. You have been asked to develop a WBT. During your needs analysis, you concluded that your e-learning systems will be located in dedicated training rooms at each hotel and they will all have some sort of access to the Web.

During the technical analysis, your Information Technology (IT) organization defined a standard computer platform for all future training applications that meets or exceeds the requirements for delivery of today's most sophisticated e-learning applications. With some consultation from you and your WBT development team, they have preloaded all the plug-ins and drivers needed to support multimedia applications, such as Flash and QuickTime, among others. Thus, your users and your support staff will not need to download and install these applications.

Happily, all your hotels will be equipped with these dedicated training systems by the end of your WBT development project.

The technical infrastructure can be analyzed on three levels:

- Level 1: What infrastructure is required to support the learner and the courseware?
- Level 2: What infrastructure is required to support the databases?
- Level 3: What infrastructure is required to support the administrators and the LMS?

2.1.1 The course

In your analysis you determined that a mix of courses provided the best solution to the training problem at hand (training wine stewards and bartenders). Several e-learning courses are available commercially on such topics as how to prepare various types of drinks and how to assist guests in selecting appropriate wines. You have determined that your new course must teach your employees how to interact correctly with guests, includ-

ing how to serve beverages properly. You are required to certify that all new employees in these two job categories have met your standards within one week of their hire date.

The requirement to teach your employees how to interact with clients and how to correctly serve beverages indicates that the use of digital video would be highly desirable. In order to decide how to deliver the video, however, you will need to know the connection speed available at each of your hotels. In some cases, where hotels are directly connected to your new corporate high-speed intranet, you will be able to deliver the digital video directly over the network. You learn as part of your analysis, however, that in some parts of the world only 56K dial-up connections are available. You will need a hybrid solution for these users.

2.1.2 Hybrid courses

In this scenario, the hybrid solution delivers some of the e-learning content directly over the Web, while the high-bandwidth assets (such as video) are accessed locally from a CD-ROM or hard drive. The development of your e-learning application can take into account the possibility that the video is stored locally so that you need to maintain only one version of your course. In this manner you can accommodate the different bandwidths available for the distribution of your course and ensure high-quality instruction for all of your students.

2.1.3 LMSs

LMSs are typically installed on dedicated servers with their own unique technical requirements; so, again, you will need to involve your IT department in the technical analysis to determine the required infrastructure.

2.1.4 Network topology

Your technical analysis will need to include a careful review of your network delivery system. In this example, your company has a high-bandwidth network; however, your WBT application will be competing with other "mission-critical" company applications, such as those financial systems that manage payroll for the entire company. Your IS department will want to know what impact your applications will have on the performance of these other systems; it will also expect you to be able to estimate what the department's additional workload will be.

2.1.5 A hosted solution

The costly, complex, and time-consuming effort associated with the installation of new servers and software to support your LMS and all the WBT courses that you must host for your employees may lead you to consider using a third-party learning portal, such as click2learn.com, as there are no costs for the installation of servers, LMSs, and associated databases. Instead, there are pay-as-you-go costs on a per-student basis and, of course, costs for the development of your new e-learning applications; however, the fact that you will not need to struggle with the complexities of integrating your e-learning applications into your other enterprisewide software systems will enable you to get your training to your employees faster and in a more cost-effective manner.

Obviously the technical analysis is a detailed and complex process, and it is beyond the scope of this book to cover every possible technical requirement and configuration. You will need an expert in this field on your team to facilitate this process—ideally, a software engineer experienced in implementing enterprisewide software applications. The following questionnaire, however, will guide you through the primary technical issues you must address in the technical analysis.

Top 10 technical infrastructure needs

1. What are the customer's IT standards?
2. Will the training go through the firewall port? This is important. A port 80 firewall allows hypertext markup language (HTML) and Java to pass. If the courseware requires other ports, use other courseware or run the training from a server outside the firewall.
3. What is the current and required LAN topology?
4. What are the current and required standard platforms (server platforms and client platforms)?
5. What are the network capacities (bandwidths)?
6. What are the current and required media software and hardware (sound cards, speakers, headphones, CD-ROM drive)?
7. What plug-ins are allowed, and what plug-ins are required?
8. What is the current and required infrastructure maintenance program?

9. What is the required load time (course load time and media load time)?
10. What is the current and future number of simultaneous active users (learners and administrators)?

2.2 Cost-benefit analysis

Another key component of the front-end analysis is a cost-benefit analysis. You will need to evaluate and justify the investment in WBT to your training management decision-makers, operations management, and line management. (Rather than attempt to provide a detailed discussion of this issue here, the authors recommend Whalen and Wright's *The Business Case for Web-Based Training* [1], and *Evaluating the Effectiveness and Return on Investment of E-Learning*, an ASTD research report [2].)

We believe that business goals are at the heart of every successful learning technology initiative. While investment in new training technology has traditionally been justified as more cost-effective than sticking with the existing approach, it is a much more compelling argument to demonstrate that WBT improves employee performance and helps the organization achieve its business objectives.

It is this direct link between WBT and business objectives that ensures that e-learning is central to the success of the organization. E-learning justified in this manner will not be dropped when times get tough. In fact, it will likely be given increased funding as a smaller organization attempts to achieve more with fewer human resources.

2.2.1 Aligning training strategy with business goals

The first step in this cost-benefit analysis is to define the business goals for your client's business unit clearly. Once this is done, you may find that the existing training should be eliminated; however, replacing existing training that fails to help the business unit meet its goals with new e-learning that has the same fatal flaw is obviously a bad idea.

Once the client's business goals have been clearly identified, it becomes possible to define the delivery strategy. Naturally, your goal is to improve employee performance and not just to deliver training.

In our hotel example, the analysis identified the following issues:

- Geographic distribution of staff;
- Cultural diversity;
- Linguistic diversity;
- A requirement to provide training when needed;
- A requirement to provide training where needed.

All of these factors support the use of e-learning. Because we can track the performance of all our employees around the world through our LMS, including evaluations from their supervisors, we can know conclusively how employee performance has changed. In this example, this much training simply cannot currently be delivered due to the costs of delivery using traditional means. The improvement in employee performance and the resulting improved economic performance of the hotel chain is projected to be dramatic and incremental over time.

E-learning solutions should routinely be evaluated based on such measures as the following:

- Dollar savings;
- Improved employee performance;
- Improved customer satisfaction;
- Improved competitive performance.

Such success must be documented for management. All training activity must be managed, tracked, and centrally reported to achieve three ends:

- To meet compliance requirements;
- To reduce legal liability;
- To ensure that performance standards are met.

Based on our experience with Fortune 500 companies, this approach to cost justification for e-learning is by far the most effective in winning support from all stakeholders and keeping that support throughout the entire life cycle of the e-learning.

2.2.2 Traditional learning versus e-learning

Another (and older) approach to cost-benefit analysis compares the proposed methodology to existing and alternative methodologies and considers three factors:

- Cost expenditures;
- Cost savings;
- Financial gain.

The cost-benefit analysis is a two-part process that spans the analysis stage and the strategic planning phase. First, in the analysis phase, opportunities, resources, and constraints for every potential methodology are identified, analyzed, and compared. Then, in the strategic planning phase, the findings input data to the strategic plan. Here, the cost-benefit analysis is one of many factors considered in the selection of the delivery method (always with instructional effectiveness as the primary factor). The costs and benefits of the selected methodology are then used to establish a financial plan that consists of an ROI and a budget for the project.

The analysis and planning parts of the costing process are interrelated. The factors that are examined in the analysis phase are the same factors as those used to prepare an ROI plan. Therefore, the detailed discussion of the cost-benefit factors is presented in this chapter.

While the identification of cost expenditures is fairly straightforward, training departments have traditionally failed to identify cost savings and financial returns, or they have identified them only vaguely. In recent years, however, the training industry has realized that until it can demonstrate a cost benefit to the organization, the training department will remain in the unenviable and dispensable realm of the cost center, rather than becoming an integral, aligned business unit. Current business trends have demonstrated the risk inherent in this position. In times of reorganization, cost centers are often outsourced.

Table 2.1 will help you determine if your on-line learning investment is justified. The comparison of delivery methods is typically completed prior to an investment decision.

Table 2.1 looks at the costs and benefits inherent in each training delivery method; however, as we have already discussed, when you tie your training strategy to the business goals, you can look at cost-benefit

TABLE 2.1 Cost-Benefit Analysis and WBT Justification

DESCRIPTION	CLASSROOM TRAINING VERSUS E-LEARNING
Cost of training versus not training	With e-learning you can reach a wider audience, more often. Those employees who could not attend traditional training now have access to learning content.
Cost of "no-shows"	With traditional learning, a significant expense is incurred when scheduled trainees do not attend.
Reduced errors	Well-designed e-learning has proven more effective than traditional learning with better retention rates. Furthermore, with traditional classroom training inconsistent delivery is a hidden, but real, cost.
Reduced support costs	Once e-learning is established, it is less costly to maintain and support.
Travel and living expenses	These expenses are ongoing and costly with traditional classroom training.
Time off the job	Lost productivity is a large hidden expense with traditional classroom training. While trainees are traveling, they are not productive.
Development costs	WBT can be more costly to develop. Your analysis should include a long-term projection of ROI.
Delivery costs	Once your WBT is developed, it is much less costly to deliver than traditional training.
Material costs	Compare the cost of updating WBT content to that of republishing printed materials.
Infrastructure costs	This is can be a significant expense for WBT depending on the size of the project. Again, third-party hosting services may be considered.

another way. You can also estimate the impact training will have on your company's overall financial returns, or ROI, by looking beyond the specific costs and benefits of training delivery to the larger picture of improved job performance. If you can project that your training will improve job performance, you can project how improved job performance will affect the company's bottom line.

In a traditional cost-benefit analysis, there are three ways to increase your company's financial income. You can reduce production costs, increase the price per unit, or increase the number of units sold. In devel-

oping a solid cost-benefit analysis, consider how the training program and the resulting improved job performance can contribute to the following:

- Reduced production costs;
- Increase retail per unit;
- Increase sales volume.

Here's an example: Let's say your corporation (your customer) is a financial consulting firm. The company has a new system in place that streamlines the creation of financial plans for its customers and uses historical models to create accurate projections. But the planners find the system confusing and often return to their old spreadsheets. Your training program has been designed to simplify the process and provide ongoing informational support so that the financial planners will understand, use, and enjoy the new system.

- *Reduced production costs.* Because your WBT training program will get the planners to use a system that is faster and more efficient, you will reduce production costs by reducing production time, which in turn increases productivity. In addition, the whole premise of just-in-time training further increases productivity. With e-learning, not only can you offer training to hundreds of users whenever they need it, but new hires do not have to wait for training events. In short, you increase profit (the difference between cost and sales) even when the other two factors do not change.
- *Increased price per unit.* In the scenario outlined above, maximizing the usage of the new system results in a better product (more accurate financial plans). This improved product is more valuable to the consumer and may lead to a higher price per unit.
- *Increased sales volume.* Because the time it takes to produce a plan has been reduced, the company will be able to produce more plans per unit of time. And, because the plans will be more accurate, the company can expect an increase in consumer demand. More available units and more product demand result in increased unit sales—a time-honored method for increasing financial gain.

Estimating a financial return takes time and effort, but the analysis need not be as difficult as it appears. Your customer has a strategic plan in

place and wants you to provide training because it already has a return in mind. It needs to increase productivity or train employees on a new system. In many parallel ways, your customer has already done its own cost-benefit analysis. Have those conversations—investigate the corporation's needs—during the needs analysis phase. This will align your strategy with that of the corporation.

Even if you find that accurate numbers are hard to predict, you can still tie your training benefits to a financial return. For example, a key benefit to your proposal might be that your training would be more effective than the training currently in place. You could plan to conduct pre- and post-training surveys that ask questions like: At what point after training were you able to successfully complete (the task) on the job? When employees answer that this time has been reduced, the training program is definitely contributing to the corporation's bottom line.

We've talked about the components of a cost-benefit analysis. Now let's talk about timing and deliverables. Ultimately, your financial analysis will result in three deliverables, or outputs:

- A cost-benefit analysis and WBT justification;
- Detailed cost information;
- Project estimates.

Looking at the WBT development model, you can see that the cost-benefit analysis and WBT justification occurs during the initial analysis phase. It is a big-picture description of the cost benefits of your proposed WBT. It may include some estimates and examples, but it is not generally a line-by-line expense report. Rather, it is intended to get buy-in from the key stakeholders. This analysis feeds into the next phase in the development model: strategic planning. It is this analysis that you recap in your management summary, which is the topic of Section 3.2.

Detailed cost information needs to follow the conceptual, big-picture, financial analysis. These detailed costs are then rolled up into project estimates. For example, you may know the exact cost per hour for a graphic artist. You estimate how many hours of graphic design the project will require. This estimate is incorporated into your project estimates, and so on for every cost component of your WBT project. The detailed costs and project estimates make up the financial plan that you will prepare in Phase 2: Strategic planning. Strategic planning is the topic of Chapter 4.

Finally, while these three deliverables represent the stages of developing a financial plan, it is important to remember that with WBT, development phases are interdependent. Your cost-benefit analysis affects your training strategy and vice versa.

References

[1] Whalen, T., and D. Wright, *The Business Case for Web-Based Training*, Norwood, MA: Artech House, 2000.

[2] *Evaluating the Effectiveness and Return on Investment of E-Learning*, ASTD Research Report, 2000.

Part II
Phase 2: Strategic planning

3

Your overall WBT strategy

As a training professional, you already know that any training project should start with a plan, but if you are new to WBT, you may not have considered that a well-constructed strategic plan is even more paramount when using WBT (Figure 3.1). WBT often entails a significant up-front investment in time and money—the payback is the long-term ROI—and the size of that investment depends on the preliminary decisions regarding both the learning strategy and the implementation strategy.

The learning and implementation strategies, however, are interdependent. Your WBT learning strategy affects your WBT technical strategy, because only when you have an idea of where you are going can you think about how you will get there. Conversely, your implementation strategy affects your learning options. For example, it does no good to say you will stream video to your users' desktops if you don't have the resources to do so. Only when you have a clear, strategic plan for both learning and implementation can you estimate your investment in time, cost, and resources. In short, the strength of your overall strategic planning can make or break a WBT project.

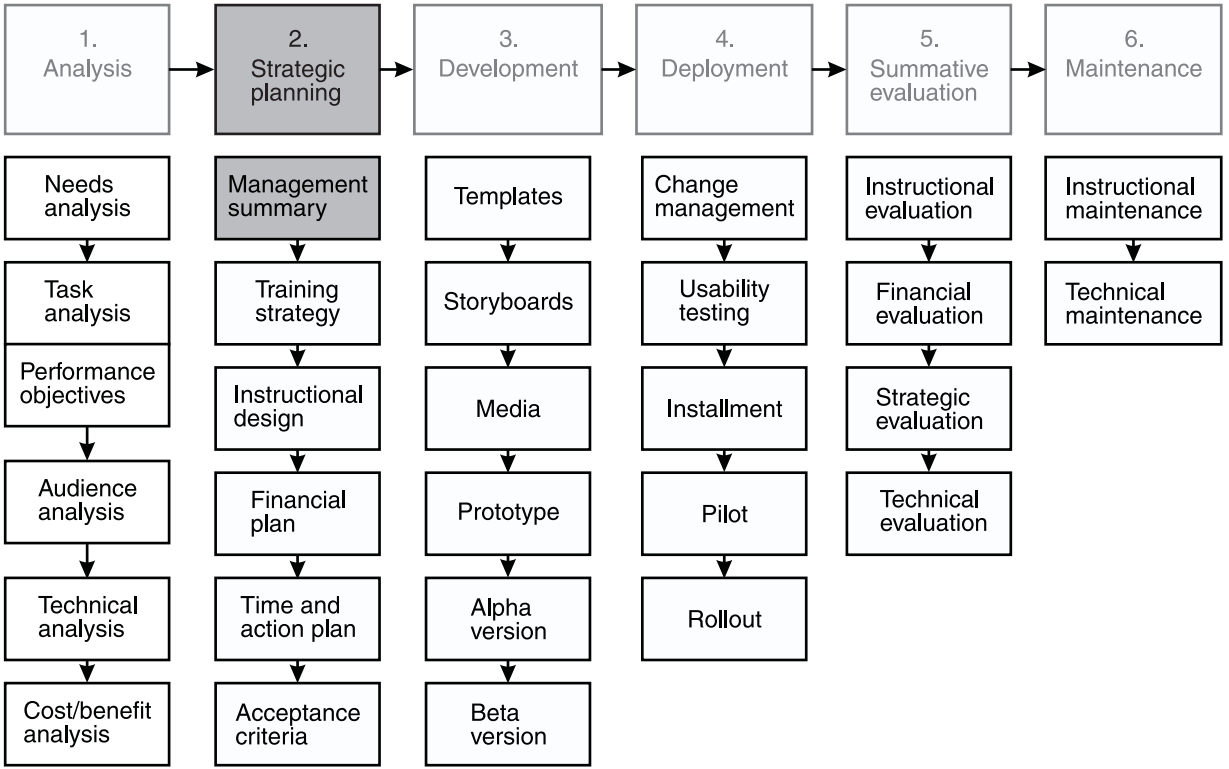

Figure 3.1 The strategic plan.

3.1 The overall WBT strategic plan

Your WBT strategic plan is based on your analyses; it specifies what you will do, how you will do it, and what resources you will require. The plan comprises two levels, the first being the "big-picture" snapshot presented to the key stakeholders, the second being the detailed plans that will be used as project management tools.

Specifically, the WBT strategic plan is a document that consists of the following:

1. Management summary;
2. Training strategy;
3. ISD document;
4. Financial plan;
5. Time and action plan;
6. Acceptance criteria.

The plan's first level includes the management summary presented to the chief stakeholders. The stakeholders are the management representing your customer—whether your customer is internal or external. You probably already generate such a summary for more traditional forms of training, but the components may be a bit different when using WBT. For example, management will want assurance that your plan aligns with the corporate strategy for both human and technological development. Because the initial cost of technologically delivered instruction is substantially higher than that of traditional stand-up training, the stakeholders will also want a quick estimate of the bottom line—the costs and the benefits. The purpose of the management summary is to get initial management buy-in before you expend valuable resources.

The plan's second level, its details, provides a "road map" for the development team and also specifies the budget. At this point you've had numerous planning meetings. Now, outline the conclusions so everyone on the team understands clearly what has been agreed upon! This may seem obvious, but with WBT, project coordination can be complex, depending on the size of the project. There are a significant number of development roles, and these team members need to share the same vision. For example, the writer, designer, and programmer need the same understanding of how the navigation will work. The customer (internal or

external) and the development team need a common understanding of the acceptance criteria. "Scope creep" is a common pitfall; a clear plan can help your team stay on course.

3.2 The management summary

Because the purpose of the management summary is to get management buy-in, it summarizes all of the other strategic plans. It is designed to give managers the key points without the detail, and as it provides a snapshot of the overall strategy, it is the topic of the rest of this chapter. When you understand the components of the management summary, you can understand conceptually the components of the entire strategic plan.

It is important to note that although the WBT development model shows the management summary as the first component of the strategic plan, it may be the first or last, depending on the size of the project. If you are creating one course in-house or using third-party courseware, it won't take long to complete the plan from overview to detail. Similarly, if the solutions are obvious, you can make the necessary decisions fairly quickly and move on. Under these conditions, you may chose to present the management summary once the detailed plans are fairly complete.

On the other hand, the complexity of the planning stage grows exponentially with the complexity of the project. For a large project, the detailed plans will take considerable time and effort. Under these circumstances, the management summary may be presented to management before all the detailed plans are complete. Remember that the purpose of the summary is to get buy-in. For a large WBT project, you will want to get preliminary buy-in before you spend weeks, or even months, completing detailed project plans that have not been approved.

The management summary presented to the chief stakeholders should include the following:

1. A summary of the conclusions drawn from the needs, task, audience, and technical analyses (see Chapters 1 and 2);
2. An overview of the training strategy;
3. An overview of the required resources—human and technical;
4. An estimate of the bottom line ROI.

3.2.1 Analysis summary

In the analysis summary segment of the management summary, briefly review the conclusions drawn from the needs analysis. Describe the performance gap and why training is the solution. If there are other factors affecting job performance, mention them here. It may be that only the chief stakeholders can address such issues as motivation, equipment, and so forth.

Provide a snapshot of your audience analysis. Remember to include the technical and instructional implications of your findings. For example, your audience is located all over the globe (necessitating asynchronous delivery); they all have access to the corporate intranet (making WBT a viable option); many speak English as their second language (ruling out Web conferencing); and so on.

The task analysis summary should be very high level, specifying what the users will be able to do on the job when they have completed the training. You may also wish to include a summary of prerequisites (what you are not training them to do).

Regarding the technical analysis, management will most likely want to whether the current infrastructure can support it and, if not, what infrastructure is needed. (Of course, they will want to know how much it will cost, but that is covered in the ROI overview.)

3.2.2 Training strategy summary

When preparing the management summary, remember that key decision-makers want concise information quickly: They are not interested in the details. For example, as a summary, the training strategy segment should not discuss what instructional techniques will be used. Save this level of detail for the detailed ISD document. The management summary should include a brief description of decisions made regarding the approach and the primary instructional cost factors.

For example, it should answer the following questions:

1. Where is the content coming from? What portion of the content will be purchased off the shelf, developed by a third party, purchased then customized, or developed in-house? (See Chapter 4 for a more detailed discussion of content acquisition.)
2. Will all of the instruction be delivered via WBT, or will it involve a hybrid delivery (see Section 2.1.2)?

3. Will the course structure be synchronous, asynchronous, or a combination of the two?

3.2.3 The WBT team overview

Management will also want to know what team members your proposed project will require. Your team members represent both financial and human resources. You need to know whom you will need and how you will recruit them. Of course, the size and complexity of the project will greatly affect the size of your team, but other factors will influence it as well.

In Section 3.1, the ISD document was listed as one component of the strategic plan—and the ISD document includes a description of the media to be used. In a traditional ISD model, the decisions regarding media come later in the development process; but technology changes that assumption. With WBT, instructional techniques and media decisions affect costs, time, and resource expenses. So the makeup of your team will depend not only on the size of your project, but also on the instructional techniques you will employ, the types of media you will use, and the way you will develop your media. The following sections list the most common WBT team members and suggest factors to consider when planning your team.

Project manager

Is the team large?

- If yes, you will need a project manager. The management of communications, sign-offs, schedules, and budgets is a full-time job.
- If no, a small team that works well together can agree on processes without a full-time project manager.

Instructional designer

Does your designer understand the basic principles of ISD, or are you using a design tool that can guide the designer through the process?

- If yes, you still need an instructional designer. Good ISD, or the absence of it, will make or break your project; however, if your designer understands the basic principles of effective instruction or is using a design tool such as Designer's Edge (Allen Communications), which walks the user through the process, you might use the SME to develop the basic structure. In that case an instructional

designer can act more as a "consultant" who suggests creative enhancements and improvements.

- If no, you need a dedicated instructional designer. Easy-to-use authoring software means that anyone can create WBT. The goods news is that development is being pushed down to the level of the SMEs and business units to save time and money traditionally spent on educating external courseware developers and on edits and rewrites. The bad news is that it is dangerous to assume that anyone who can create a Web site or use an authoring tool can create effective WBT. In recent years, experts in the field of training and development have been calling for a return to good ISD because multimedia technology is becoming so easy and ubiquitous that the message is getting lost in the media. The media is not the message.

Don't assume that the authoring tools are better than a good designer. Just because the software suggests a template, exercise, or course structure does not mean you have to use it, that you should use it, or that you cannot make it better. Does the "sexy" navigational interface provided in the template really help users navigate, or is it ambiguous? Do the exercises provided in the template really test for understanding? Will the suggested course structure be clear to your audience? An instructional designer can look at the tools from the learner's perspective and apply ISD principles to WBT (see Chapter 4).

Graphic designer

Does your project require high-end, custom graphics, such as 3D animation, sophisticated diagrams, or virtual reality?

- If yes, you will need a graphic artist.
- If no, you may be able to do most of the graphic design yourself. Graphics packages are getting easier to use. If you only need simple graphics that you can pull from an existing source (sales brochures, newsletters, annual reports, digital photos, purchased artwork, or manuals), or if most of your graphics will be easy-to-capture screen shots, you don't need a graphic artist. Nor will you need a graphic artist to scan an image or use a flow-charting tool. But before you decide you can do without a graphic artist, consider your answer to the following questions.

Does your designer understand the principles of good design?

- If yes, and if your needs are simple, you may not need a graphic artist.
- If no, it is important to realize that good graphic design entails more than pretty pictures. It supports the underlying structure and provides contextual cues to the user (see Section 7.5).

Does your designer understand the technical issues of displaying graphics on the Web?

- If yes, and if your needs are simple, you may not need a graphic artist.
- If no, it is important to realize that there are technical issues involved with displaying graphics on the Web. If your audience uses a variety of browsers, you may have color-shift problems, whereby the colors display differently depending on the browser. File size is another graphical issue that can directly impact performance. An experienced graphic artist can help your team successfully publish graphics on the Web.

Audio-video producer

If your training will require video, forget about the Web for a minute and just think about what your video will look like. Could you effectively tape it yourself, or do you already have existing video?

- If yes, you may not need a production studio. There are a number of easy-to-use, video-editing software packages on the market. For example, if you are video-taping a process that includes computer keystrokes, you could probably film and edit that in-house. There are even software packages that will capture keystrokes as you make them and create a standard electronic video, or audio-video interleave (AVI) file for you.
- If no, you will probably need a professional studio, a producer, and a scriptwriter. For example, let's say you are teaching negotiation skills, and you want to use video for role playing. You may want a detailed script and professional actors to ensure that the video is effective.

Is your audio simple narration?

- If yes, anyone with a good speaking voice can create audio files with easy-to-use desktop software.
- If no, as with the video, you may need to have the audio professionally scripted and produced.

Does your designer understand the technical issues involved with delivering video and audio on the Web?

- If yes, you may not need an audio-video producer.
- If no, the successful delivery of audio and video on the Web still depends largely on streaming media, plug-ins, or dedicated servers. Someone on the production team needs to understand the options for getting this media to the user without negatively impacting the performance of the program or the server.

Writer and editor

Will you use text, and does your designer understand the principles of effective technical writing?

- If yes, you may not need a writer, but you should still use an editor for QC.
- If no, you will need a writer and an editor experienced in technical communications. The principles of effective technical writing can—and should—be applied to on-line text, but somehow the democracy of the Web has caused a proliferation of bad grammar, unclear writing, and poor on-line documentation. Nothing can destroy the credibility of your site more quickly than information that is not easily understood, hard to find, or just plain wrong. The principles of effective technical writing are discussed in more detail in Section 7.9.

SME

Does your designer know the subject matter?

- If yes, the designer can create the courseware fairly independently, with perhaps SME review checkpoints along the way for QC.

- If no, you will need to estimate and budget the amount of time you will need from the existing experts.

Production manager

The production manager oversees all of the production staff members. This role is different from that of the project manager, although it requires similar management skills. The production manager oversees and coordinates the technical aspects of the actual product development. If your project is sufficiently ambitious to require a number of production personnel, you should consider hiring a production manager.

Production staff and programmers

Again, the size and scope of the project will determine the size of the production staff. If you are creating one course, the team will be small. One person can produce or assemble one course. At the other end of the spectrum, you might be creating multiple courses linking to additional informational resources and existing within the context of an integrated LMS. In that case, your team will be relatively large.

Quality controllers

In his article "Building a Winning WBT Team," Jeff Ubois writes, "Often quality control is assigned to the team as a whole, rather than to a particular person, which means that nobody really does it at all" [1]. If QC is not done until the project is almost completed, several things can happen:

- There is not enough money or time left to do a thorough job.
- No one is free to do it.
- Problems that may have been caught earlier have spread and are more embedded in the product.

In addition, if you are the audio producer and you have listened to the audio a hundred times, you will certainly cease to hear it the same way a user would. Uboise says, "Whoever is responsible for quality control needs to be able to look at the program with a fresh eye from the users' perspective even after repeated viewing" [1]. Thus, the QC effort must include early involvement by representative end users. It is the responsibility of the QC team to ensure that early prototypes are presented to such users and that data is systematically collected about their reactions to WBT compo-

nents, such as navigation controls and screen designs, and to other product characteristics, like ease of use.

Often the team analysis reveals that an individual member can function in multiple roles. For example, if your graphic needs are basic, you may have an Instructional Designer who can satisfy the requirements. You may have an SME who can also use a basic authoring tool and is a good technical writer. At other times you may require a specialist.

Table 3.1 provides a checklist that can help you build your WBT team. For each role listed, use the questions as a guide to determine if you need to add a member to your team.

TABLE 3.1 A WBT Team Checklist

ROLE	QUESTIONS	YES/NO	CHECKBOX
Project manager	Is the project small?		❑
Instructional designer	Does your designer understand the basic principles of instructional design, or are you using a design tool that can guide your designer through the process?		❑
Graphic designer	Does your designer have the technical knowledge to develop the necessary graphics?		❑
	Does your designer understand the principles of good design?		❑
Audio-video producer	If your training requires video, can you effectively tape it yourself, or do you already have video you can edit?		❑
	Is your audio simple narration?		❑
Writer and editor	Does your designer understand the principles of effective technical writing?		❑
SME	Does your designer know the subject matter?		❑
Production manager	Does your project have only one or two team members?		❑
Production staff and programmers	Are you using custom programming to build elements of your WBT?		❑
Quality controllers	Is there someone assigned to QC that can look at your WBT from a fresh user perspective?		❑

For every no, place a check in the checkbox. You will need to add a member to your team.

3.2.4 Technical resources overview

There are two levels of technical support: the initial support you will need to get your training program up and running, and ongoing support. Following the WBT development model, you completed a technical analysis in Chapter 2. For management, you will want to describe your technical needs briefly and summarize what they entail in terms of resource expenditures—human and technical.

3.2.5 Estimated ROI

Finally, the management summary should conclude with the estimated ROI. At this level, the ROI includes an estimate of the initial investment, the break-even point (the point at which cost is recouped by profit), and a projection of future returns. All of your analyses come together in the estimated ROI, which is one of the primary reasons you need to conduct these analyses up front. You can't estimate how much time and money will be required until you have some idea of where you are going, how you will get there, and who and what the process will require.

While the ROI summary or overview presented to the chief stakeholders is based on the detailed financial plans, the sequence in which these plans and summaries are completed is not set in stone and can depend on the scope of the project. Following the WBT development model, at this point you have completed your cost-benefit analysis, as discussed in Chapter 2. For a small project your analysis may be fairly complete. If the project is large, however, you may not have developed a detailed financial strategy. You know the cost-benefit estimates—you generated them in your analysis to see if WBT was a cost-effective choice—but you have not yet fleshed out all of the details. When the project is large, you need to present an overview to the stakeholders to get initial buy-in. Then, once you get approval to move forward, you can flesh out the details. Cost and benefit factors are discussed in detail in Section 6.1.

Practical tip: *The management summary presented to the chief stakeholders should include the following:*

1. *A summary of the conclusions drawn from the needs, task, audience, and technical analyses;*

2. *An brief overview of the training strategy;*
3. *An brief overview of the required resources;*
4. *An estimate of the bottom-line ROI.*

Remember, the management summary is an overview of your detailed strategic plan. That plan represents a stake in the ground, a planned direction based on your prior analyses. Here's some advice to consider: Do not get distracted by the myriad of e-learning options. Keep your plan simple. Ask yourself, What is the least the learners need to know to perform the desired task at the desired level? Then, ask yourself, What is the smallest investment in technology necessary to be meet our objectives? The bells and whistles that can add interest and interaction to your WBT can also overwhelm the user, bury your message, and cost time and money in unnecessary development.

The selection of instructional techniques and the resulting media implications are discussed in more detail in Chapter 6.

Reference

[1] Ubois, J., "Building a Winning WBT Team," *Inside Technology Training*, July/August 1999.

4

The training strategy

Your WBT strategic plan is based on your analyses (see Figure 4.1). It specifies what you will do, how you will do it, and what resources it will require. Following the WBT development model, the management summary discussed in Chapter 3 presented a snapshot of the plan to the key stakeholders in order to get preliminary buy-in. It stated your general direction. Now you must develop the detailed WBT plans that will serve as the roadmaps to your destination.

Specifically, your WBT strategic plan includes the following documents:

1. Training strategy;
2. ISD document;
3. Financial plan;
4. Time and action plan;
5. Acceptance criteria.

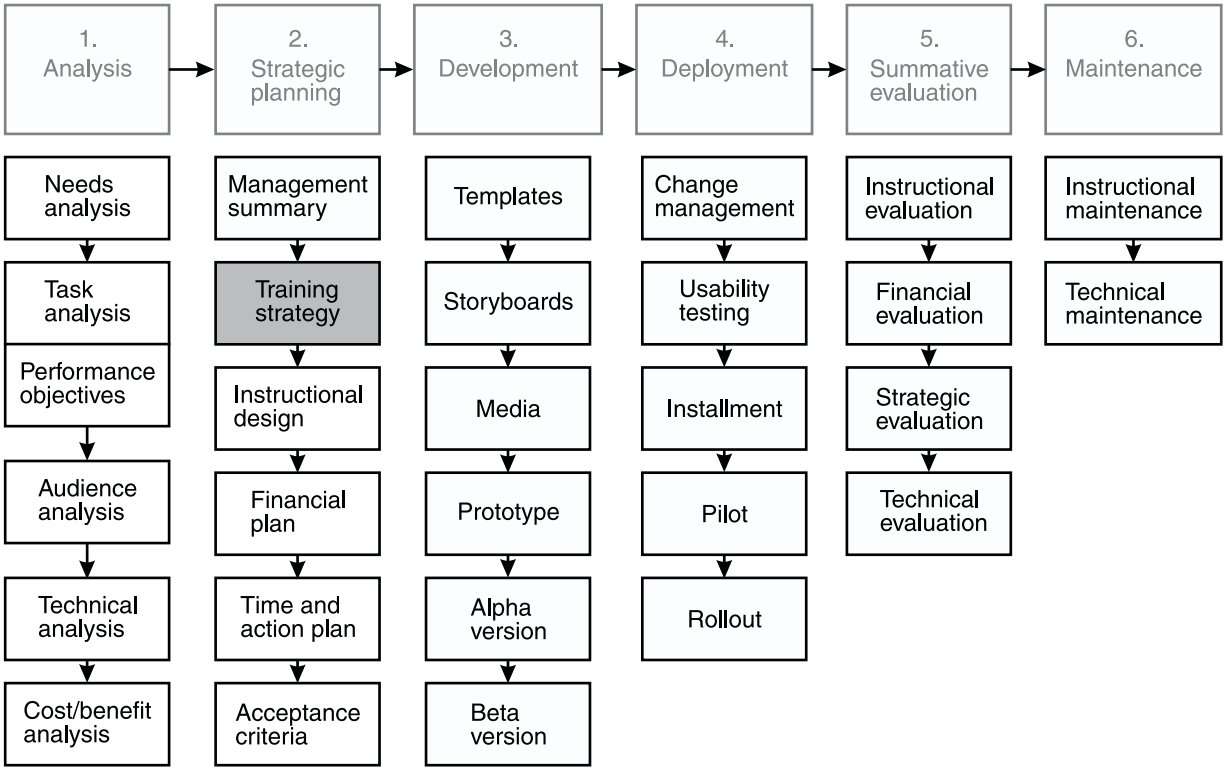

Figure 4.1 The detailed WBT plans.

4.1 The training strategy

Both the training strategy and the ISD document address the instructional strategy. The two documents differ in scope: The former shows the "big picture;" the latter, the detailed specifications. The WBT training strategy document describes the entire training package, provides a broad context for the individual courseware, and addresses the more global management issues. Typically, it is no more than one or two pages long. The ISD document specifies detailed courseware design decisions to the development team and can be quite elaborate, depending on the size of the project. It is the training strategy that states the strategic decisions you have made based on your analysis and should be recapped in the management summary.

When you are creating your WBT training strategy, you will need to make the following strategic decisions:

1. What types of learning tools will be available (WBT, CD-ROM, Web conferencing, classroom, or hybrid combinations; see http://www.dr-david-stone.com for a detailed discussion of these tools).
2. Where will the WBT courseware come from (third-party off-the-shelf, third-party customized, or developed in-house)?
3. How will you manage your WBT (manually, databases, an LMS)?
4. Will the WBT interface with any other systems [human resources (HR) databases, system databases, knowledge management systems (KMS), EPSSs], and if so, how?

4.2 How will WBT fit into the larger training strategy?

Your training strategy should state the integrated training solution. This means that the needs of the learner have determined the types of training tools that will be available. Your WBT may be integrated with a mentoring program, a workshop, an EPSS, job aids, or all of these tools. State in your training strategy document how your WBT fits into the larger training strategy.

4.3 Where will the WBT courseware come from?

The decision about where to procure WBT courseware will depend on the objectives revealed during the task-performance analysis. Is some or all of the subject matter generic, or is it proprietary? How much courseware is required, and what is the time frame? The following guidelines will help you decide whether to develop your WBT courseware in-house or to purchase it from a third party.

Factors favoring third-party vendors are as follows:

- If much of the instructional need is generic, it may be easier and faster to purchase the courseware from a third-party vendor, who will often tailor their generic courseware to suit the specific needs of an organization.
- If the instructional need is proprietary, generic courses will not be available. The decision then becomes whether to use a third party to develop the course, or to develop it in-house. Depending on the time frame and your resources, you will need to decide which route is more cost-effective.
- Benjamin Bloom created a taxonomy for categorizing the level of abstraction in educational content. The taxonomy provides a good reference point for selecting third-party content and integrating it with the WBT that you develop internally. For example, you will need to understand whether the content that you purchase will ask learners to "list, name, or identify"; "summarize, describe, or discuss"; "apply, demonstrate, or discover"; "analyze, explain, or infer"; "integrate, compose, or generalize"; or "assess, explain, or conclude." Terms such as "list" are at the low end of the abstraction scale, while a term like "explain" is at the high end.

You will need to ensure that the level of abstraction in the content in all your WBT is appropriate for your learners and that the tests and measurements used to assess learner performance are appropriate for the level of abstraction in that content. If the content is designed to teach the application of sophisticated skills (such as flying advanced aircraft), then the correct assessment of such skills will require not only the knowledge of each cockpit instrument and its function, but also how to use cockpit controls in concert with those instruments to make a successful landing.

Practical tip: *It is important to bear copyright and code-ownership issues in mind when using an outside vendor to develop WBT. You will want to ensure that you not only own the code developed by another company as "work for hire," but that you have a complete copy of the commented source code, along with access to tools that you can use to edit that code in the future. (See our Web site at http://www.dr-david-stone.com for information about authoring tools.)*

Factors favoring in-house development are as follows:

- If rapid development is a priority, you may decide to develop the WBT courseware in-house, provided that the expertise exists internally. (See Chapter 3 for staffing recommendations.) While a common rule of thumb used to allot 400 to 1,000 hours of development time for one hour of CBT instruction, a nonprogrammable authoring tool can now cut that time to less than half. In-house development can save time because the tools are faster and easier to use.
- Because today's WBT authoring tools are easy to use, some development can be pushed down to the SMEs and business units. Time is not spent on teaching outside developers the content, and the entire editing process is expedited because both the volume of edits and the amount of time it takes to complete each edit is reduced. For example, if you are producing the audio in-house and you need an edit, you can simply rerecord it. If the audio is produced by an outside studio, you will need to communicate the edit to the writers, the writers will have to rewrite the script, and the producers will have to reschedule the studio and voice talent.
- If the course is fairly straightforward, it will cost you less to develop it in-house than it will to pay a third-party vendor to develop it. You are cutting out the middleman.

Practical tip*: The time estimates above are rough guidelines only. When estimating your own development time, remember to add in a certain percentage to pad for errors and project delays. If this is your first WBT project, add an additional percentage to compensate for a learning curve. In addition, you will want to err on the high side as the level of technical complexity increases.*

Here's an example of a rapid development estimate. Let's say you are developing two hours of instruction in-house using a relatively simple authoring tool with simple audio and graphics. You estimate 300 hours for development (150 development hours per hour of instruction) and add 30% because you are new to WBT for a total of 390 hours.

4.4 How will you manage your WBT?

As you develop your WBT training strategy, you also need to consider how the WBT courseware will be managed. Based on the needs assessment (see Section 1.1.3), you determined how the customer will perform the following administrative functions:

1. Enrolling students;
2. Tracking performance;
3. Prescribing courses;
4. Analyzing course effectiveness.

Whether you have decided to manage your WBT manually or to use an LMS, the management of your WBT training should be described in your WBT training strategy.

4.5 How will the WBT courseware integrate with other systems?

There are a number of outside systems your courseware can interface with. For example, you could link to a training database, an HR database, an EPSS, or a KMS. Again, your WBT training strategy should describe how you will accomplish the integration, including any issues and their resolution. You will want to make note of the names and contact information for key staff in the departments that own these other systems.

5

The ISD document

Once you have made your high-level training strategy decisions and recapped them in the training strategy document, you are ready to create the ISD document (see Figure 5.1). The ISD document describes in detail the design decisions drawn from your performance-task analysis. The document should include the following:

1. Unit objectives;
2. Assessment criteria;
3. Course outline;
4. Course or site map (particularly if there are multiple lessons);
5. Navigational strategies;
6. Instructional techniques.

The performance-task analysis determines what to teach; the ISD determines how to teach it.

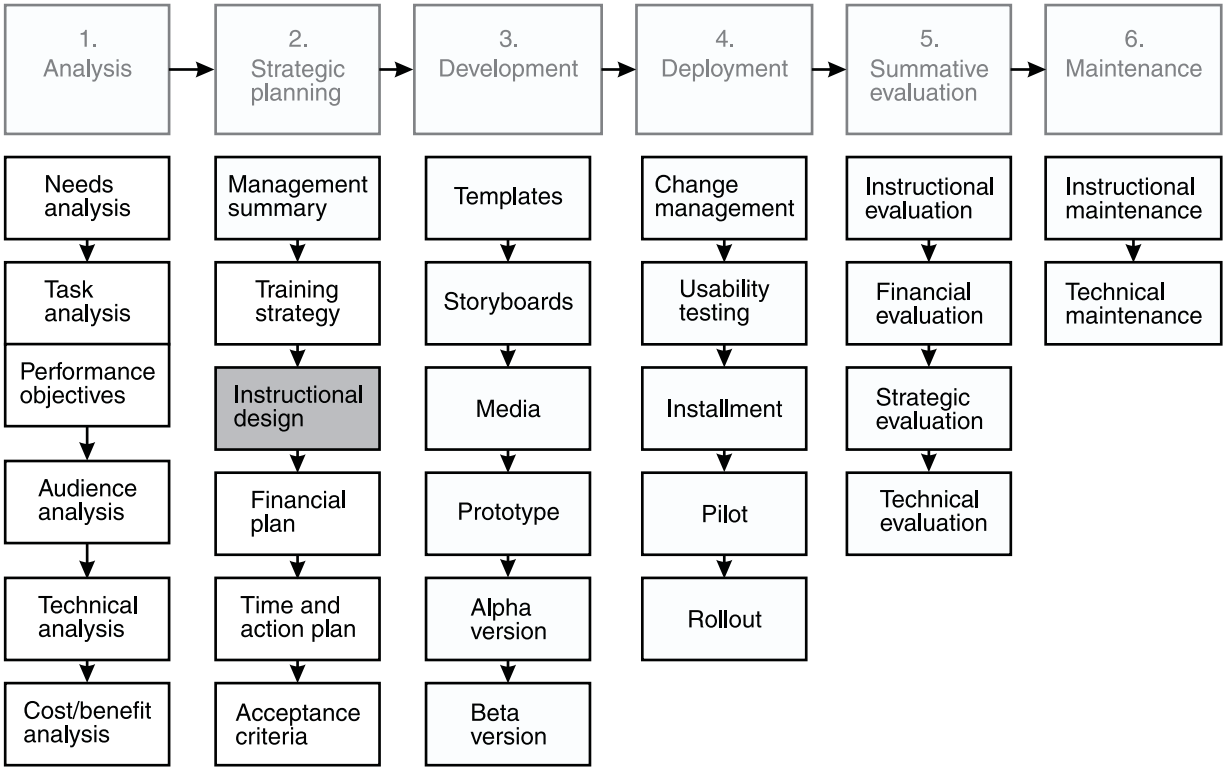

Figure 5.1 Creating the ISD document.

5.1 WBT unit objectives

During the task analysis the tasks and performances required to achieve the final objective were delineated and then grouped into logical units of instruction. Remember the performance objectives example from Chapter 1? In that example, a specific performance objective became one unit of instruction: "How to Input the Data."

The ISD document should specify the subordinate, detailed objectives that enable the learner to perform this higher-level unit objective. For example, the instructional designer may determine that in order to input the data successfully, the learner must be able to do three things:

1. Identify and explain the purpose of each mandatory field;
2. Identify which fields are typed entries without validation, which are typed entries with validation, and which are filled from drop-down menus;
3. Read a variety of customer interviews, interpret the data in each, and correctly input the data into each type of field.

These detailed objectives should be clearly identified and defined in your ISD document. When the document is reviewed with the stakeholders, you can ask, Will your performance objectives be met if the learner can meet these learning objectives? When it is reviewed with your SMEs, you can ask, Is this the least the learners need to know to perform this job?

For any type of training, it is important to remember that meaningful learning objectives are reality-based. Do the learning objectives measure that the trainees can memorize something under specific conditions or that they can creatively problem-solve in a variety of real-life conditions? When you develop WBT, the simulation of real conditions represents a unique challenge. Still, reality-based simulation is the difference between ineffective and effective WBT. How well does the WBT simulate the real world? Some WBT has been criticized in the past because it does not provide real-life simulation. But this is where ISD creativity comes into play. Simulation is discussed in more detail in Section 5.6.

A simulation might allow the learner to experience what it is like to receive a telephone call from an irate customer by listening to a recording of an actor's voice. The learner might then be asked to select from several potential responses with each response branching to a new and different

recording. The right series of choices by the learner would lead to a satisfied client and the wrong responses might lead to a dissatisfied client.

Simulations differ from role playing in that role-playing scenarios typically require that another learner or instructor directly participate in an interaction mediated by the computer. Role playing allows a much more realistic set of interactions because they are more flexible than simulations. After all, human beings can improvise and adapt freely in real time. The drawback to role playing, of course, is that it requires that someone else be available to work with the student.

Although the ISD document breaks the larger unit objectives down into more detailed objectives, it is important to remember that planning decisions cannot be made in a vacuum. Your objectives affect your instructional techniques, your techniques determine your media choices, and your media choices influence your cost-benefit analysis; they are all interdependent. So while you may present the management summary to the stakeholders before the ISD document is complete, you should at least have a unit objective for each learning module so as to have a sense not only of where you are going, but how you will get there.

Practical tip: *Start with reality-based learning objectives. As you design your course, keep reminding yourself of these objectives. That way your WBT will be reality-based as well.*

Table 5.1 provides a small sampling of some unit objectives from a much larger, multicourse program. Notice that nonscored exercises are provided for practice. The actual assessment comes later in a mastery exercise at the end of the lesson.

5.2 Assessment criteria

The traditional ISD model recommends that the designer design the test questions before writing the content—a logical progression from the unit objectives. The assessment criteria describe how you will measure your unit objectives. Once the measurement is established, the content plan describes how you will instruct learners so that they can master the required assessment criteria. You should determine the destination before you map out how the route; ask yourself, What will the learner do at the end of the lesson to demonstrate mastery of the desired performance at the desired level under the specified conditions?

TABLE 5.1 An Extract from an ISD Document: Unit Objectives

I. Module 2: Item	N/A (title screen)
A. How to complete the item header record	N/A (objectives SCREEN)
1. The item header (lesson screens)	Describe the business purpose and business requirements of every header field used by Company X (conceptual).
	Identify which header fields are mandatory and which are optional (conceptual).
	Identify which fields are conditional (conceptual).
	Apply the business rules to construct a header record according to a specified scenario with 100% accuracy (practical).
	Query for records (practical).
2. The item header (exercise)	
a. Practical exercise	Provides practice and feedback for the practical objectives within the item header lesson.
	Have student create an item header according to the business requirements inherent to the scenario provided.
b. Conceptual exercise	Provides practice and feedback for the conceptual objectives within the item header lesson.
	Describe the business purpose and business requirements of every header field used by Company X (conceptual).
	Identify which header fields are mandatory and which are optional (conceptual).
	Identify which fields are conditional (conceptual).
B. Item mastery test	N/A (objectives screen)
1. Item conceptual scored test (exercise screens)	Demonstrate an understanding of the key concepts of item.
	Identify errors in incorrect records (score required).
2. Item practical scored test (exercise screen and training database)	Have student demonstrate ability to complete an item record and all associated records according to a specified scenario with 100% accuracy.

This assessment-before-content model is extremely valuable when planning ISD for WBT for two reasons:

1. The assessment criteria will have significant bearing on the media and design choices made during content development.
2. Determining the assessment criteria up-front will help set clear parameters that help to define and contain the content.

For example, if the unit objectives include performing a task within a certain time limit, that time limit will be part of your assessment criteria. But your content probably needs to provide practice exercises and feedback that allow the learners to hone their skills in preparation for the mastery test. Thus, the assessment criteria will affect the content design.

The assessment criteria can also restrict the content. It is tempting to provide the learner with too much information. SMEs not familiar with the principles of ISD often make this mistake: They want to tell the learner everything they know about the topic. Too much information is detrimental to any instruction, but it can be deadly for WBT. For instance, the authors have experience working with SMEs in aviation who have attempted to include more information than is appropriate in WBT lessons. Students have found such lessons confusing and more time-consuming because extraneous information has obscured the concepts, facts, procedures, and principles to be taught. WBT designers should strive to give learners what they need and only what they need.

In addition to experts who want to overload the content with too much information, the nature of WBT presents yet another challenge. Because it is a fun and exciting delivery method, designers and developers may be tempted to overload the courseware with bells and whistles that do not contribute to the learning objectives. Establishing the assessment criteria before the content helps you contain costs and deliver the product on time.

The types of assessments you use will also make your WBT more or less effective. Some critics of computer-based training (CBT) feel that the testing options within a computer environment are limited and somewhat ineffective. In the past, on-line testing has too often consisted chiefly of fill-in-the-blank, multiple-choice, and matching exercises. We would argue, however, that testing within a WBT can be quite effective for a number of reasons.

1. Such traditional testing methods as fill-in-the-blank can be used effectively if the questions are carefully designed to measure the achievement of the objectives truly.
2. Creative WBT design can go beyond these traditional methods through the use of test items that involve interactive simulations of the software or mechanical systems being taught. Successful completion of a procedure, for example, using a simulation is closer to the criterion behavior than correctly answering a multiple-choice question.
3. New technology offers more sophisticated testing options. Adaptive testing, developed by Kikumi Tatsuoka (now at the Educational Testing Service, in Princeton, New Jersey) presents the next test item based on the student's answers to the previous items, thus tailoring the test to the student in real time. This approach has the advantage of reducing tests length and measuring student knowledge more accurately.

Assessment methods are discussed in detail in Section 5.6.

5.3 Course outline

The course outline provides a logical sequence to your WBT content. There are a number of ways to sequence your units of instruction. Here are some sequencing tips that can help you maximize the effectiveness of your WBT presentation:

- Whole-part-whole sequencing provides the big picture overview, then details each component, then brings the pieces back together again into a cohesive whole.
- Logical job sequencing delivers the instruction in the same order that job tasks are performed. Figure 5.5 shows a lesson menu sequenced by job task.
- Easiest-to-most-complex sequencing builds the learner's expertise by beginning with a simple task and working up to a more complex proficiency.

- Most-complex-to-easiest allows the learner to practice the critical task again and again. For example, in a flight simulation you could allow learners to "land the plane" without any instruction, then show them how to use the instrument panel and allow them to try again. Based on the authors' experience in developing WBT for F/A-18 pilots, S-3A pilots, and T-38 pilots, most student pilots will prefer to extract the facts, concepts, procedures, and principles of flying an aircraft from simulations of the aircraft. They will use the direct exposition of this content only when experience with the simulation makes it clear that they need it. This appears to be an efficient learning strategy for this population of learners.

Course outlines are also living documentation tools that can help you track your content as it is developed. Course outlines works well because they develop a hierarchy as levels of information are established. For example, in the ISD model you first determine your performance objectives, then logically group them into units of instruction. These units are therefore based on a higher-level performance or task and can reach a high level of priority within the course outline. As each task is broken down into its detailed components, additional layers are added to the outline. The final outline will give you a way to estimate the length of the course and the page or screen count.

Table 5.2 provides a small sample course outline from a program consisting of several courses. The first level of the outline represents a course, the second represents a lesson within the course, and the third represents the tasks—each of which could be broken down further into subtasks—within each lesson.

5.4 Course map

The course map is a visual depiction of the course outline. It helps you visualize the physical layout of your course or training program. Figure 5.2 shows a sample map of a WBT training program. There are seven lessons in the course. The map shows the details for the second lesson. (See http://www.dr-david-stone.com for more information about learning maps, including course maps.)

TABLE 5.2 An Extract from a Course Outline

Module 2: Item basics (title)
A. Item overview (objectives screens)
1. Item overview (lessons screens)
2. Item overview exercise (concepts—exercise screen)
B. How to complete the item header record (objectives screen)
1. The item header (lesson screens)
2. The item header (exercise)
a. Practical—(within training database)
b. Conceptual—(exercise screen)
C. How to complete the item detail records (objectives screen)
1. Detail record overview (lesson screens)
2. The detail line (lesson screens)
3. Packing (lesson screens)
a. Complete the header
b. Specify the carton quantities
c. Specify the carton dimensions
d. Specify the weight
4. Costing (lesson screens)
5. Detail records exercise
a. Records practical exercise—(within training database)
b. Records conceptual exercise (exercise screen)
D. Item review (objectives screen)
1. Item review (lesson screens)
E. Item basics mastery test (objectives screen)
1. Item basics practical scored test (within training database)
2. Item basics conceptual scored test (exercise screen)

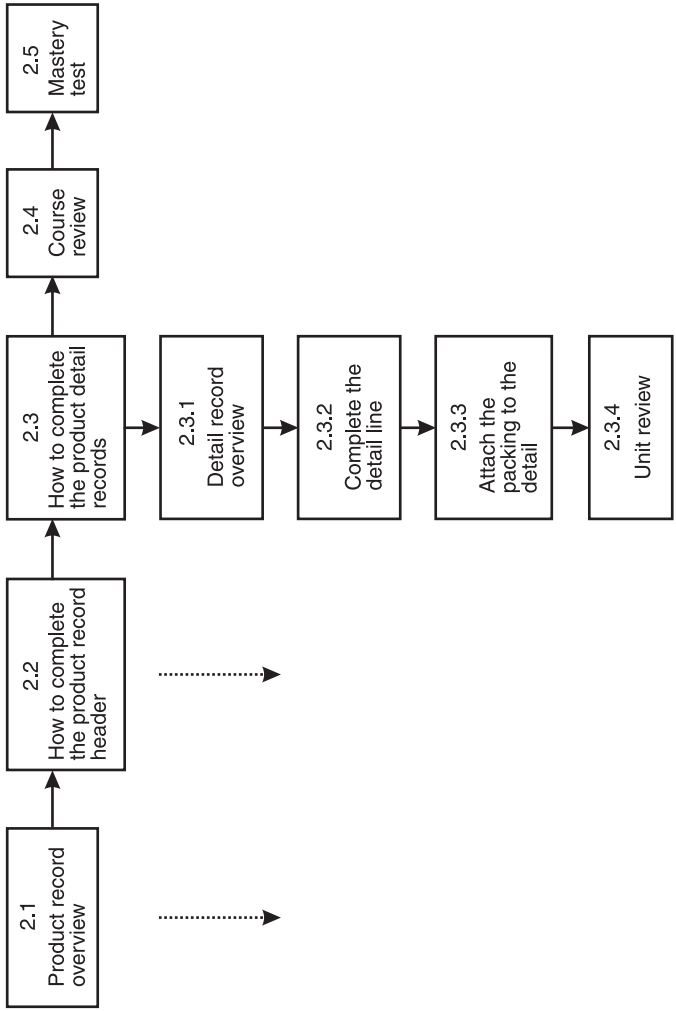

Figure 5.2 A course map.

5.5 Navigational strategies

Establishing a navigational strategy is a vital part of the strategic planning process. When you are designing WBT, the factors you will need to consider can again be categorized as human or technical. You will want to ensure that all those using the WBT are able to access the instruction easily and use it efficiently.

If you and your team have the luxury of establishing the standards for the "look and feel" of the WBT to be used in your organization, you have an opportunity to create a consistent graphical user interface. That is, you can establish standards for the colors, fonts, icons, and other WBT components so that users encounter an easy-to-use interface that is consistent across all of your WBT. You may also wish to embed instructional components in your basic navigational interface so that users can always select to go, for instance, to a glossary, a search function, or a lesson summary.

Of course, the key to navigation is usability, which is determined by the user. But not all users are created equal. Consider the data discovered in your audience analysis to determine if there are user characteristics that can affect navigation.

- *Are your users savvy Web- and PC-technology users, or are they relatively inexperienced?* If your users fall into the latter group, you may need to keep the navigation somewhat linear, at least until they are comfortable with the format. You may wish to provide additional support, such as a "Getting Started" live demonstration, on-line coaching, or internal help functions.
- *Do your users have any preexisting expectations?* For example, they may already be using a particular interface and expect new courseware to work the same way, in which case you will want to design a navigational interface that is part of a consistent whole. Or, they may be used to high-end CD-ROMs and you will need to prepare them for the differences they will encounter with WBT. Most WBT (given today's low bandwidth network environments) does not provide the high-quality audio and video or the rapid response times typical of high-end CD-ROM-based instruction. Consider what you discovered in your technical analysis to determine if there are technical factors that can affect navigation.

- *Will all of your learners use the same platform or browser?* If not, you will need to plan navigation that will work in all environments, including the least technologically advanced.
- *Will your courseware link to other informational resources, such as paper documentation, CD-ROM, conferencing software, and external Web sites?* If so, you need to plan how users will get there, how they will get back, and how you will maintain the links.
- *Will your courses be incorporated into an LMS or KMS?* If so, you need to plan how you will link to the system.

The navigational interface can appear at the bottom of the page, the top of the page, or to one side of the page. It can be represented visually by a text-based table of contents, graphical icons, or a graphic image map.

Often, WBT authoring software comes with a navigational graphic interface already built in, either as part of a template or as objects you can add to a page. These existing interfaces, however, may not be your best choice. For example, if your users have to think for more than a second about what a button does, consider a more obvious solution. ("Gee, that 3D backward arrow sure is pretty, but does it take me to the previous page in the sequence, or back to the page I came from?")

Navigational exercise

Here are two different navigational bars. Figure 5.3 shows a navigational bar from a popular authoring tool. Figure 5.4 shows an interface easily created by modifying existing objects within that tool. Show each individually to some of your users. Ask your users to describe what each button does and when and why they would it. For instance, when or why would a user jump to the last page in the course, or how would a user exit the course?

Figure 5.3 The template's default navigational bar.

Figure 5.4 The replacement navigational bar.

The following tips, based on extensive usability research, can improve the usability of your navigational interface:

1. Make the navigational interface consistent from page to page, lesson to lesson, and—as much as possible—course to course.
2. If you are using buttons or icons, label them as shown in Figure 5.4.
3. Provide rollovers, but do not assume that they will work for every browser configuration.
4. Keep the navigational interface visible at all times. Do not allow users to scroll to the bottom of the page only to find they must return to the top of the page to navigate.
5. Consider carefully how much navigation your site needs to be effective. For example, a back button on every page can quickly confuse and lose the learner—the path to where they are can get very convoluted.
6. Design your courseware navigation so that it is easily distinguished from the navigation of the browser.
7. If your users will have the option of turning off the graphics or audio, incorporate tags in your design so that they can identify the missing content.
8. Provide visual elements to remind the reader of the site's structural hierarchy and where they are within it. (The use of visuals as content clues is discussed in more detail within Chapter 3.)
9. Do not place a high-risk button next to an often-used button. For example, do not place the "Exit" button adjacent to the "Next" button.

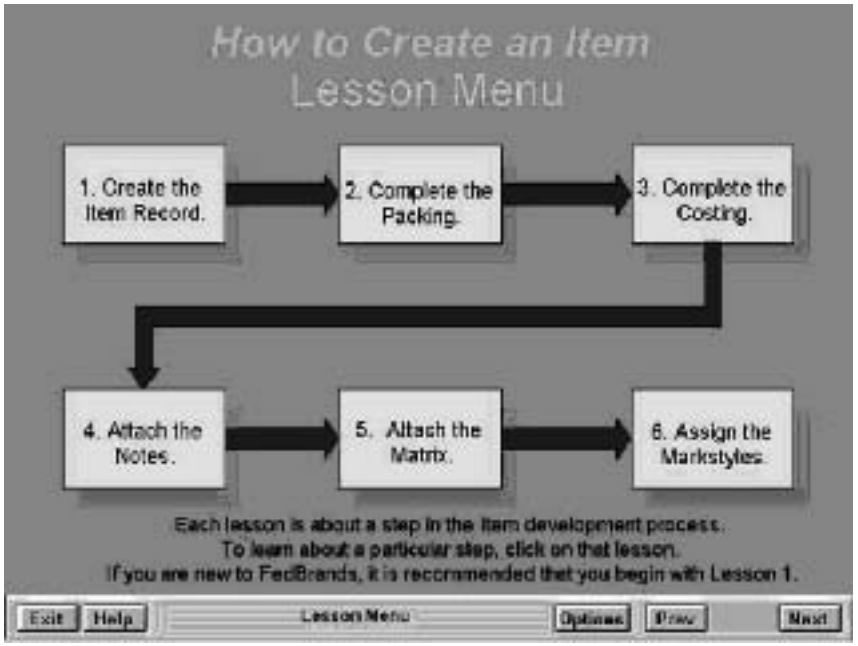

Figure 5.5 A process-based menu.

Links to additional information about Web usability are provided on our Web site.

Figure 5.5 shows a menu that works on a number of levels.

1. It allows the user to access the lessons linearly or nonlinearly.
2. It is a teaching tool. Whenever users go to the menu, they are reminded of the "big picture"— how each lesson fits into the overall process.

Practical tip: *The image map shown in Figure 5.5 was created without using sophisticated graphic tools or complex HTML. The graphic was created in PowerPoint and then copied into a graphics-editing application where it was saved in a graphic file format (see Section 8.3). The hot spots were created within the WBT authoring application.*

Figure 5.6 shows a tabbed metaphor used for navigation. Notice how clean and clear the navigational interface is.

Figure 5.6 A tabbed navigation metaphor. (Courtesy of: http://www.learning-byte.com.)

Once you have determined your navigational parameters, specify them in your ISD document. A paper mock-up can be incorporated into the document. You may have different navigational features for different types of screens.

5.6 Instructional techniques

Instructional technique decisions should be part of the strategic planning that occurs before any development takes place. Remember that the instructional techniques you choose will influence your media choices and your media choices will affect the resources required, which will in turn affect development time and costs.

Typically, a description of both the instructional techniques and the media would appear within the ISD document so that writers and developers know what techniques they will use and what media options are available for deploying those techniques. For example, you would not

want a writer to waste time creating a storyboard that calls for video (the media) to enable role playing (the technique) when video is not an option.

As you decide which techniques to use, remember that one of the key benefits of WBT is the ability to create interactive experiences for the learner and that the effectiveness of WBT is quite limited without interaction. True interactivity is a design characteristic that engages learners with the subject matter so that they make decisions and choices. It is not navigation, hot text, or animation. As you consider the various instructional techniques, consider how they will engage the learner and at what level.

Learning styles are yet another important consideration when selecting appropriate instructional techniques. Think again about your audience analysis. What do you know about the users' learning styles? While many learning theorists believe that every adult learner uses every learning style to some degree, most adults favor one or two styles. To some extent you can predict by job role what type of instruction your learners prefer. For instance, studies have shown that engineering types generally prefer hands-on experimentation, while human resources types generally prefer collaboration and human interaction. Can you imagine taking a group of actors through sensitivity training via asynchronous WBT? That said, good instruction usually contains a variety of techniques that appeal to a variety of learning styles and moves the user through a number of different learning experiences.

To help you select the instructional techniques and media that you will use in your WBT, the following sections list a number of instructional techniques that offer some form of interaction; however, creative designers may find other techniques beyond what is listed here. For each technique listed, we offer suggestions regarding how the technique can be used effectively on-line and what media can be used to implement that technique.

Instructional theories, such as the Component Display theory, prescribe specific instructional techniques for different types of learning objectives. (See http://www.dr-david-stone.com for more information.)

5.6.1 Option 1: Demonstration followed by practice

This is a very effective technique that works well in an on-line learning environment. It is particularly suited for asynchronous delivery in which the learner accesses the WBT independently, but it could be used within the context of synchronous, or real-time, learning as well. With independent learning the user is free to learn from his or her mistakes, and there is

no pressure to perform in front of a peer group. This is an easy way to simulate the real-world environment and an effective means for getting the information into the user's personal schema or cognitive memory. Think about it. If you make a mistake, figure out what you did wrong, and then perform the task correctly, you are more likely to remember the correct procedure than if you hear or read a detailed set of instructions without trying them for yourself. Indeed, for many learners, experimentation and hands-on practice are the preferred learning style. As good WBT appeals to a wide variety of learning styles, demonstration followed by practice is a good way to appeal to the hands-on learner. Furthermore, when practice occurs within an asynchronous venue, the independent learner can take as little or as much time as is needed to complete the task successfully. This is a key benefit of learner-centered instruction.

Which WBT media can be used for demonstration followed by practice?

- *Video.* Within an asynchronous environment, video can be used for both demonstration and practice. For example, if the topic is customer service, you can demonstrate the desired behavior and then allow the learner to practice by interacting with a series of video clips that play in response to specific learner decisions. (To simulate the real world, you might want to plan follow-up activities beyond the WBT.)
- *Web conferencing.* Within a synchronous environment, the way Web conferencing can be used depends on what you are demonstrating. For example, if you are demonstrating role playing, you can use the audio exchange feature to demonstrate a hypothetical conversation, and then have the students perform a collaborative exercise as practice. If you are demonstrating a system application, the application-sharing feature of most Web conferencing software will allow the facilitator, or conference leader, to demonstrate and then share control of the application with the learners so that they can demonstrate their understanding to the facilitator.
- *Graphics and text.* Whether the environment is asynchronous or synchronous, a series of static sequential graphics can demonstrate processes, a series of steps, and so forth. Text can be used to provide instructions and support the graphics. The trick is in giving the user practice. "Practicing" with graphics and text is not truly practice, unless they simulate the real environment. Many programs that do

mimic the real world with varying degrees of success have been designed. See [1] for a discussion of how graphics and text can be used to simulate maintenance of military systems.

- *Animation.* Animation can also be used to demonstrate a process. For example, a "cut-away" animation can be used to show how the internal components of an internal combustion engine operate. Interactive animations can later be used to allow students to practice their understanding. You can either program the animation yourself or use software designed for that purpose.

Examples

- One award-winning Web site teaches learners how to dissect a frog (see the on-line exercise). Quick Time video is used to demonstrate how to pin the frog. After watching the demo, the user clicks on a graphic of the frog at the locations where the frog should be pinned. Remedial feedback allows the learner to learn from his or her mistakes until they have correctly "pinned" the frog. Does this meet the lesson objective? Because the objective was that the user would know where the frog must be pinned, the answer is "yes." The fact that it was not a real frog has no bearing on that particular learning objective.
- "Stanford University was experiencing heavy calls to their IT Help Desk and suffering some damage to the equipment in their campus classrooms from instructors not familiar with the various presentation equipment. Stanford tapped SFmedia (a graphic design firm in San Francisco) to develop a Web-based interactive demo on how to use the [equipment]. The designers at SFmedia used Macromedia's Flash to illustrate and create all the animations for these tutorials" [2].

On-line exercise

Go to "The Interactive Frog Dissection—An On-line Tutorial" at http://curry.edschool.virginia.edu/go/frog. There you can view QuickTime demonstrations and "practice" dissecting a frog.

5.6.2 Option 2: Role playing

This is another very effective technique that works well within the WBT environment. It requires learners to problem-solve and allows them to

interact with others (often with people to whom they would not normally have access), learn from their mistakes, and repeat exercises to hone their skills.

What WBT media can be used for role-playing?

- *Video.* Like demonstration and practice, interactive video can be used for role playing with the caveat that role-playing with a computer is not as effective as role-playing with peers. You may need a hybrid solution.
- *Web conferencing.* This medium can be used with the caveat that most often training delivered via Web-conferencing software does not include videoconferencing. In other words, often you cannot see the person(s) with whom you are role-playing—you can only talk to them. Technology promises to make it easier to transmit live video over the Web soon; however, if you have audio only, consider whether that medium will work in your favor by comparing the environment to the real world. If the role playing is for customer service via the telephone, you have a good match. If you are teaching managers how to deliver a negative employee review, you may need to reconsider as body language can be an important aspect of the real situation. You could use Web conferencing to teach principles, but you would probably need to follow up with other opportunities to role-play face-to-face.
- *Collaborative chats.* A synchronous on-line chat can be incorporated into a Web site that delivers the bulk of the instruction in an asynchronous environment, or it can be used as part of a real-time Web conference. Although text-based chat is common, voice chat is quickly emerging as another option. Many case studies have reported success with this technique, although many others have not faired as well. Most training professionals agree, however, that the key to using on-line chat functions is effective, carefully orchestrated facilitation. You will want to avoid a free-for-all in which net etiquette is not followed, in which some learners lurk on the sidelines not participating while others dominate, or in which learners go off an a tangent and are left wondering what conclusions were drawn.

  Virtual classrooms allow the instructor to control who has the floor, thus overcoming the problems associated with open chat free-for-alls. Naturally, voice chat is preferable if some of the students

have poor typing or reading skills. It is also important to consider whether your students all have the ability to express themselves clearly in the language selected for the chat. Links to chat facilitation information are provided on our Web site (http://www.smartband.com).

- *Threaded discussion*. You could also role play using an asynchronous threaded discussion. This would most closely match the real work environment if you were training help desk personnel to respond to e-mailed requests for help.

5.6.3 Option 3: Games

This technique is particularly well suited for asynchronous WBT. The computer allows you to create all kinds of fun, interesting, and instructional events, and following the tenets of learner-centered instruction, learners can play or not play the game, repeat the game, or take as long as they like to play the game. A shy learner, who might be self-conscious playing a game in a room full of peers, will be more likely to participate when in control.

Well-constructed games allow users to learn from mistakes and offer valuable tips and feedback; they also allow adult learners to learn from experimentation, require them to problem-solve, and relate content to what students already know. For example, a game that uses a metaphor is an effective way to relate the content being taught to what the learner already knows. Interactive computer-based games are commonly used in military training to teach students how to manage air, land, and sea forces to engage an enemy successfully.

What media can be used for games?

A better question to ask would probably be: What media cannot be used for games? Interactive video, graphics, audio, and text can all be used to create effective games. The trick is in the creative design and the cause-and-effect programming, although there are some software applications that allow you to create games based on preprogrammed models. Links to game software are provided on our Web site.

5.6.4 Option 4: Lecture

Many training professionals argue that lecture is not a particularly effective instructional technique. When you think about the passive-listening model that has been used by academic educators for centuries, this argument is hard to dispute. Still, lecture survives as a "necessary evil." How

else do you tell someone about something? The countless PowerPoint presentations we have all seen are modern-day examples of the lecture. The learner is the passive recipient of knowledge dispensed by an expert.

We would argue that while lecture may be required to convey conceptual information, it does not have to be either passive or an evil. While traditional lecture does not appeal to multiple learning styles, permit interaction, or allow the user to control the content or pace, lecture within a WBT environment can do all of these things. A variety of media can appeal to a variety of learning styles and allow users to navigate to the content they need when they need it—in short, multimedia can create user-centered instruction that appeals to different users with different needs. Within the context of a lecture, media and programming that may at first glance appear to be gratuitous bells and whistles can add real value in a number of ways:

- By giving users something to do, thereby holding their attention;
- By providing entertainment, thereby motivating users to continue;
- By breaking the information into digestible chunks;
- By allowing learners to select from layered content;
- By appealing to a variety of learning styles.

What media can be used for lecture?

- *Graphics.* Graphics can add interest, illustrate a point, or act as interactive icons that allow the user to access layered content.
- *Text.* When you need to convey conceptual information, it is tempting to overload your Web site with too much text. It is important to realize that most people find it more difficult to read text on-line than in print, and we would caution you to avoid too much text. At the same time, text still plays an important role when using lecture—it supports the other media.

  Consider this: In your lecture experiences, which learners were most successful? Probably not the learner who only listened. Most people remember only one-third of what they hear. Learners who are able to chunk the information into useful notes and summaries often fare better in a lecture environment. Your ISD can perform that chunking and note-taking for the learner. In other words, text can be used to support the content of audio or video delivered lec-

tures by emphasizing key points and providing summaries. It can also be used as a means of allowing the user to select from various lecture options. It should not be the primary means of conveying lecture-style information when there are other options available.

There is a rich research literature on the subject of how text can best be used with still pictures, motion video, and audio. Researchers have found that text as a medium of expression is better for communicating some types of information than illustrations, while other types of information are better communicated visually. See [3–5]. Furthermore, the use of other media may be limited in some instances. For example, limited bandwidth can make large amounts of audio and video impractical for the Web. Many commercial sites do not offer courses with large amounts of audio or video because they cannot control the bandwidth, browsers, or plug-ins of their users. In that case, text may carry the lion's share of information. In that case, a compelling or interesting story helps keep the learner interested. Case studies, metaphors, and analogies can give the text life.

- *Audio.* Audio is an excellent way to deliver a lecture, but you will need to consider the technical aspects of including audio files in your course, as well as several instructional factors. For instance, is the audio optional or a primary communication vehicle? If it is optional, that same information will also need to be conveyed via other media. If audio is required, it can be integrated with the other media and offer unique information. Ask yourself the following questions:

  1. Do I want the audio to say the same thing as the text, or is the audio going to provide additional information?
  2. If it is additional information, will it play automatically, or will it be user-controlled?
  3. If it is user-controlled, what happens if they do not play it?

  Learners working in close quarters with others will, of course, need to use earphones so as not to disturb other workers, and it is important to allow users to replay audio as a telephone call or other interruption may occur. WBT should also be designed to allow users to skip audio rather than forcing them to listen to it every time they access a screen.

- *Video.* Video can be used to greatly enhance a lecture if your students have a DSL, cable modem, or T-1 connection (see www.extension.harvard.edu). If you have the bandwidth and are developing a course on cheetahs, video of a cheetah running would add real value to your message. On the other hand, if the objective of the lecture is to deliver verbal information, the dubious benefits of adding a "talking head" rarely justify the use of large, cumbersome video clips. If you want to show the speaker, consider audio or text with static photos.

  Video is ideal for soft-skills training. For example, video allows us to show a manager how to handle an employee's emotional response during an unfavorable annual performance review in ways that still photographs and text cannot. Video (and animation) are also important if we need to depict motion, such as the correct performance of a task like CPR where psychomotor skills are a vital component of what is taught.

5.6.5 Option 5: Questions, exercises, and tests

As was mentioned in Section 5.2, some critics of CBT feel that the testing and feedback options within a computer environment are limited and somewhat ineffective. Testing within a WBT can be quite effective, however; whereas traditional methods can be effective if the questions are carefully designed, creative WBT design can go beyond these traditional methods, and technology offers new, more sophisticated testing options. Most testing provided within the context of WBT will be criterion-referenced testing designed to determine whether a student has mastered the content presented. Diagnostic testing may be used at the beginning of a course to enable students to "test out" of course content that they have already learned. One major efficiency of the WBT environment, therefore, is that WBT teaches students only what they do not know.

Mastery testing at the end of sections of the course is designed to determine whether students have met the criteria for mastery of that course's content. Tests often provide for mastery based on the number of points, percentage of points, number of items completed successfully, or percentage of items completed successfully. The criteria for test mastery is determined by the instructional designer and is presented in the course design document.

Effective test design requires a background in psychometrics. Test designers must know how design valid and reliable tests or students who

do not meet the standard may pass the course and students who do meet the standard may fail. There are also significant legal issues associated with testing. For example, tests that contain items not related to actual job performance may be found to be discriminatory and therefore grounds for legal action.

Traditional methods, such as fill-in-the-blank, multiple choice, and matching exercises, are all easy to create within a Web environment, but one must always ask if the exercise truly measures the learning objective. The answer to that question depends on the design. Consider our example of the training program designed to teach financial consultants how to create financial plans using a new system. A fill-in-the-blank question that asks the learner to name a certain process may not be particularly germane to the objective. But what if your fill-in-the-blank question asks the learner to access the system, create and complete a spreadsheet, and then enter the resulting computation in the blank? In order to answer the question correctly, the learner must be able to access the system, create a spreadsheet, and correctly complete the computations—in other words, the learner must demonstrate mastery of these three performance objectives.

A well-designed WBT course can use all kinds of multimedia and programming technology to create effective exercises that go beyond traditional methods. The options are often limited more by the experience and creativity of the designer and by available resources than by the technology itself. Drag-and-drop behaviors and object-oriented scripting languages can heighten the level of interactivity. Diagnostic feedback, used as a pretest or as remedial feedback, can assess learners individual levels of expertise and steer them to the information they need. Remember our example of the WBT program that taught the user how to pin a frog? Users clicked where the frog should be pinned and got feedback until they got it right. This exercise goes beyond the traditional methods by adding both an element of reality as well as remedial opportunities and feedback.

New testing and feedback technologies, such as the following, continue to appear on the market:

- Digital Trainer, a WBT authoring tool, can deliver testing and training documents developed in word processing applications while maintaining the formatting (http://www.micromedium.com).
- Intelligent Essay Assessor, a software product developed by the University of Colorado, can "read" batches of essays and grade them. First you "teach" the program the relevant content. Next, you pro-

vide it with a large set of sample essays. The program can then understand when the student has expressed the right idea by comparing the essay to the graded samples. (For a demonstration, go to http://LSA.colorado.edu.)

- Technological developments in artificial intelligence give learners the ability to submit and respond to questions in their "natural language." In other words, learners can ask a question in their own words and the computer will search for and interpret key words and phrases to provide an answer; or learners will answer a question in their own words, and the computer will interpret the answer and provide feedback.

  Links to new testing technologies are provided on our Web site (http://www.dr-david-stone.com).

What media can be used for questions, exercises, and tests?

As you have most likely deduced from the above discussion, there is virtually no limit to the types of media that can be used to create interactive exercises. Creative combinations of audio, video, text, graphics, animation—even 3D avatars—can create instructionally valid exercise opportunities. (To see an example of an avatar, or an "intelligent" bot, go to http://www.artificial-life.com.)

On-line exercise

Go to http://medicus.marshall.edu/medicus.htm to experience a natural language exercise. At this site, the *Interactive Patient* by Marshall University School of Medicine allows you to simulate an actual patient encounter. You can type in such questions as, What does the patient look like? and the program will interpret the question and provide a response. Whenever you wish, you can submit your diagnosis for assessment.

5.6.6 Option 6: Collaboration

In terms of instructional design, collaboration is a very effective team-building and problem-solving technique that allows learners to interact and learn from one other. On-line collaboration can take place in either an asynchronous environment or a real-time, synchronous environment. Regardless of how it is delivered, its effectiveness depends on the context, how well it is designed, and how it is facilitated.

What media can be used for collaboration?

- *E-mail and threaded discussions.* If the collaboration is asynchronous, the electronic exchange between learners will be largely limited to e-mail or threaded discussions. Threaded discussions can be difficult to follow unless ground rules establish the purpose, the etiquette, and start and end dates. A facilitator can help things go smoothly by doing the following:

  1. Making sure that everyone is comfortable with the technology ahead of time;
  2. Kicking off the discussion;
  3. Monitoring the discussion to ensure that it stays on track and that the ground rules are followed;
  4. Encouraging democratic participation by assisting reluctant participants and reining in the dominators;
  5. Summarizing the key points at the end of the discussion.

- *Web conferencing.* Conferencing, by its very nature, is collaborative. However, videoconferencing—the predecessor of Web conferencing—was not widely used for training because it was expensive and required satellites or dedicated T-1 access, requiring learners to be at a common location. Today, new Web-conferencing software allows conferencing to take place over the readily available Internet or intranet and has brought down the cost, improved the ease of use, and enhanced the functionality of real-time conferencing. Most Web-conferencing software now includes such media features as a shared white board, hand raising, polling, testing, synchronous chats, and application sharing.

  Because of these recent improvements, Web conferencing is now seen as a viable medium for collaborative learning. In their 1999 State of the Industry Report, *Inside Technology Training* magazine surveyed 1,400 training professions to determine which delivery methods would be used in the future. They found that asynchronous WBT would continue to outpace synchronous Web conferencing (which they called the "virtual classroom"), but both media were predicted to grow about 3% from 1999 to 2000.

5.6.7 Option 7: Simulation

We have already discussed, at various points in this chapter, how simulation that mimics real-world conditions is a very effective instructional technique and can help bridge the gap between training and job performance. The level of sophistication with which you simulate job conditions, however, can once again run the gamut, depending on your needs and your budget.

Simulations of aircraft controls, such as an Inertial Navigation System (INS), provide students with the ability to interact on the computer screen with graphics that mimic conditions in the real aircraft. With a simulated INS, a student can enter the latitude and longitude of the aircraft's present location (perhaps on an aircraft carrier in the Indian ocean) and enter the way points that take the plane to an airfield on Diego Garcia just as a pilot would do in a real aircraft.

A simulation differs from practice demos, role playing, or gaming presentations in that the interaction the student experiences is just like that which would occur with the real device or system.

What media can be used for simulation?

- *Multimedia.* Graphics, audio, and video can all be used to simulate real-world conditions; the best solution will depend on what those conditions are and what resources are available.

> The most obvious (and common) use of computer-based simulation is to teach computer skills—it's easy and effective. Companies are also increasingly using computer simulations to teach mechanical skills. Even soft skills can be refined and reinforced with on-line simulation as in the program used to train Oracle's sales force. The future of multimedia points in one direction: Simulation. [Brandon Hall] has seen the evolution of multimedia away from the simple programs … towards complex simulations which mimic real-life, on-the-job activities and let learners screw up and learn from it in the risk-free environment of the keyboard and the computer screen [6].

Some WBT programs use 360° still photography to simulate real-world views of equipment, layouts, 3D objects, and so forth. Captain Jason Mergenov with the U.S. Air Force at Vandenberg AFB in California says, "We are currently testing 360-degree panoramas to train students to the layout of complex, underground launch-

control centers for Minuteman intercontinental ballistic missiles. The feedback we have gotten so far is that these panoramas provide a very realistic training environment. They work very well for increasing student retention between classroom and simulator-training environments."

Stephanie Pounds (http://intercom-interactive.com), an instructional designer with CBT developer InterCom of Woodlands, Texas, says, "We built a lesson using 360-degree camera technology to teach oil-refinery employees how to inspect an operating unit." The program, Pounds says, lets users click on "hot spots" in the panorama to learn more about individual pieces of equipment.

An example of software simulation: Database simulation

1. You can design the instruction so that the user actually uses the real system or an existing training database. In this case, the user would toggle back and forth between the application and the instruction, inputting answers to exercises and questions in the instruction based on results determined within the application.
2. You can create a graphical interface within your WBT that looks and feels like the real system. For example, you can layer transparent input fields on top of a screen print from the actual application so that, to the user, the interface is invisible.
3. There may be a third-party database available. For example, one training company offers a training database for MSCE certification. The learner can link to the database from within the WBT.
4. You can actually program the WBT to mimic the application (a rather complex solution).

- *Virtual reality.* "Virtual reality" refers to realistic 3D on-line simulations of real-world conditions, which allow the student to move about at will, interact with others (usually represented as graphics of people), and make choices about what to do next based on what has been learned so far. Because it is currently expensive to produce and not well understood by many designers, it not widely used in today's WBT. Still, many industry watchers believe its day will come. Certainly, it is possible within a Web environment, and there are instances when virtual reality can help convey concepts difficult to communicate by any other means.

On-line exercises

Go to CommerSel Web's page http://www.commersel.com/360.asp. From there, click on 360° photo tours. From this site you can visit various pieces of real estate presented in 360° photography. You can view the floor plan of a property and click on the room you wish to view.

Go to National Geographic's "Virtual Solar System" (http://www.nationalgeographic.com). This program enables you to see the actual orbits, rates of rotation, and relative sizes of the planets in our solar system.

Practical tip: *Use this checklist to be sure that your ISD document includes the following components:*

1. *Unit objectives;*
2. *Assessment criteria;*
3. *Course outline;*
4. *Course or site map (particularly if there are multiple lessons);*
5. *Navigational strategies;*
6. *Instructional techniques.*

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[6] *Training Directors' Forum*, March, 1999.

6

Your detailed WBT plans

6.1 Financial plan

The WBT financial plan is another component of the strategic plan. A thorough financial plan compares the proposed methodology to existing and alternative methodologies and considers three factors:

1. Cost expenditures;
2. Cost savings;
3. Financial gain.

These are also the same factors considered in the high-level cost-benefit analysis discussed in Chapter 2; however, the financial plan is a much more detailed document that contains both the detailed project budget and a projected ROI (see Figure 6.1).

Be sure to include these costs and benefits. Also remember to include the break-even point. The break-even point is the projected point in time where your costs will equal your benefits. This is a particularly important concept when you are building a financial case for WBT. While the immediate expense may be greater than traditional forms of training, the benefit accrues incrementally over time. For example, with stand-up training it

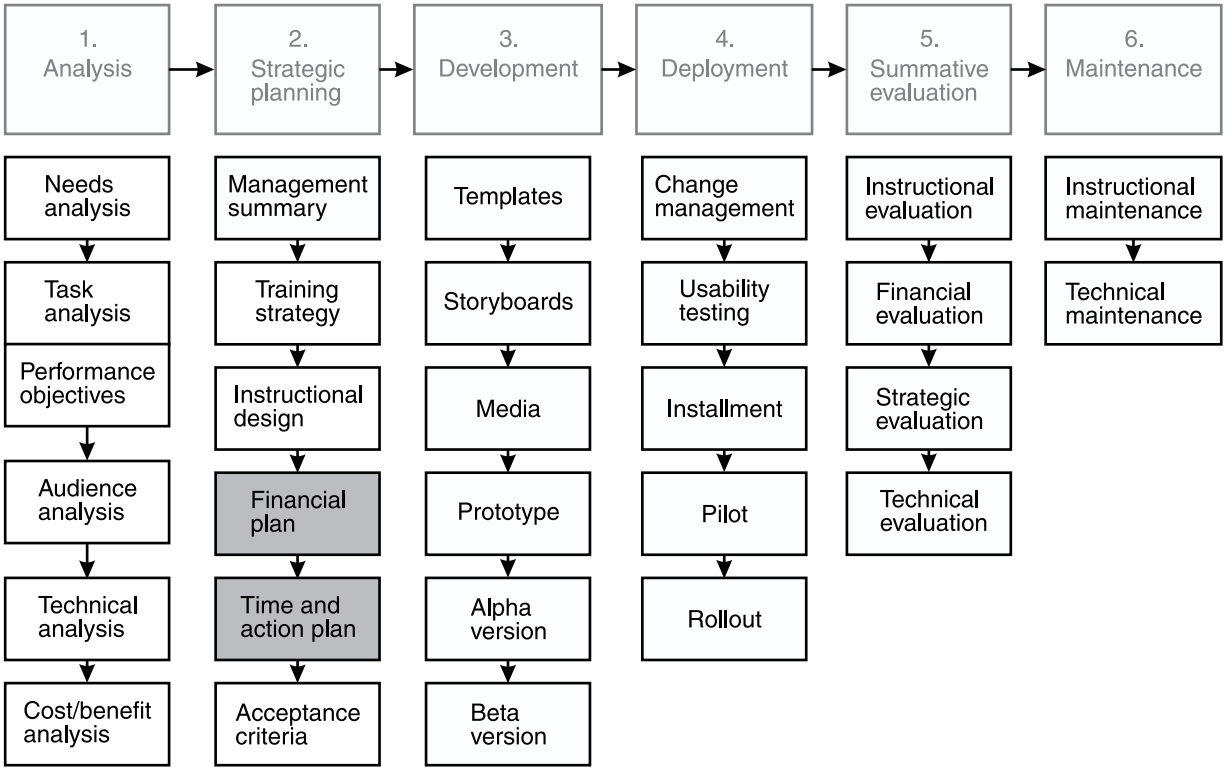

Figure 6.1 Detailed WBT plans.

does not cost much to create the materials, but you must pay a trainer every time the training is delivered, and perhaps even pay travel expenses for participants. With WBT, the reverse is true. It is more costly to create the materials, but you save on delivery every time you use it.

6.2 Time and action plan

The purpose of a time and action plan is twofold:

1. In the planning stage it is used to outline the phases of the project and how long they will take. The project's duration can be driven by predetermined time constraints or by the project itself. Often there is some degree of negotiation before the customer and the production team reach an agreement. For example, the customer may initially say that all users must be trained within 3 months. After analysis you may respond that, based on the customer's requirements, it will take 4 months. You will both need to review deliverables, objectives, and resources to find a workable compromise. In that sense, even the time and action plan does not exist in a vacuum! It depends on the instructional, technical, and resource factors we have been discussing throughout this chapter.
2. In the development stage, the time and action plan is used to stay on track—to ensure that the project proceeds in an orderly fashion, that team members know what to do, and that it is completed on time.

Here is how you put together a time and action plan for WBT:

First, each phase of the process must be analyzed. The phases described in the WBT Development Model can provide a foundation for defining the phases within your project. For each phase you will need to determine what tasks are included in that phase, and how long they will take?

For example, in a first-phase process analysis, the WBT Project Manager and Systems Integration Engineer might meet with the various stakeholders to gather information necessary to meet the customers' requirements and develop a strategy for implementing an on-line learning development and delivery system. The deliverable from this phase might be a document similar to that shown in Table 6.1.

TABLE 6.1 Time and Action Plan for Phase 1

Tasks	◆ Meet with all on-line learning system stakeholders ◆ Read and analyze any technical documentation ◆ Identify requirements ◆ Formulate an overall solution ◆ Publish an On-line Learning System Requirements document ◆ Present strategic plan to stakeholders for evaluation
Time required	Two weeks

As illustrated in the proceeding example, the time and action analysis breaks each phase down into a series of tasks and results in clearly delineated deliverables. For example, at the end of the planning phase you will deliver a strategic plan to the stakeholders. These deliverables also feed into the acceptance criteria as noted in the following section.

Second, after all phases have been analyzed, each phase and the resulting deliverables are plotted onto a timeline. As with most projects, the actual timing of various events is not always linear; instead, the events might overlap. For example, while your SMEs are reviewing the beta version of your first WBT lesson, the writers may be creating the storyboards for the next lesson. In addition, various events can be interdependent. For example, your development team cannot make edits to the beta version until the SMEs have completed their review. When any one phase is late, the rest of the timeline can be affected. A good time line is not a one-time planning event. Instead, it is dynamic in that, if one event moves, the remaining dependent events also move. In other words, it is a true management tool that tracks the current status of the project.

Practical tip: *If your WBT project involves multiple team members performing multiple, interdependent tasks, it is wise to consider a project manager to manage the time and action plan.*

Part III
Phase 3: WBT development

7

WBT development guidelines

As in the traditional ISD model, the "content" phase follows the strategy phase in the WBT Development Model as well: Now that you have developed your strategic plans, it is time to develop your content.

There are, however, several differences between the traditional ISD model and the WBT Development Model. Content development for WBT follows the very specific sequence shown in Figure 7.1. Templates, storyboards, media, and developmental versions are typically required to manage the development of electronically delivered instruction successfully.

The sequence shown in Figure 7.1 has long been used in the creation of CBT because it offers a number of benefits:

- It creates uniformity within a lesson, from lesson to lesson, from course to course, and between development teams.
- It communicates design decisions and expectations early in the development cycle to avoid costly edits.
- It provides checkpoints for quality control and usability testing.
- It contributes to rapid development.

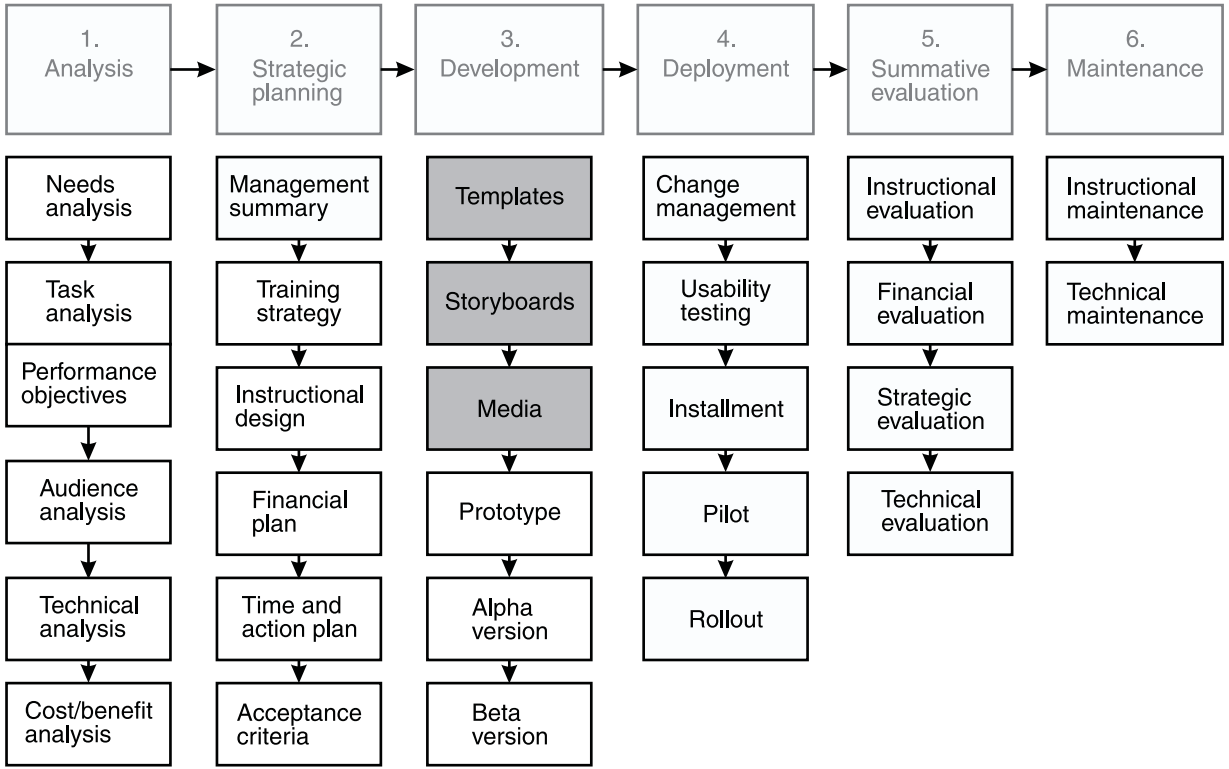

Figure 7.1 WBT development.

To develop your WBT you should be familiar with both the WBT development process and the elements of good WBT design, the two topics discussed in this chapter. At the end of this chapter, you will be able to plan your own content development and make informed design decisions along the way.

Typically, the instructional designer, or course developer, is most active in the early stages of content development. The templates and storyboards convey the ISD, and the development team should determine how the course is designed and what media is required.

After the design plans are completed, the size and complexity of the project will dictate who actually creates the media and authors the courseware. As was discussed in Chapter 3, if your project is large, graphic designers and audio-video producers may produce the media and Web designers, or programmers may author the courseware. On the other hand, if the project is small and the media needs are simple, the training department might complete all phases of the content development process.

For large projects you may wish to use a content management system (discussed further in Chapters 8 and 12) to ensure that you can track each content component (text, graphic, animation, video, and audio) and that you can manage changes to content over the life cycle of the WBT.

7.1 Templates

Templates contribute to all four of the benefits, listed above, of the WBT development sequence. First, they help to create uniformity. Templates are like a photocopied form. The blank form provides the uniform look and functionality of the document; specific details are then entered on individual copies. Similarly, with WBT the templates are "master" or "parent" pages that dictate the look and placement of common graphic elements. They are copied to create specific, or "child," pages where details are entered.

Some people harbor the misconception that templated courseware is simplistic and monotonous. Actually, well-designed templates help ensure that a course is engaging, stimulating, varied, and attractive. To create interesting and effective courseware, one should begin by creating interesting and effective templates designed to present and give interactive support to the objectives devised earlier in the development process.

Typically, the instructional designer, together with the graphic designer, designs a separate template for each type of page—for title

screens, menu screens, lesson pages, summaries, test questions, and so on. These templates specify the background, navigational interface, font, color, and position of key elements.

Depending on the complexity and visual design strategy of the course, templates may all take the form of fixed layouts, or there may also be object layouts that designers are allowed to place freely or within certain guidelines. For instance, in software simulation training, there may be movable and sizable text overlay frames, graphic overlay frames, arrows and rectangles for pointing, and transparent colored shapes for highlighting display or information elements.

Figure 7.2 shows an example of a template from a popular authoring tool and illustrates how templates work. The position of key elements is specified, as is the typography and navigational design. If the key elements include video, graphics, or audio, placeholders are specified for these media as well. Remember that there may be a different layout for a menu page, a quiz page, a summary page—for any page with a different purpose. Following the layout, all the instructional designer has to do is provide the media specifications for each page. The media, or content, are specified in the storyboards (see Section 7.2).

Figure 7.2 A template. (*From: Toolbook Assistant*, an authoring tool by Click2Learn.)

Templates can help a single instructional designer maintain consistency, but they are particularly helpful when multiple designers are working on a project. For example, you may be creating a training program that consists of several courses, with separate training teams developing each course. A common template will ensure that the users get a consistent, uniform package.

Because templates are the first visual depiction, or mock-up, that the customer sees, they are the first checkpoint for quality and usability control. For example, it is the first opportunity to see what the navigational interface actually looks like. Templates also help communicate design decisions to other team members and to the customer. When the major design decisions are communicated to all parties before any courseware is developed, there is no confusion about what is expected and no need to go back and edit numerous pages later on. For that reason, it may be wise to have the customer sign off on the templates with an agreement as to the financial and delivery implications of major design decisions made afterward. (Some authoring tools, however, will allow you to specify a background page so that an edit to the parent background will appear on each child that uses that background. In that way, if you decide to change the title screen font down the road, you do not have to maintain each title page.)

From the above discussion, it is clear that templates contribute to rapid development in two ways:

1. They can be copied to create individual pages so that many settings are global and do not have to be recreated on each page.
2. They help to minimize costly edits.

There are several ways to create templates. You can create a sample page and copy it, create a background and apply it to specific pages, or use cascading style sheets (CSS) to create parent-child relationships. The technique you use will depend largely on your authoring tool. Authoring tools are addressed in Chapter 8.

Practical tip: *If you are not using a preexisting template, you may want to use a simple presentation tool such as PowerPoint to draft your layout ideas before creating your templates. When a layout is approved, you can output it to dynamic HTML for viewing on the Web, at which point on-line templates can contribute even more to rapid development.*

7.2 Storyboards

Once you have designed your WBT templates, you can use them as the basis for creating your storyboards. With the templates, establish the layout parameters for your story and media; now, use storyboards to plan the content—how you will tell your "story"— and to convey your media and interaction ideas to the team members and customers before precious time is spent creating the actual content. In that way, the storyboards again help to communicate design decisions, provide a quality control checkpoint, and contribute to rapid development by avoiding costly edits.

How do you create storyboards? Creating a good storyboard is very similar to creating a traditional page layout in that the storyboard moves the media presentation from a rough idea to a detailed script or plan.

Storyboards present design plans for each page or screen in the story and include a description of the media components and interaction. There are many storyboard models, but in essence one half of the storyboard is a graphic depiction of the course page or screen while the other half lists and describes the media (graphic, audio, and video files) and navigation (links, previous page, and next page) for that page.

During the early stages of development, storyboards are often presented on paper; however, attempts to represent an on-line medium in a paper-based format often lead to misunderstandings. You may wish to show the customer storyboards on-line so that they can more easily imagine how the page really will look. The advantage to establishing your templates early in the development process is that you can use these templates to create a mock-up of a screen or page. At this point, you are conveying ideas. The screen is not interactive and you may not have all of the media developed, but the customer can see the full-page layout as it will appear on-line and in full color.

Practical tip: *Some WBT authoring software has built-in storyboard functions. Toolbook Assistant is an entirely what-you-see-is-what-you-get (WYSIWYG) design-and-development environment that makes it possible to create storyboards and lesson prototypes rapidly (http://www.click2learn.com).*

As you may remember from Chapter 5, one of the benefits of a good course outline is that it establishes a naming convention that can be carried forward throughout the subsequent stages of development. While you may wish to use alphanumeric conventions that are specific to your orga-

nization, be aware that the world is moving toward standardized indexing of all Web content through the use of metadata in accordance with the World Wide Web Consortium (W3C)'s standards as described on the W3C Web site at http://www.w3.org/Metadata/Activity.html. The W3C points out that:

What the Web lacks is a part of the Web which contains information about information—labeling, cataloging, and descriptive information structured in such a way that allows Web pages to be properly searched and processed in particular by computer. In other words, what is now very much needed on the Web is metadata.

The use of metadata will allow you to access and reuse easily components of your WBT in other courses that you may develop later. It will also enable you to keep track of all the assets you use on this course as it changes over time.

In this model, the instructional designers used the storyboards to script and name the media files, the media developers created the media to those specifications, and the developers assembling the course used the tags to insert the content. During alpha and beta reviews, the quality controllers can use the storyboard pages and media tags to track and communicate edits.

Most advanced developers now use WYSIWYG storyboarding tools in which designers use facsimiles of the delivery screens to enter content and to place visual elements. This kind of tool saves much time and can even eliminate entire review cycles from the development process. The creation of such storyboarding tools, however, requires additional effort to incorporate visually faithful representations of project templates and to enable the entering of content without specifying all the other details that would slow down the storyboarding and make the process more like authoring. Typically, the storyboarding tools used by professional developers have been created in-house (often by modifying off-the-shelf development tools) and offer easy customization to support various project standards and document-generation requirements.

Regardless of how you create your storyboards, at the end of the storyboarding process you should have a clear and agreed-to storyboard for every page or screen within the course, and each storyboard should include a graphic and a text description, such as that shown in Table 7.1, of all of the media and functionality for that page.

In this example, the instructional designer can either present the description of each note in a linear progression or make each note label on

TABLE 7.1 An Excerpt from a Storyboard—The Text Description That Accompanies the Sketch

SCREEN TYPE	LESSON SCREEN TEMPLATE
Frame	4.2
NEXT:	4.3
BACK:	4.1
File Name	Description
4_2polo.gif	Polo graphic from overview with Notes illustration (see attached sketch)
Title Text	Step 4: Attach the notes. Overview
4_2.txt	(Above graphic) There are three mandatory notes.
4_2.mp3	Notes amount to a special kind of booster that allows you to add additional, free-form information to the item record. You can add your own notes whenever you need to, but there are three mandatory notes that must be added to every item record you create: a packing note, a label note, and a description note.

this page "hot," so that users can get more information if they need it. These are the types that must be described in the storyboards.

***Practical tip**: One of the ISD decisions you will need to make is how you will display your course. For example, you can display the course within the user's current browser window or you can open another window. You can elect to display the course full-screen, or provide a menu bar. A full-screen display will provide you with the most display space, but you will need to provide the learner with some method for exiting the course. The screens shown in Figures 7.2 and 7.3 would work well at full screen. The exit button allows users to exit the course.*

The decision about how you will display your course should not be made in a vacuum. You should consider any company standards, the site characteristics that surround your course, and how your course will link to other sites or programs as determined in your technical and needs analyses. Test your options early, before designing your storyboards, because your display method will have a direct impact on your available display space. In Figure 7.4, the course is displayed at 800 × 600 resolution with a menu bar. Dropdown menus offer the learner a number of options for

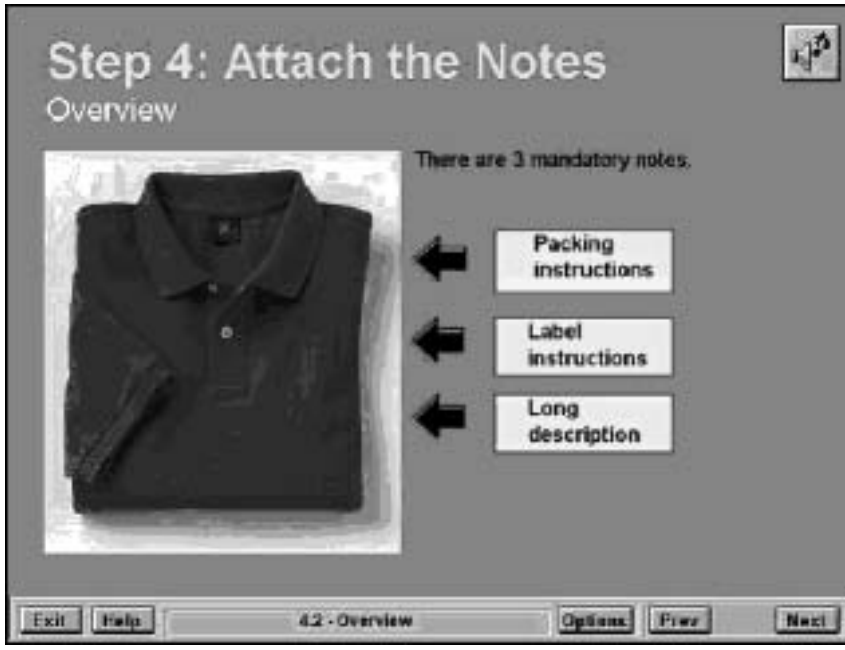

Figure 7.3 The page resulting from the storyboard presented in Table 7.1.

accessing content. While the navigational interface is an attractive, relevant metaphor (the buttons look like drops of water), they are clearly labeled.

7.3 Media

As we have said throughout this book, you may develop the media yourself if your needs are simple, or you may have team members who specialize in media production. Either way, once the storyboards have been agreed upon, the media developers will begin to develop the content, or media. Some of the media, such as the text, are included in the backbone of the course—they are a part of the Web site itself—while other media are external media files upon which the site calls. Therefore, the WBT assembler—whether that role is yours or a specialist's—can begin to develop the prototype lesson at the same time that other team members develop the external media. The WBT developer will simply leave placeholders until

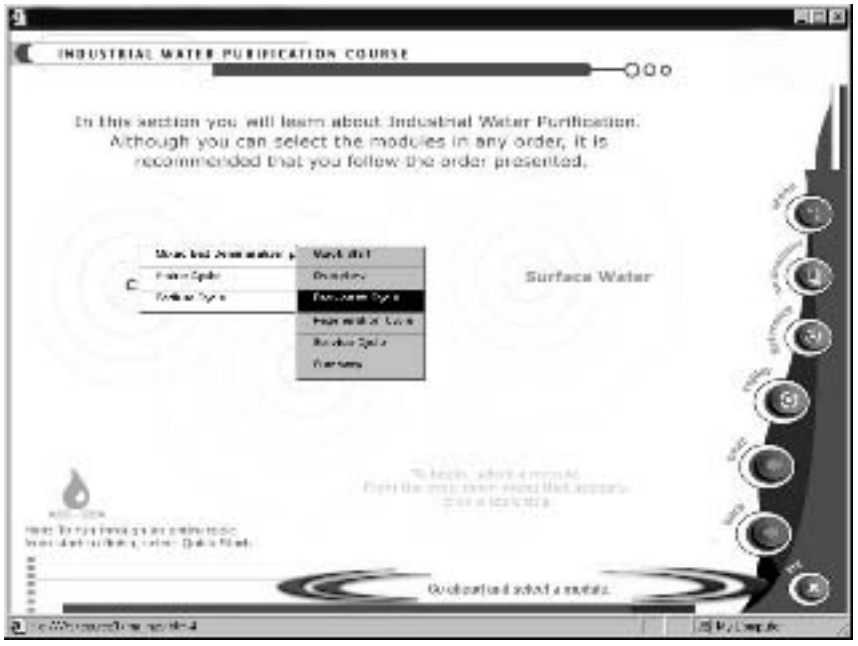

Figure 7.4 A WBT page using a separate window and a menu bar.

the external media files are available. For example, the template shown in Figure 7.2 already has a placeholder for a video file. The storyboard example shown in Figure 7.3 scripts and names the file that will replace that placeholder. While the WBT assembler is creating the surrounding text, links, and other elements, other team members can work on producing the video.

Note: Techniques for creating external media are discussed in Section 8.3.

7.4 Prototypes and alpha and beta versions

When creating WBT, create one lesson before beginning work on other lessons and use this "prototype" lesson as a quality and usability checkpoint. The team and customer can review the prototype to ensure that it works as intended, both from a technical and an instructional viewpoint. If changes are required, adjustments to the storyboards can be made before the WBT team gets too far down the development path.

The alpha version of your WBT is the first version that has all pages, media, and functionality completed, although untested. It is reviewed by the team to ensure that all of the technical functions are working properly. Once the courseware is functioning properly, the technically operational version, the beta version, is given to the SMEs for content review. When content edits are complete, the course is ready to move to the deployment phase, which is the subject of Chapter 9.

7.5 The elements of good design

Now that you understand the WBT development process, let's step back and look at the key decisions you need to make as you design your WBT. In Section 3.2.3, the point was made that it is not enough to understand the mechanics of WBT. In order for the training program to be successful, someone on the design team needs to understand the elements of good design. For the purposes of this section, WBT design is divided into four categories:

1. Graphic design;
2. Web design;
3. Documentation design;
4. Interactive design.

The quality of each of these design elements can have significant impact on the aesthetic appeal, instructional effectiveness, and usability of your courseware.

7.5.1 Graphic design

According to *The Non-Designer's Design Book* by Robin Williams, the four basic principles of good graphic design, wherever it appears, include the following:

1. Proximity;
2. Alignment;
3. Repetition;
4. Contrast.

Proximity is used to build relationships between elements. For example, when text is in close proximity to a graphic, the user will assume they are related. It sounds simple, but keeping this principle in mind can improve the instructional effectiveness of your course. Proximity builds conceptual relationships. Proximity can also improve the usability of your WBT. For example, when you put navigational instructions by the navigational interface, the learner can more quickly determine the action to take.

Alignment within WBT can mean the alignment of textual elements, of text to graphic elements, or of different graphic elements to each other. Careful alignment contributes a sense of visual unity to the page and can help build relationships between elements. Do not assume that the templates supplied with the software know best. For example, the template may show a central alignment when a left or right alignment is often stronger.

Practical tip: *Do not align content to a background image because a change to the display resolution may change the position of that image.*

Repetition can be used to accomplish three objectives:

1. Add interest;
2. Create unity;
3. Cue the user.

Repetition is an especially useful tool within the context of WBT, because the user can't look at more than one screen's worth of information at a time. For example, when the lesson titles always look the same, users begin to see the pattern and every time they see that font, size, and color displayed, they recognize a lesson title and know they are on a lesson page. Menu pages might use a different title style to alert the learner to a different type of page. (This is where the template comes into play.)

Here are some additional examples that will help you think about the use of repetition:

- One WBT course that links to an external training database uses yellow text boxes for conceptual information and white text boxes for directions to go to the database and perform a task.

- In another course, all summary screens use the same text box color and border to contain the summary points. These summary screens immediately look different from the lesson screens; thus, learners are cued that they are on a summary page. (This also helps to break the monotony of page turning and grabs their attention.) Similarly, the exercise screens take on a still different appearance, but all exercise screens repeat the same layout.
- Finally, the way the authors of this book have the entire WBT process diagram at the beginning of each chapter of this text is a good example of repetition.

In each of the above examples, the repetition would not be effective without its counterpart, contrast. For example, if all layouts looked the same, the user would not be able to tell a lesson page from a summary page. The strategy is for all similar elements to look like each other and to look different from the other elements. You are cueing the reader to contextual relationships.

As demonstrated in the previous examples, contrast is the partner—not the adversary—of repetition. Contrast is used to accomplish five goals:

1. Create interest;
2. Create a focal point;
3. Establish the informational hierarchy;
4. Cue the reader;
5. Increase readability.

First of all, too much repetition gets boring. Contrast creates visual interest, a very important consideration in WBT, and can help focus the users on key points, or "distinctive features" as they are called in the literature of the psychology of perception. This principle applies, of course, to visual displays of many types and not just those on computer screens [1].

In addition—and perhaps even more importantly—repetition and contrast can help users sort and categorize information by creating an informational hierarchy. In Section 5.6, lecture was discussed as an instructional technique and it was pointed out that the most successful passive listeners, or readers, really are not passive at all. They are busy tak-

ing notes (written or mental) that sort the information into meaningful categories. Not all learners, however, have developed sophisticated, cognitive strategies that enable them to decide what they need to do to learn and aquire the study skills to follow through. In essence, a strong informational hierarchy creates the note-taking structure for the users. Again, this is particularly valuable in a medium where the users cannot view more than one screen's worth of information at a time.

Naturally, WBT can be designed to provide students with the ability to take notes that link back to the relevant points in the course. This approach was used as long ago as the 1970s in the Time-Shared Interactive Computer-Controlled Information Television (TICCIT) System, one of the first true multimedia development-and-delivery systems. TICCIT provided full-motion video over the network; had high-resolution, interactive, color-graphic displays; and had a comprehensive LMS, a prompted easy-to-use authoring system, and a full-featured, sophisticated authoring language—used, for example, to create simulations of aircraft cockpit displays. In today's PC environment, of course, students can open a word processor and take notes while they are using WBT at their desktops.

In Figure 7.5, contrasting titles and subtitles repeat from lesson screen to lesson screen to cue the reader as to the hierarchy of information. The labeling hierarchy matches the stepped procedures in the user manual and quick reference cards, and learners are encouraged to use their quick reference cards as they complete on-line exercises.

The discussion of audience analysis in Section 1.3 listed special needs as one audience attribute to be considered. For instance, the "Getting Started" information presented in Figure 7.6 is layered because some learners may be comfortable using the course, while others may need more information. From a previous screen, the learner clicked a smaller audio icon to arrive at the screen shown in here (see Section 7.5.3 for further discussion of layering). All programs, however, whether designed specifically for special needs or not, can benefit from increased readability.

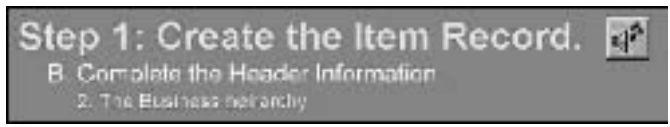

Figure 7.5 A labeling hierarchy.

Figure 7.6 An illustration of basic design principles.

Color contrast can improve the readability of your site. For example, when text has the same value as the background, it is harder to see than light text on a dark background or vice versa. Furthermore, if you know that some of your users have trouble seeing color, you may elect to not hard-code color into your WBT program.

Practical tip: *The W3C's Web Accessibility Initiative Work Group at http://www.w3.org/WAI has developed a set of guidelines for producing sites that are more accessible to a wide range of users.*

Finally, when you are creating WBT, it is not enough to understand the aesthetics of design. You must understand your authoring tool and its design capabilities and limitations. For example, if you plan to use basic HTML to create your Web pages, you need to understand that the exact positioning of page elements will be very difficult. Today, Web designers use CSSs and dynamic HTML (DHTML) to control page layouts exactly.

If you are not a Web designer, a good authoring tool will translate your design into these Web languages for you. The pros and cons of different authoring tools are discussed in Chapter 8.

Exercise

Look at the WBT page in Figure 7.6. How is each of the four design principles applied?

1. *Proximity.* The directions for the audio button appear below the button. The Audio Tips text box is next to the enlarged audio icon so that the relationship is clear.
2. *Alignment.* Elements are aligned on the left and right.
3. *Repetition.* All titles and subtitles use the same color and font. There is also repetition from page to page. Similar pages exist for text and graphics.
4. *Contrast.* The audio icon is pulled out of the left alignment and enlarged to contrast with the other icons, which brings it to the forefront as the topic of this page. The contrast in the font and color of the title and subtitle establish the informational hierarchy.

On-line exercise

Go to Power2Learn at http://www.Power2Learn.com and register as a visitor to take the free demonstration course. As you move through the course, ask yourself how the basic design principles of proximity, alignment, repetition, and contrast are used.

7.5.2 Web design

There are numerous articles and books on the subject of Web design—too many to reference them all in this book—but a few are particularly worth mentioning: *Web Design in a Nutshell: A Desktop Quick Reference,* edited by Jennifer Richard; *Designing Web Usability: The Practice of Simplicity* by Jakob; and *Learning Web Design: A Beginner's Guide to HTML, Graphics, and Beyond* by Jennifer Richard.

In addition to the general principles of good graphic design discussed in Section 7.5.1, there are a number of design tips particularly germane to WBT to keep in mind:

- Don't use graphics for graphic's sake. Integrate them with the content.
- Avoid hackneyed clip art. While use of existing graphics can save time and money, be sure that any graphics you use meet the standard for production values that you have established for your project
- Use graphics that are similar in style. For example, use of a photorealistic style throughout is preferable to mixing different (and incompatible) styles.
- Use graphics to layer information, as in an image map or process flow. Figures 4.7 and 4.8 show different approaches to layering content.
- Keep it simple. Bells and whistles can add interest and meaning, but when overused, they can distract and annoy. Likewise, busy, loud backgrounds can detract from the content.
- Choose a resolution. As you design your WBT, you need to know how much "real estate"— or screen space—you have available. At the same time, you also need to design for the lowest denominator—the lowest resolution used by your learners. (Know your audience!) In the past, many Web designers designed to 640 x 480 resolution, but today most users can view WBT designed for 800 x 600 resolution. The higher resolution gives you more screen space with which to work.
- Use a Web-safe, 216-color palette (also known as the *Netscape-safe* or *browser-safe* palette) whenever possible. For images with subtle graduations of color, however, use dithered colors (your file size will be larger) or JPEGs instead of GIFs. (Graphic file formats are discussed in more detail in Section 8.3.)

On-line exercises

Try different display settings on your PC.

- Go to several different Web sites (any of your favorites). Try viewing them using different resolution settings on your PC.
- Try viewing them with different color settings on your PC. How much degradation, if any, do you see at 256 colors, at 16 colors? Go

to the article "In Design School, They Promised No Math, A Web Color Primer" by Bob Schmitt at http://www.webreview.com/wr/pub/97/11/28/tools/index.html for an explanation of color palettes.

Links to additional Web design resources are provided on our associated Web site (http://www.dr-david-stone.com).

Finally, it is worth mentioning the ongoing debate as to whether or not WBT should follow the page, or frame, model so prevalent in CD-ROM–based CBT. An analysis of that debate breaks the argument down into three issues:

1. Practical application;
2. Usability;
3. Instructional effectiveness.

Certainly, most WBT authoring tools follow the page, or frame, model in which each screen view is self-contained and limited to what can be seen on the screen at one time; users are not required to scroll through continued text. The proponents of this approach believe it contributes to the usability and instructional effectiveness of the courseware in several ways:

- When the information is clearly delineated within a screen view, the user can focus on the content instead of wasting focus and energy searching for information. Many users absorb information as holistic visual impressions, and the formation of such impressions is favored by a screen view.
- Page, or frame, numbers can provide a reference point so that learners always know where they are and how far they have yet to go.
- The user is already familiar with this page format or metaphor—it fits the learner's schema.
- Finally, the page model makes navigation more consistent: The learner only needs to click "next," rather than scrolling, then clicking "next" for each new section of content.

Some critics of this approach, often experienced Web designers, point out that it is not enforceable and therefore not practical. However care-

fully you design the page, some browser somewhere will display it differently. While this is certainly a design issue, it is also true that many authoring tools provide functionality that allows you to control to a large degree how the course will display. You can choose the resolution, whether or not the display is full-screen, and a color mat to display behind the actual course if it is viewed at a higher resolution than the one specified. The point is, if you believe the page model is instructionally effective, there are often ways to control its practical application.

Critics of the page model further believe it does not necessarily correlate well with how the Web is used. They argue that experienced Web users are accustomed to the linked information and the freer organizational structure of the typical site. They prefer to search out their own information.

Finally, a new trend in WBT is to present content in small, granular learning objects (reusable learning objects or reusable information objects) that the learner searches for in a database. Proponents of this approach argue that it promotes just-in-time learning, individualizes the learning, keeps the WBT content digestible, and increases completion rates.

In the authors' opinion, the real issue concerns whether the page model is instructionally effective for your audience. It really comes down to the basic principle of instructional design: To thine own audience be true. Regarding linear versus nonlinear content, certainly not every user is a savvy Web surfer who enjoys seeking out information. Many learners look for structure and guidance and feel uncomfortable without it. In addition, even if they are savvy Web surfers who often use the Web as a recreational or self-directed activity, many users have other objectives within a training context. They want to access the information they need and get out. They don't want to search.

Similarly, granular learning objects, or small nuggets of training, are very appropriate for just-in-time performance support, but if users are new to a topic, they will most likely find it very difficult to fit a small nugget of information into their schema without a big-picture context. Again, a basic ISD principle should be applied: What is your learning objective? In summary, before you decide what format you will use, research your audience and let their needs determine your approach. Here are two examples. Figure 7.7. shows a WBT course built on a logical, linear, task progression because the tasks are sequential. Note that the learner still has

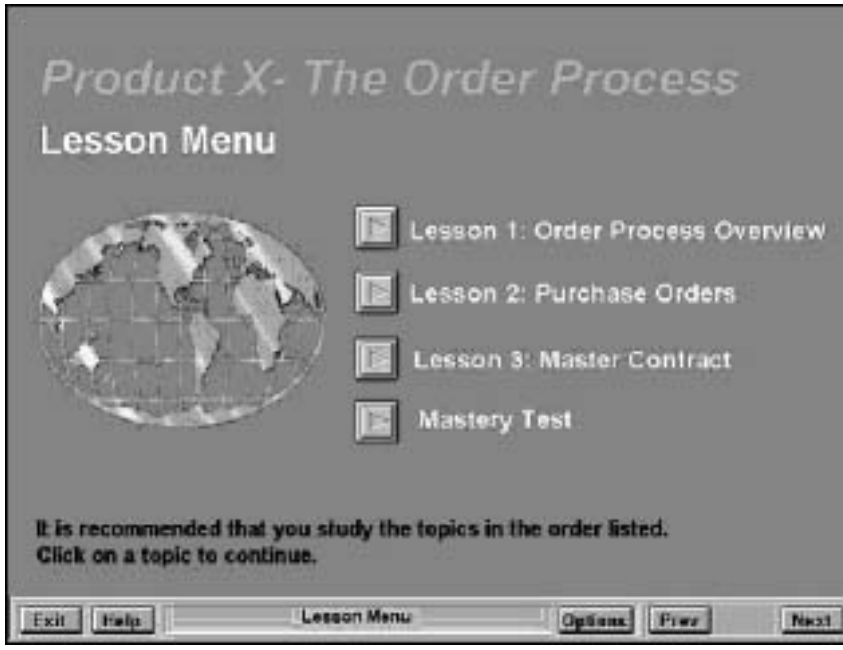

Figure 7.7 A linear menu.

the option to skip a task if they know it. The WBT course shown in Figure 7.8 lists topics from a nonlinear menu because each topic is independent.

7.5.3 ISD hints from documentation design

The key to effective documentation is easy access. Usable information, whether presented on paper or on-line, should provide what the users need when they need it. Oftentimes, however, the users vary. Consequently, so do their needs. While the development of a design strategy must begin with thorough audience and task analyses, clear and easy access to different layers of information may be where it ends.

The three basic principles of accessible content are as follows:

1. Organize for easy access.
2. Make the structure visible.
3. Write for readability.

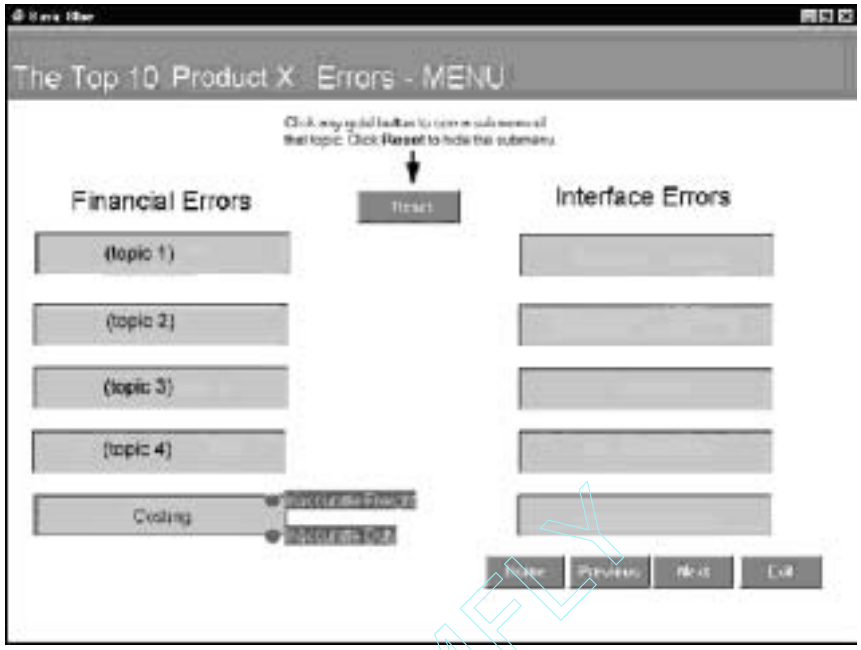

Figure 7.8 A nonlinear menu.

Organization is the underlying structure. Easy access is supported by an underlying structure that accomplishes five objectives:

- Groups tasks by users;
- Makes high-risk tasks easy to find;
- Puts critical information in front;
- Integrates the graphics;
- Makes the details accessible.

Layering information has a clear instructional benefit. It can highlight the key content, while providing user-controlled access to the details. When the information is presented on-line, however, there is also a very practical benefit. It is impossible to fit every bit of information on one screen. Rather than expecting users to scroll and hunt for what they need,

layer the information—particularly the detail—so that they can find it and go to it when they need it. But always provide them with a navigational interface that tells them where they are and allows them an easy escape. There are numerous ways to layer information.

Here a few examples.

- Information can be layered via an image map or menu. This is appropriate for situations where learners will have a varying degree of familiarity with the content.
- Critical information can be presented as primary content and additional information can be layered through the use of pop-ups or hot text.
- Optional audio buttons can provide additional information, if the learner wants it.

Figure 7.9 shows an example of layered content. The primary content appears in the black text to the right of the graphic. The users clicked on "Temperature and Resin Bed" to get the additional information shown in the bottom half of the screen. Notice the careful use of alignment and contrast.

The second document design principle pertinent to WBT states "Make the structure visible." When the goal is easy access, an underlying structure that supports layered, user-controlled content is not enough. To support easy access truly, the structure must be clearly visible. A WBT design that provides easy access also includes the following:

- Visible "chunks" of information;
- A labeling hierarchy;
- Descriptive headings and captions;
- Effective use of white space;
- Easy navigation.

Breaking information into visible chunks aids in access, comprehension, and retention. It helps the readers quickly scan for the specific chunk, or topic, they need. This is particularly helpful to the reader who is retrieving information as an ongoing reference. In addition, research has told us that readers comprehend and retain information best when it is

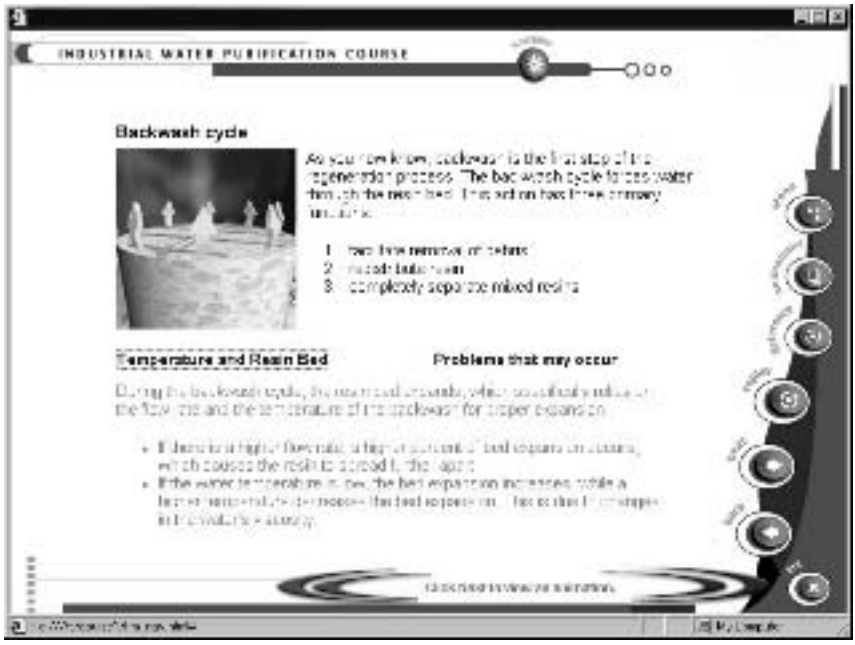

Figure 7.9 Layered content.

presented in approximately seven (plus or minus two) chunks [2]. Again, although this principle is traditionally applied to paper documentation, it is extremely relevant to on-line information. When users can see only one screen's worth of information at a time, it becomes extremely important that you make it easy for them to categorize and group key points into manageable and memorable units. A labeling hierarchy, descriptive headings and captions, and effective white space are all visual techniques for helping the reader categorize, manage, and retain the information presented. The example shown in Figure 7.5 illustrates a labeling hierarchy. Within step 1, there are steps A, B, C, and so on.

In addition, an effective layout aids access to information by providing easy navigation. When you provide consistent and obvious structural cues, learners will develop a comfort level that will allow them to concentrate on the content, rather than the navigation, of your site.

In summary, graphic and document design principles are not mutually exclusive. Your WBT layout decisions are both visual and informational.

Writing for readability is the third document design principle that carries over to WBT. Writing for readability simply means write in a style that is easy to understand. There are a number of style elements that contribute to readability:

- Correctness;
- Clarity;
- Concision;
- Cohesion and coherence.

The term "correctness" refers to the correct use of grammar and punctuation. When text is displayed on-line, correctness is less strictly enforced, because it is harder to read text on-line than on paper. This makes it more difficult for us to proofread our work on-line, which is all the more reason for a good editor.

Practical tip: *If you have a lot of text in your WBT, print the pages to proofread them on paper.*

Clarity refers to how easily your textual information is understood. Table 7.2 provides examples of ways that clarity can be enhanced.

The guidelines for creating concise documentation are too numerous to list here, but, in general, information is concise when the language is direct rather than passive, to the point rather than redundant or rhetorical, and economical rather than excessive.

Cohesion and coherence develop from the following characteristics:

- Clear chunks of information in reasonable lengths;
- Easily identified topics;
- Consistent treatment of like subjects;
- Clear transitions;
- Meaningful repetition.

In Chapter 3, we pointed out that poor writing can destroy the credibility of your WBT. Someone on the team needs to be a proficient technical writer, whose work should have both editorial and user reviews.

TABLE 7.2 Hypothetical Examples of Clarity

PRINCIPLE	ORIGINAL TEXT	SUGGESTED EDIT
1. Put preferred action first	User may further narrow down the list by clicking in the field.	Click in the selected fields to further narrow down the list.
2. In instructions, start with verb, followed by object.	Once the selection criteria has been defined, the user may press escape to return to the select screen.	Press ESC to return to the select screen.
3. Readers expect and quickly understand subject/verb/object.	Plans that are to become permanent records must be flagged.	You must select and flag the plans that will become permanent records.
4. Turn nominalizations into verbs.	It is easy to give any record enhanced capability.	You can enhance the capability of any record.
5. Put known information first; end with the unknown.	The heading dropdown menu allows you to define specific heading formats.	You can define your heading formats using the heading dropdown menu.

Practical tip: *Remember that typographical attributes, such as fonts, leading, and kerning, can be difficult to control or predict when filtered through a variety of user settings and browsers. Rather than trying to control every typographical nuance, focus on applying what you know about technical writing to presentation, navigation, and usability.*

7.5.4 Interactive design

The ability of the user to interact with and even control content is a primary benefit of WBT and one of the primary reasons for its success as a delivery method. You can use the following simple interactions in your WBT:

- Click interactions;
- Drag and drop;
- Rollover or pop-up;
- Text entry;
- Feedback.

Click interactions make things happen on the screen. Clicking on hot text—a word or words hyperlinked to information, such as a definition—is a classic example. If users need more information about a hot-text word, clicking on the link might take them to another screen, for instance. Graphics and icons can also be "hot." For example, you may be developing a new-hire orientation program for a retail organization, one objective of which is that the learner be able to use basic retail terminology, including "UPC." Some new hires will know what a UPC is; some will not. You could say, "All of our product must have UPCs," then include a graphic of a universal product code (a bar code) with the instructions "If you are not sure what a UPC is, click the graphic to learn more." Here, the graphic does double duty. It shows a UPC, and if that isn't enough, it provides a path for more information. Clicking on a graphic can also trigger animation, audio, or feedback. See [3] for research on the use of hot text and graphics.

Drag and drop allows the user to drag one screen element to another part of the screen. This approach lends itself to a variety of interactive concepts such as matching, categorization, and even construction of virtual machines, processes, or layouts. Rollovers and pop-ups display text or graphics when the mouse moves over a specific screen location. This is a fun way to allow the user to "search" or actively select more information.

Text entry interactions allow the user to type in a word or number. You may think of this as a "fill-in-the-blank" question, but with some imagination, text interaction can be used as a type of simulation as well. For example, suppose you wanted the user to fill in a field on a software screen. You could layer an invisible type area over the field on the screen print so that it looked as if the user were actually typing into the field. Text interactions make the most sense when coupled with a feedback mechanism.

Feedback is the heart of all good training. Within WBT, feedback is most often presented as text or graphics. While feedback is often limited to telling users whether they are right or wrong, once again it pays to think outside the box. Remedial feedback can also provide coaching or tell the user where to go for more information or review.

While these interactions may seem obvious, it is only with the advent of DHTML and the newer browsers that these types of interactions have become easy to create on the Web. Today, Web designers use JavaScript and DHTML to increase the interactivity of their sites, and many authoring tools offer a potpourri of interactive functionality.

DHTML is still a bit confusing for many developers—owing more to browser-compatibility issues than to the nature of the technology itself. Because Microsoft and Netscape are still not using the same standards, your authoring tool should offer only interactivity that works across browser platforms. If you are programming your own WBT, your developers must design bearing in mind that incompatibility issues do exist and that they have three options:

- They can design two versions of every page.
- They can design using only the technologies that are standard between the two browsers.
- They can design carefully, planning for a static display on the competitive browser.

Practical tip: *If your learners use different browsers, test your WBT using the different browsers.*

On-line exercises

Go to Microsoft's DHTML demos at http://www.bezerk.com. Play the game "You don't know Jack." This is a very creative example of high interaction with low graphic resolution. The audio creates an illusion of individual responses, while in reality the interaction is created via a series of simple clock-timed events. The download is also an illusion. The user actually downloads the common audio and graphic files.

WBT programming is discussed in more detail in Chapter 8.

References

[1] Gibson, E., *Principles of Perceptual Learning and Development*, New York: Appleton Century Crofts, 1969.

[2] Conway, M. A., *Cognitive Models of Memory*, Cambridge, MA: MIT Press, 1997.

[3] Stone, D. E., et al., "Information Engineering: On-Line Analysis of Information Search and Utilization," presented at the annual conference of the Eastern Educational Research Association, Baltimore, MD, February 1983.

8

Content development

WBT content development (see Figure 8.1) is a tricky subject to pin down because it is so volatile—WBT is hot and just about every major software developer has jumped into the software production arena. Thus, new and better technology is constantly being developed. Some basic concepts and considerations, however, are fairly constant, and this chapter discusses the following more conceptual aspects of tool selection:

- Tools used to develop the Web site;
- Tools used to develop the courseware;
- Tools used to develop the media.

Furthermore, a number of key players have been around for a while. Therefore, it is with some confidence that a table of potential product sources is provided in Appendix A.

First, it may be helpful to understand what you need to run WBT. You need a Web server, or a host; on that server, you need a Web site; on that Web site, you need courses; and within those courses, you need media. Your training courses may exist as a separate site on a shared server, they may exist on a dedicated server, or they may exist as links on a corporate Web site that has multiple functions. The point is, a single training course

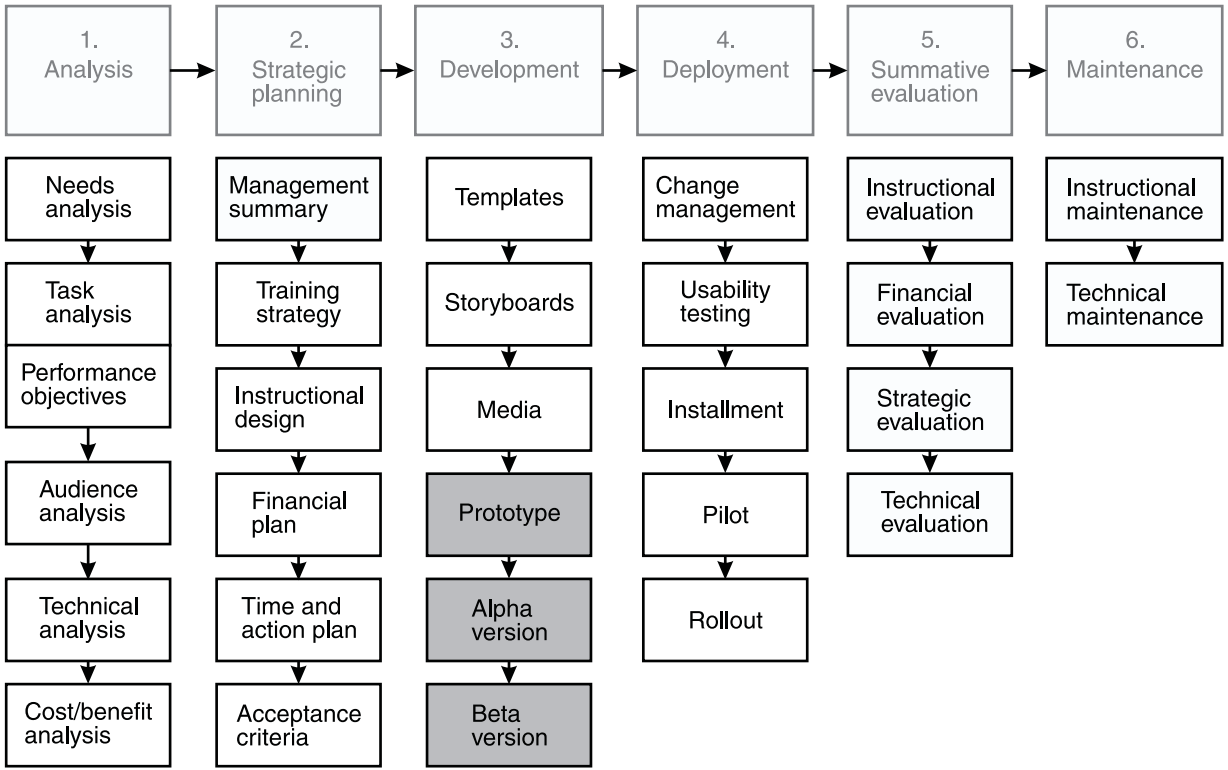

Figure 8.1 WBT content development.

rarely exists as a single Web site. Typically, one course is part of a larger pool of information, including the training's administrative and organizational structure.

8.1 Web site development tools

There are basically three ways to approach Web site development:

1. Use a programmable Web authoring tool;
2. Use a nonprogrammable authoring tool;
3. Program the WBT yourself.

Your team will decide on an approach based on the existing infrastructure, the size of the project, and its level of expertise. For example, if you are a single training developer who is going to put a course out on your existing corporate intranet, you do not need to develop the Web site at all. The Web framework already exists; you will only need to develop the courseware. You will, however, need to talk to your Web master to determine what standards exist and how your courseware will be integrated into the existing site. If, on the other hand, your project is large or a Web site does not already exist, you may want to consider creating the Web site outside of your courseware or using a third-party hosting service.

8.1.1 Programmable Web authoring tools

Programmable Web authoring tools are software applications that allow you to create a Web site without prior knowledge of HTML—supposedly. Realistically however, although these tools might be a blessing to training teams creating basic sites, teams developing complex corporate sites will want a member able to read and tweak the software-generated HTML.

You can use these tools to manage the infrastructure surrounding the courseware, to create the actual course framework (i.e., the pages or frames), and even to generate some of the content, particularly the text. These tools will then allow you to embed externally developed media. Some of the most pervasive Web authoring tools include Microsoft FrontPage, Macromedia Dreamweaver, and Adobe PageMill.

8.1.2 Nonprogrammable Web authoring tools

A number of tools will create your site for you. For example, many third-party Web sites will host your courses for you on their server and provide you with their tool for creating the course. LMSs can also be used create and manage your course infrastructure. These LMSs are compatible with, but do not create, a variety of courseware programs.

8.1.3 Program the WBT yourself

Of course, if you have a unique need and a competent Web master on your team, you can create your own Web site and WBT. The Web site will provide a single location for people in your organization to access their learning needs. Once logged into the LMS through the Web site, students can take courses with a wide range of attributes. Naturally, you will need to ensure that your development team has all the right skills for the courses you plan to offer. For example, if you want to create a sophisticated course that contains custom simulation, your team may need to include a programmer who can create the simulations.

In addition to HTML, the following new markup languages are being developed, which enable Web masters to work more efficiently, maintain better control, and create more dynamic sites:

- *DHTML* (dynamic HTML) is not a language per se, but a combination of several technologies including HTML, CSS, layering, VBScript, JavaScript, and Document Object Model (DOM). It is used to make Web pages interactive and has three very appealing characteristics:

  1. Considered "client-side" technology, it relies on the browser only for display and navigation. In other words, the code comes from the server, but the action takes place on the user's machine, which makes it a low-bandwidth, fast-response means of delivering interaction.

  2. CSS allows control over fonts, margins, and spacing, as well as absolute positioning, which allows elements to overlap and move into exact positions.

  3. The Microsoft version of DHTML includes built-in multimedia and data objects that are controlled via scripting languages and that allow for stereo sound, on-the-fly image manipulation, and even access to server-side databases without the use of plug-ins.

The not so appealing side to DHTML is that Netscape and Microsoft both support their own versions, which are not fully compatible. Although both companies have committed to working with W3C to develop standards, as of September 1999, both companies still use some proprietary components. Until this is resolved, a promising and relatively simple way to delivery interactivity over the Web will remain impractical for most Web designers. In the meantime, they can design two versions. Alternatively, they can design for one browser knowing that some interactive elements will appear static when viewed with the competitive browser, they can use only those components that work with both browsers (cross-browser DHTML).

DHTML will eventually be replaced by extensible HTML (XHTML), which cleans up the inconsistencies of HTML and incorporates all the advantages of extensible markup language (XML). It supports scripting like HTML, but is being driven by W3C standards rather than ad hoc development.

- *XML* "is now an industry standard for delivering content over the Internet. … XML allows authors to define their own tags based on what the content actually is. When tags are used consistently over a set of documents, the set of tags becomes a language," writes William DuBay [1]. According to DuBay, XML languages have been designed for different disciplines, such as science, mathematics, software, and multimedia. He says XML offers five benefits:

  1. Platform-independent exchange of information;
  2. Reusability of documents and individual items;
  3. Classification of individual elements for easy search and retrieval;
  4. Standardization of tags via rules which are then verified by the browser;
  5. Customization of XML documents for the preference of individual users. (For example, Amazon.com uses XML to develop user profiles and make purchase suggestions based on that profile.)

  Conceptually, the essential difference between HTML and XML is that HTML tags describe how the enclosed information should be

displayed (e.g., bold italic). XML tags describe what the enclosed information is:

```
<name>
   <first>David</first>
   <last>Stone</last>
</name>
```

A style sheet then controls how the elements are displayed. XML can use standard CSS or more powerful style sheets developed just for XML (see [2] for a basic book on this subject).

CCS offers improved control over formatting by separating the format from the content and permits the use of parent templates.

- *SMIL*, or synchronized multimedia integration language, "is a recommendation from the World Wide Web Consortium that allows for the creation of time-based multimedia delivery over the Web. Based on XML, it allows developers to mix many types of media, text, video, graphics, audio and vector based animation together and to synchronize them to a timeline" [3]. (See also [4].)

Among all of these choices, DHTML has the advantage of being the most universal; however, it is also cumbersome as well as awkward to maintain and migrate to future languages for storage and presentation. If your delivery platform and the sophistication of your developer resources allow you to use XML or XHTML, your content will be easier to maintain and more easily converted to emerging technologies.

Other programming languages are available in addition to the markup languages listed above. One of the most common languages used to develop client and server Internet applications is JavaScript. JavaScript Applets create special effects and interactivity, and they can run on any Netscape 4.0 or Internet Explorer 4.0 browser or higher without plug-ins. Most training professionals, however, are not Web masters, and most Web masters are not training professionals—thus the need for Web courseware development tools and WBT authoring tools, which will create complex code for you.

On-line exercise

For a good overview of markup languages and Web design, visit "Web Developer's Virtual Library" at http://www.stars.com.

8.2 Courseware development tools

There are three approaches to developing WBT:

1. Use a programmable authoring tool;
2. Use a nonprogrammable authoring tool;
3. Program the courseware yourself.

8.2.1 Programmable and nonprogrammable WBT authoring tools

A number of the software vendors that provide WBT authoring tools offer two versions of the software: a programmable version and a nonprogrammable version. You may decide to use one or the other or a combination of both, depending on your needs.

For example, you may find that 90% of the functionality you need is contained within the application programming, but you would like the option of adding additional functionality. In this case, you would probably opt to purchase the programmable version. This will allow you to "tweak" the code, add new objects to the menus, or both.

Nonprogrammable authoring tools would not allow you to create simulations of aircraft cockpit controls, for example. Therefore, if you have such a requirement you would need to use a programmable tool to supplement or replace the nonprogrammable tool. (Toolbook Assistant and Toolbook Instructor are, respectively, nonprogrammable and programmable tools from click2learn, http://www.click2learn.com.)

Conversely, you may have several different business units creating courses without programmer support, or you may find that all of the functionality you need exists in the nonprogrammable version. In this case, it may be a strategic decision to use the nonprogrammable version. Not only is it easier, thereby permitting rapid development by nonprogramming development teams; it also creates a self-enforced standard in that teams cannot go beyond the parameters defined by the software. One word of caution—when this approach is taken, it is not unusual for the users to eventually bump up against some programming they wish they could change. Understanding this caveat up front, these tools have still made a dramatic impact on the accessibility and usability of WBT tools.

Practical tip: *Even if you decide to use a nonprogrammable authoring tool, you should be familiar with the basics of HTML so that you can make decisions about how to display and publish your course. Basic HTML is extremely*

easy to learn. For a good on-line tutorial go to http://www.2kweb.net/html-tutorial. Try creating a simple site with a few pages before tackling WBT.

Sometimes, if you have multiple courseware developers, a combination of a programmable and a nonprogrammable version can be an attractive alternative. For example, you may want additional functionality or design and control over course consistency. In that case, some authoring tools will allow you to create objects using the programmable version that can be utilized in the nonprogrammable versions. In that way, you can design elements that are passed on to the individual developers, and you can even shut off functionality or design elements that you do not wish them to have access to. This alternative can be cost efficient as well. Usually, the programmable versions cost more. You may want the one central

TABLE 8.1 Pros and Cons of WBT Authoring Tools

TYPE	PROS	CONS
Programmable	◆ Can add functionality or code ◆ Can customize existing code ◆ Can control object menus and template options	◆ More expensive ◆ Longer learning curve ◆ Must know code and be able to program to customize
Nonprogrammable	◆ Relatively inexpensive ◆ Easy to learn ◆ No programming experience required ◆ Contributes to rapid development ◆ A certain level of control over function and design is inherent in the application	◆ Cannot be customized
Combination	◆ Combines the best of both worlds (see above) ◆ Provides mechanism for achieving consistency across development teams	◆ More expensive ◆ Longer learning curve ◆ Must know code and be able to program to customize ◆ To optimize this strategy, each team must reach consensus and/or support the "central control" approach.

design group to have the programmable version while the individual units are licensed for the less expensive nonprogrammable units. The pros on cons of each approach are summarized in Table 8.1.

Practical tip: *Determine what functionality you need before deciding on your development tool.*

8.2.2 Program the courseware yourself

The tools, or languages, used to create Web sites and WBT are basically the same, as is the rationale for electing to "do it yourself," whether you are creating the site or the actual courseware. If you have a unique need and the expertise, you may feel that programming the courseware in-house is the best method.

8.2.3 Other considerations

Most WBT development involves a third-party authoring tool for the site, the course, or the media. Once you have determined what kinds of tools you will need, you will need to decide on a software vendor.

Top 10 considerations when selecting an authoring tool

1. *What is the reputation and longevity of the vendor?* If you are dealing with a start-up company, you may want to arrange to have the source code for the authoring tool placed in escrow so that if the company fails you have a method of protecting your investment.
2. *What training does the vendor provide?* You will find it much more cost-effective to implement an authoring tool if your staff can be properly trained in its use at the start of the project.
3. *How is the vendor's technical support?* All authoring tools have some undocumented "features" or just plain bugs. You will need help to get around them.
4. *Are user groups available?* Learning from others who are using the tool is one of the best ways to go beyond the initial training and do exciting new things.
5. *Does the tool support collaborative authoring?* Most authoring teams, especially on large projects, need to coordinate their development. If your prospective tool does not support collaborative authoring and version control, you may be in for trouble.

6. *Can the tool be integrated into related systems, such as automated storyboards, HR systems, EPSS, LMS, or KMS?* Your courses must work within the framework of your organization and with industry-standard tools. If your tool cannot report results to the students' personnel files, you will have a problem.
7. *Is the tool compatible with other authoring tools?* You will want all of your courses to work together seamlessly under the control of your LMS. If they do not, you will not have a workable learning system.
8. *Are your designers familiar with the tool?* Designers need to understand the tool's design capabilities. If they create designs that exceed the tool's limits, you will either need to redesign or select another tool.
9. *What are the tool's abilities (e.g., answer analysis, simulation, feedback mechanisms)?* The tool that you select must be able to create the kinds of instruction that your organization needs. First define those needs, then find the tool.
10. *How compatible is the tool with industry standards?* Developing courses that can be edited using other industry standard tools is the best insurance that your investment in WBT development will be supportable (technically) in the future. Do not use tools that create a proprietary format inaccessible without a special editor. (See http://www.dr-david-stone.com for more information regarding industry standards such as SCORM, W3C, and AICC compliance.)

Regardless of what method you use to develop your courseware, the means for developing the external media evoked by the course is the same. Media development tools are discussed in Section 8.3.

8.3 Media development tools

The big issue with multimedia on the Web has never been how to create it, but how to create it so that it will download quickly and perform well given the limited bandwidth available. Why is bandwidth an issue? Studies have shown that pages need to download in 10 seconds or less for learners to use and like the course and, therefore, for the course to be productive.

Limited bandwidth, however, contributes mightily to download time. As a result, the number-one issue with multimedia on the Web has always been, and continues to be, bandwidth. In the past, bandwidth has limited which media could be deployed from a Web site. Long download times have forced WBT designers either to avoid certain media (e.g., large graphics or audio and video files) or to search for tricks to shorten download times. Although many users are upgrading their modems and larger pipelines are slowly being laid, the infrastructure upon which Web data travels is not going to change dramatically in the near future. In short, limited bandwidth will continue to be an issue.

Therefore, much effort has been taken to develop technologies that compress or stream the media, and great strides have been made. In addition, progress has been made in defining an optimum infrastructure based on today's available resources. In short, multimedia on the Web is a reality today. This section discusses the four following options for providing multimedia:

1. Compressing files;
2. Streaming media;
3. Designing for limited bandwidth;
4. Employing efficient architecture.

8.3.1 Compressing files

Compression is one of the methods most often used to reduce file size and shorten download time. For several years, technology has allowed content developers to compress multimedia files easily, and that technology is improving all the time.

Graphics file compression

You can reduce the size of graphics files in the following ways:

- By reducing the proportions;
- By reducing the resolution (which also reduces the size of the image);
- By reducing the number of colors;
- By using a compressed file format.

While you do not need to be a graphic artist to create effective, basic, graphics files, you should understand the differences between file formats in order to determine the best way to save your images. You will want to consider image quality, file size, and what file formats are supported by your authoring tools and your users' browsers. (See Table 8.2.)

The most common Web graphic bitmap file formats are Graphic Interchange Format (GIF) and Joint Photographic Experts Group (JPEG). In addition, graphic and Web designers have recently become interested in Portable Network Graphics (PNG). All of these file formats are used to compress graphics, which is why they are so pervasive on the Web.

The GIF format, which has been used for Web graphics for a number of years, is an 8-bit file format supported by many platforms. It uses indexed color to confine colors to a specified palette. Because it is 8-bit, the maximum number of colors it can use is 256. When this format is used for the Web, however, you can confine it to a 216-color, Web-safe palette, or you can reduce the colors even further for even more compression.

GIFs can be used in special ways:

- *They can contain a transparent area.* When you see a graphic that looks like a "cut out" silhouetted against the background, you are seeing a transparent GIF.
- *They can be used to create simple animation.* When you see a globe rotating on a Web site, that is an animated GIF.
- *They can be saved as "interlaced" files.* Browsers that support interlaced GIFs will begin to build a low-resolution version of the full-sized GIF image on the screen while the file is still downloading. This creates a "fuzzy-to-sharp" animated effect that is visually appealing and gives the illusion of a faster download.

Practical tip: *Save your graphic as a GIF when you want to make the background transparent or animate the image or when the original image is already 256-color (i.e., a screen print of an application that uses an 8-bit graphical user interface).*

More recently, the JPEG (pronounced "j-peg") format was introduced. While a JPEG graphic is slightly larger than the same graphic in a GIF format, this format can efficiently compress 24-bit, true-color images. True color means that the image can contain a virtually infinite number of colors (technically, 16.8 million). For that reason, JPEGs are used largely

for photographic images and complex illustrations. Sounds great, right? It is, but to use the format effectively you should understand how JPEG compression works. JPEGs use "lossy" compression that looks for redundancy in the image and throws away unneeded image data to achieve a smaller file size. In many cases, the naked eye cannot see the difference, while the reduction in file size can be dramatic. At the same time, data is discarded every time a JPEG image is saved, and, as a result, with every save, some image quality is lost. Eventually, after too many saves, you will see degradation in the image quality.

Practical tip: *If your file is a photograph, save it as a JPEG, but not until you are ready to save it for final output.*

The PNG file compression format is becoming more widely accepted by Web designers for a number of reasons. First, unlike the GIF format, it is patent free. (As a graphics developer, you do not need a license to make, view, or send GIFs, but graphic software developers do.) Second, the PNG

TABLE 8.2 A Comparison of GIFs, JPEGs, and PNGs

FEATURE	GIF	JPEG	PNG
Is supported by all Web browsers	X		
Can create transparent areas in an image (e.g., a transparent background)	X		X
Compresses bitmap images	X	X	X
Compresses images with large fields of homogeneous color most efficiently	X		X
Compresses true color images with little distortion		X	X
Handles complex illustrations well		X	
Handles hard-edged images such as text, diagrams, and computer-generated graphics well	X		X
Can be interlaced	X	Possible with a new form called "progressive JPEG," but most image editors do not yet support the files	X

format has several advantages over GIFs: It has more transparency options, an interlaced PNG builds faster than an interlaced GIF, and images can be saved in either 8-bit or 24-bit true color. Because PNG is relatively new to mainstream graphic development, however, some software applications and older browsers do not support it. (See the PNG Web site at http://www.libpng.org/pub/png/png.html for up-to-date details on browser support.)

Whether your bitmaps are GIFs, JPEGs, or PNGs, you can optimize your file size with graphics editing tools such as PhotoShop, Corel Draw, or PaintShopPro; however, if you want to get really sophisticated, tools exist that can analyze your images—or even an entire Web site—and show you what options are available for optimizing their file size. Equilibrium's DeBabelizer is one such tool that is popular with graphic designers. Raspberry Hill Publishing's GIF Wizard has similar functionality, but it uses a remote site, rather than your computer, to process the images. For each image, it allows you to compare the original and several reduced versions simultaneously before taking action.

Although GIFs and JPEGs will likely be used in the near future to compress bitmap images, there is yet another file format on the horizon: scalable vector graphics (SVG). According to *Adobe Magazine*, "There will soon be a new graphic format, called SVG, that promises to define vector images (line drawings) with smaller file sizes." The project of the SVG Working Group, the SVG format promises to generate smaller files for more complex vector graphics, use XML standards, provide increased functionality as compared to today's illustration programs, take advantage of interactive technologies, and require no plug-ins. (For more information on SVG, see Adobe's Web site at http://www.adobe.com/svg/main.html.)

On-line exercises

- Go to http://www.ee.surrey.ac.uk/FAQ/standards.html for explanations and examples of the different graphic file formats.
- Go to http://www.kodak.com and click on "Taking Great Pictures" in the drop-down menu. Here you can watch an interlaced image develop as it downloads.
- Go to Pat McClendon's page at http://www.patmcclendon.com/graphics.html for examples of different graphic files and techniques.

Audio file compression

Delivery of audio or video on the Web requires the installation of plug-ins—software programs that extend the capabilities of your browser. Cross-platform plug-ins are available for most important audio formats, such as RealNetworks' RealPlayer, Apple Computer's Apple QuickTime, and Nullsoft's Winamp MP3 player. (See http://home.netscape.com/plugins for more information.)

Helper applications are similar to plug-ins in that they must also be downloaded and then launched by your browser. Applications that run with helper applications typically run outside the browser window and operate independently of applications running in the browser. For example, audio files that are run with helper applications are not synchronized with animations or other events running within the browser window. This may not be a problem if the audio application is a recorded speech that is played while the user looks at a still photo of the speaker in the browser window; it would be a problem if the audio application was to be associated with an animation of a door slamming in the browser window.

Up until recently, there were two basic audio file types used in electronically delivered instruction: the musical instrumental digital interface (MIDI, or .midi) and a Windows wave form audio file format (WAV, or .wav). MIDIs are electronically produced melodies. The best sound quite good, but there are many poorly made MIDIs that sound metallic or cartoon-like. What is nice about them is their small file size.

WAVs can be used for music or voice, offer a much richer sound than MIDIs, and are easy to create with basic recording and editing software, such as Creative Lab's SoundBlaster. No matter how you slice it (or record it) though, WAV files are relatively large and cumbersome to download.

There are several ways to reduce the size of your audio files. First, you have some control over file size when you record. For example, a 16-bit recording is twice as large as an 8-bit. Of course, the decisions you make to reduce the file size will also affect the sound quality, but you may find that you do not need a larger file. You may wish to experiment with several recording options to determine "how low you can go." Second, you can reduce the size of your audio file by using compression, or encoding, software. With the latest audio encoding technology, you do not have to sacrifice quality to reduce your file size. The most efficient audio compression technology available today is MP3.

What is MP3? MP3 is an open standard compression format for digital audio that provides CD-quality sound in files a fraction of the file size

of older technologies. Because it is an open standard format, no one organization controls it; because no one corporation controls it, it has quickly become the Internet standard and is support by the all of the giants in the audio field, such as Microsoft's media players, Macromedia's Shockwave, and RealNetworks' RealPlayer.

MP3 can compress audio data in a ratio of up to 11:1 with almost no audible loss in sound quality. This means that a four-minute song on a CD, which would take up 40.3 MB in 16-bit, stereo WAV format, can be reduced to only 3.65 MB. Making an MP3 track out of a WAV file is simple, and conversion tools are available on the Web at little cost or for free. We have provided several links on our associated Web site.

Video file compression

AVI is the most common video format for PCs. Like audio, when these files are left uncompressed they are too large for most WBT, but again MPG compression technology can be used to significantly reduce video file size, and MPG full-motion video can be viewed over the Internet with a plug-in.

8.3.2 Streaming media

Streaming technology, or video on demand, was developed as another solution to limited bandwidth. It allows the user to view and listen to media before a file is completely downloaded. RealNetworks' RealProducer and Apple's QuickTime are two of the most common video streaming tools. Microsoft has recently introduced it's own streaming media format.

There is also a Quick Time platform called Quick Time VR that allows you to use 2D photographic images to create 360°, panoramic views complete with interactions. According to Apple's Web site, "Interactive content design and immersive imaging allow the viewer to explore and examine detailed virtual worlds using a computer and mouse, not cumbersome goggles, headsets or glove" [5].

Even with today's compression, video streaming requires a separate server to avoid impacting your corporate network, but these servers are becoming very affordable. In addition, while each type of streaming media requires its own, specific plug-in, surveys have shown that most Internet users routinely download plug-ins to view desired media. For example, according to Apple's Web site, over 10 million Star Wars fans downloaded the film trailer for *Star Wars, Episode I: The Phantom Menace* [6].

Practical tip: *Prices for streaming software and servers can reach over a thousand dollars. The price of the software depends on how sophisticated your video will be. The price of the server depends on the streaming capacity you need. Will you have five users or several hundred users accessing your course at the same time? Once again, you should determine your needs before you select your tools.*

On-line exercise

- For information and demonstrations, go to http://www.realnetworks.com or http://www.apple.com/quicktime.
- Go to http://www.streamedinfo.com for free on-line tutorials that feature streaming video.

8.3.3 Designing for limited bandwidth

The emergence of new technologies has enabled Web designers to design for limited bandwidth. For example, CSS and DHTML have given Web designers control over advanced page typography and layout. Before the advent of CSS, a headline had to be made into a graphic, which wasted bandwidth. Now CSS offers the ability to select type style, precise size, and leading for regular text, as well as exact placement on the screen. New vector graphics formats like Macromedia's Flash enable tiny images to scale to any size without degradation in image quality. Downloadable fonts send only the characters needed for a given page. All of these developments are combining to advance WBT as a viable training medium, and all of them have been driven by the constraints of limited bandwidth.

Fonts, of course, are a key issue with respect to delivery of WBT in multiple languages. Most readers of this text will find that if they want to access a Japanese or Chinese language Web site, they must first download the appropriate character set for the page to display correctly. Go to http://www.china.com. Most readers will be prompted to download Chinese (simplified) text display support. Once downloaded the character sets and fonts must be properly installed to display the Web site correctly.

Unless you have an experienced Web developer on your team, you probably are not familiar with these often complex technologies. Not to worry! There are other simple ways to reduce download time. First, you should understand that your browser has to communicate with the server for every graphics file. Therefore, if you are creating a collage, such as a navigational toolbar, you might combine smaller images into one image

and use an image map to create the individual links. In a low-bandwidth environment, the one image will download faster than all of the images would download individually, even if the file size for the one graphic is larger. Second, you should understand the various graphic file formats so that you can weigh quality against file size to determine the combination that works best for your image. Finally, most WBT authoring tools give you control over position and text attributes without your needing to understand CSS or DHTML technology. They generate the necessary code for you. Many tools also allow you to easily create image maps, or hot spots on a graphic.

On-line exercise

Go to http://www.usableweb.com/items/speed.html for more information and tips about designing for speed.

8.3.4 Employing efficient architecture

In [7] columnist Jill Hecht writes, "Content is king, but a speedy network does not hurt." She talks about how the Naval Postgraduate School in Monterey, California, replaced its existing Ethernet network with an asynchronous transfer mode (ATM) backbone. According to Hecht, "ATM is more dependable for transmitting simulations and on-line courses. ATM experts say the technology makes a better choice for training networks." Not only does an ATM framework increase bandwidth, it also manages data better and costs about the same as Ethernet technology.

On-line exercise

For more information about ATM, go to The ATM Forum at http://www.atmforum.com.

As you can see, there is a myriad of tools available for content development. Although, as the training expert, you may or may not develop all of the content yourself, you should be aware of the technical and design factors that can affect your team's content decisions. You should also contribute to those decisions to ensure that your content decisions are effective from an instructional perspective.

8.4 Content management systems

Finally, we would like to point out that a new generation of tools has been created to facilitate the collaborative creation and management of WBT

greatly. These tools promise radical improvements in time to market, globalization, and localization of content. Content management systems, discussed in greater detail in Chapter 12, can be used to facilitate the design, development, and maintenance of WBT. Companies such as Leading Way (http://www.leadingway.com) and Knowledge Mechanics (http://www.knowledgemechanics.com) have introduced systems that not only facilitate the creation of WBT, but store, assemble, and maintain content for as long as necessary. This is in contrast with traditional authoring tools that were focused only on creating WBT.

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Part IV
Phase 4: WBT deployment

9

Deployment

Chapter 8 discussed the development, or production, of WBT. This chapter discusses what happens next—how to successfully deploy your WBT now that you have developed it successfully. Basically, there are five activities that should be planned for and executed to ensure a smooth deployment (see Figure 9.1):

1. Change management;
2. Usability testing;
3. Installation;
4. The pilot;
5. Rollout.

Usability testing, installation, conducting a pilot, and the rollout are all sequential events that move the product from testing within a small, controlled user group to corporatewide deployment. Change management, on the other hand, is an independent event that does not deal with the product directly. It can take place concurrently with any or all of the other four stages; however, because change management (or the lack thereof) can greatly affect the acceptance and ultimate success of the prod-

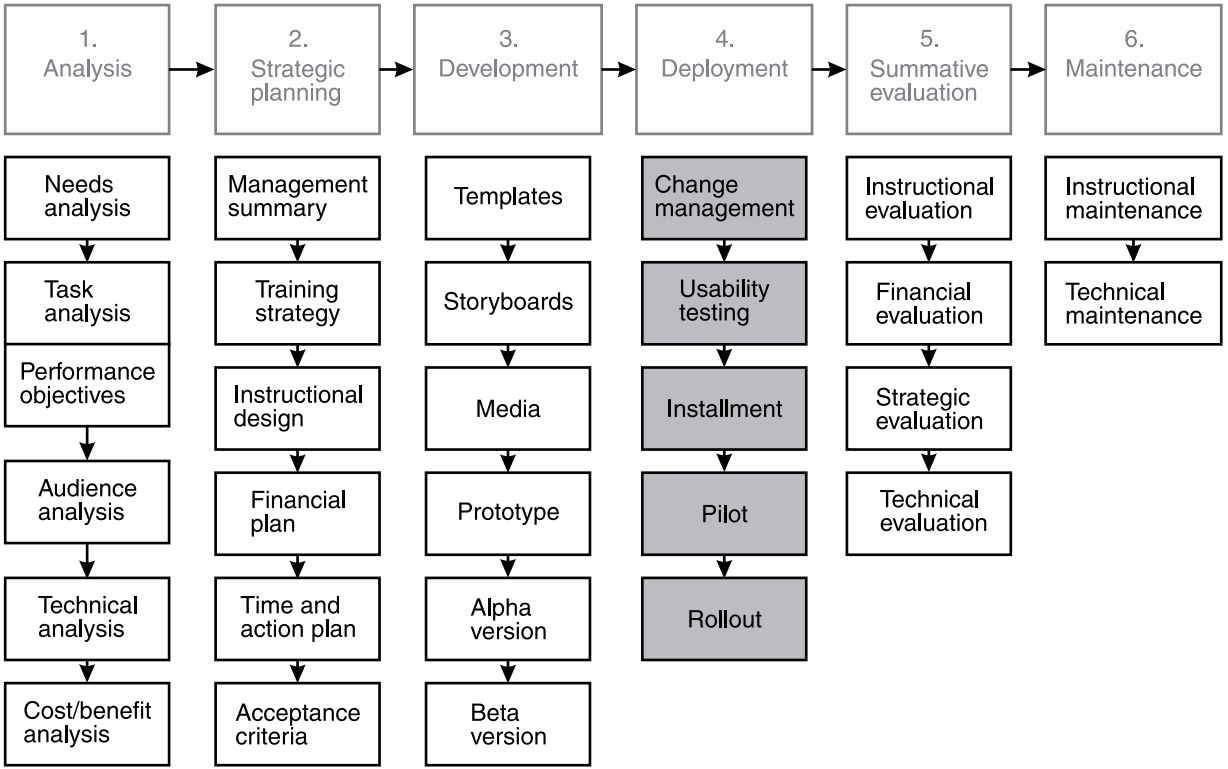

Figure 9.1 The deployment phase of the WBT model.

uct and because change management takes time, we have elected to present it as the first step in the model.

9.1 WBT and change management

Change management involves defining a systematic plan for readying an organization to accept change. When you are deploying WBT for the first time in your organization, change management will entail preparing your organization for a new learning model, or paradigm.

As a trainer, you may not be directly responsible for the implementation of change management, but you should ensure that your managers address this need. Your training will not be successful, however well designed, unless the organization is ready for it. In addition, you are the expert regarding how your users currently perceive and use training. If you are a trainer or training manager, you are the team member best able to provide the user perspective on the change management plan.

9.1.1 The human factor

Preparing the human work force to accept a change in how, when, and its members learn is at least as important as making sure that the new program is technically operable. Yet, this aspect of change management is often planned haphazardly, if at all, even though the user population's acceptance or rejection of the product is ultimately the key to its success. It is human nature to resist change, and the degree to which you prepare the users—the humans—for this change can determine how much they will resist or embrace it.

Of course, the thorough audience analysis you did up front has provided you with valuable insight into how much change your new WBT typically represents for your users:

- Are they afraid of new technology, or they are savvy Internet users impatient for an easier, more portable way to access learning tools?
- Is their current instruction competency-based, or are they being held accountable for learning in a measurable way for the first time?
- Are there any union issues involved?
- Are there government regulations or legal restrictions to consider?

- Are they used to training via full-blown CD-ROM or in a classroom?
- Have they self-managed any of their training in the past, or was a predetermined schedule and mandatory attendance the status quo?

In short, you need to determine what exactly will be different and to prepare the users for every element of impending change—for using new equipment, for performance measurement, and for learner-centered rather than stand-up instruction. There are two ways to prepare your users, and you will probably want to use both of them:

1. Market the change so that line workers see it as an improvement—not merely as a change for change's sake, as the change du jour, or as something passed down from senior management.
2. Actually train the users on whatever equipment they will be using.

The equipment training will be more effective when the marketing comes before the training, so that the users are already comfortable with the concept of WBT. People learn what they want to learn.

9.1.2 Marketing a training change

While past instructional research has shown that personal attributes, such as attitude and motivation, are among the hardest characteristics to affect, be positive—take heart! Regard that research as a warning not to leave the corporate culture to chance, and remember that you can positively affect employees' attitudes toward training. Other research has shown that training is one of the employee benefits most valued by today's workforce. To some extent, that has always been true. No one wants to be or feel incompetent. But in today's rapidly changing workplace, workers feel even more pressure to keep their skills current. Certainly, the marketing of your new learning model can include an appeal to their desire for improved training. And while the consequences of poor training are obvious, a gentle reminder of the bottom line cannot hurt. Without rapid and effective training that results in skilled workers, the company cannot compete successfully in today's global market—no growth, no new jobs, no raises, maybe even no more company.

***Practical tip**: Emphasize the accessibility (anytime, anywhere!) and effectiveness (competency-based!) of WBT to demonstrate to your audience how it will improve their job skills.*

You might remember from Section 1.1.3 that one of the key aspects of the needs analysis was to get the buy-in of line managers—their agreement as to what the training needs actually were. If you did your homework up-front, the resulting line manager support will go a long way to ensuring general acceptance of the new program. Employees need to know that their direct supervisors value training. Even when the line managers intrinsically support the new program, you may want to meet with them to define how they can demonstrate their support in practical terms. This means that employees need to be given the time to train; it means training should receive some priority billing in the list of "things to do"; and it means the employee who takes the initiative to get trained should receive recognition.

***Practical tip:** Work with line managers to ensure that "anytime" does not mean that workers have to cram the learning into an already full day. Employees should be provided the means and the time to complete the training. Unless workers are provided with time, opportunity, and supervisor support for WBT, it just will not happen. Not only workers, but their supervisors and managers must be held accountable for the timely completion of WBT, which should form part of the annual review and evaluation process for all levels of management, including the workers. Naturally, this assumes that the WBT will have direct applicability to the critical business goals of the organization and that all employees will find it directly relevant to their work performance.*

Marketing the benefits of competency-based instruction requires a clearly stated benefit to the users. Will they obtain an industry-valued certification? Is their performance measurement tied to their performance reviews, promotional assessment, or compensation? Work with human resources departments and line managers to ensure that the certification is more than a piece of paper filed away in a drawer and forgotten, that it becomes an integral part of an employee's career development. Your users will want to know the what's-in-it-for-me (WIFM) details.

You may already be familiar with Kirkpatrick's model for evaluating training by measuring four areas of learning and response [1]:

1. *Reactions.* What did the learners think of the training?
2. *Learning.* What did learners learn during the experience?
3. *Behavior.* What knowledge or skills did learners apply on the job?
4. *Results.* What changes in results and productivity have been observed on the job?

You will want to ensure that all stakeholders in the WBT effort have a clear understanding of your plan for evaluating the results of the training along each of these four dimensions. Key stakeholders will also want to know how you plan to determine the ROI for the WBT effort. Whalen and Wright's *The Business Case for Web-Based Training* is an excellent reference on this subject [2].

Finally, it is important to market the competency-based training as a development tool rather than a tool for "weeding out" poor performers. Most adults, when they think of tests, think of the traditional, academic bell curve—and that makes them nervous. Under the traditional scenario some people excel, others are average, and some people fail. When it comes to job performance, no one wants to fail. It is the marketing plan's task to ensure employees that the company does not want them to fail either. Remind your users that once a person is hired, the company has a significant investment and interest in helping that person succeed. Explain to them that WBT is an excellent vehicle for helping individuals reach their potential because it is user-centered instruction. It takes individual pace and style into account, provides remedial feedback in a private setting, and allows experimentation in a risk-free environment.

Having said that one business objective is to help employees reach their potential, you need to have a clearly defined plan in place for those who do not. In reality, a competency test often means that some users will fail. Consider the fact that not every new employee will be successful. What is the existing turnover rate? The training should be designed to reduce employee turnover, but will probably not eliminate it altogether. Business decisions need to be made regarding the following:

- What is an acceptable failure rate? Ten percent of the population? Twenty?

- How many opportunities will users have to pass the tests?
- What if they do not pass after multiple attempts? Will coaching be provided? If so, how much and by whom?

Legal issues can come into play here. If an existing employee has always received stellar performance appraisals in the past and competency measurements suddenly reveal him or her to be incompetent, you may have to consider a different action plan than you would for a new hire who is still in the probationary period.

These issues should start to disappear as the program becomes the status quo. Certainly, the objective of a competency-based program is to control, if not eliminate, these issues. Ultimately, a good competency-based training program will help to determine early in the hiring process if a new hire will make it and to eliminate inconsistent performance reviews.

Okay, we have said that public relations (PR) is important; but how do you know if your PR has been successful? One of the best indicators is the speed with which workers register to take courses in the LMS and whether they actually take the courses. Your LMS can provide nearly real-time data about course use. If rapid use of the courses is a part of the evaluation criteria for manager performance, things should move quickly. If there is resistance, try to understand the reasons for it and overcome them. For example, workers in cubicles may not be finding time free of distractions to do their WBT. In such a case, you might consider providing signs for them that say, for instance, Do Not Disturb—I'm E-Learning. Work with managers to ensure that they provide time each day for this activity and monitor whether workers are using it appropriately.

Whenever you implement something new, you will always have some dissenters; however, if the dissenters make up more than about 10% of the user population, you have a problem. Your training will never be successful unless a large majority of your audience is emotionally and psychologically ready for it.

9.1.3 Training for change

There are two groups who will be directly affected by the move to WBT: the trainees and the trainers. Both groups should be adequately prepared for the change, before it happens.

User training

Regardless of your audience, if you are deploying WBT, you need to train employees to use it. The degree to which up-front training is required depends both on the technical sophistication of your audience and the technical complexity of your program. For example, if your learners are Web savvy, they may be very comfortable navigating a single course. If, however, you are deploying an LMS as well as new courseware, students will not only need to know how to take a course, but how to use the LMS system and how it will impact their employee records: How do they know which courses they should take? How do they register for a course? How do their scores get submitted?—and so on. Depending on your audience and your need, you may be able to include instructions in the program itself, or you may need a separate orientation effort to get your learners started.

Furthermore, if your users are new to the idea of self-directed learning, you may need to go beyond equipment training and provide some training or coaching in the soft skills of time management. You will need to delineate clearly what the corporate expectations are and provide the users with tools for managing their education. An LMS can provide users and supervisors with valuable information regarding the competencies required for each job description, and the courses available to attain that competency. Even if you are not ready to implement an LMS, however, you can provide structure for the self-directed learner by supplying a cohesive and comprehensive training package that includes such tools as curriculum descriptions, prerequisites, training logs with checkpoints, suggested timelines, and enrollment procedures. When learners are expected to manage a suite of learning tools that includes a wide variety of delivery mechanisms, an all encompassing, easy-to-use structure is critical.

Practical tip: *If your users do not know how to use your courses and management systems, the best designed WBT cannot be effective. When deploying WBT for the first time, you need to train your learners to use it. That might mean that you should create a "marketing module" that both provides a sample of how a lesson might look and work as well as all the features and benefits of WBT. This can, in fact, be a variation of the prototype you construct for your first course. It can help teach everyone what to expect, while helping to sell the program.*

Train the trainer

You will also need to train the trainers. Of course, that means training the trainers on the equipment, but beyond that, if your trainers are accustomed to stand-up delivery, you will need to prepare them for a mind shift as well. The trainer's job can change in several ways:

- In an on-line learning environment, the trainers most often "facilitate," rather than deliver, the training. Facilitation is often another set of skills entirely.
- The training management function will change. If there is an LMS system, trainers will need to know how to use it. If there is not, they will need procedures in place for administrative activities.

Some trainers transition to the role of facilitator fairly easily; others have a more difficult time. The personal attributes that make a good stand-up trainer do not always translate well to WBT. For example, many stand-up trainers like to be at front and center, they like to be in control, and they need social contact. Their gregarious nature makes them good at what they do. But what may be strengths in a stand-up environment may be weaknesses in an on-line environment, and these trainers may find it difficult to adjust their focus from training delivery to training management.

If your WBT contains synchronous or collaborative components, trained facilitators will be that much more important to the success of the program. Effective facilitation is an art. Fortunately, it is an art that can be learned, and there are many good workshops available that teach facilitation skills.

On-line exercises

If you are designing for collaborative discussion, you should experience it yourself first. Go to http://www.charityvillage.com/charityvillage/stand.html for a list of four different types of on-line discussions: discussion lists, usenet newsgroups, Web discussion forums, and Internet relay chat. Select a format and topic you are interested in and join the group.

Links to information regarding on-line facilitation are provided on our associated Web site.

9.2 Usability testing

Usability testing is the testing of the application and interfaces with a small group of sample users to determine what, if any, usability issues exist from both an instructional and a technical standpoint. The emphasis is not on operability. The technical operability of the WBT itself should have been addressed in the specifications that led to its creation, the alpha phase, and the beta review. The technical operability of the WBT infrastructure is also addressed after installation at the host site. Usability testing measures how the WBT is perceived and used by the target audience. Because the intent of usability testing is to correct any design flaws in the courses and interfaces, iterative usability testing should occur throughout the development cycle beginning with obtaining user feedback on your paper prototypes, templates, and navigational interface. The usability testing of the actual product should occur early in the deployment process to provide time for modifications to the courseware [3].

Usability testing is another development step often overlooked in the rush to meet production deadlines. Ironically, it is one of the first steps to be dismissed. Even if every other stage of your development plan goes like clockwork, if the design is not user friendly, your project will be a bust. Perhaps many organizations do not perform usability testing because they do not understand it or because they do not want to invest in expensive usability labs. Whatever the reason, in this section we describe ideal usability conditions and an "adaptive" model.

9.2.1 Ideal conditions for usability testing

The conditions for usability testing can be divided into three categories:

1. The test group;
2. The methodology;
3. The environment.

The test group

The ideal test group consists of a small number of users, usually five to seven, who fit the profile of your typical user as determined by the audience analysis: They have the same background, education, experience, need, and attitudes. Each tests the application independently so that each user's reactions are formed independent of the rest of the group.

The methodology

The objective behind usability testing is to enable developers to observe passively and covertly as the tester accesses and uses the application to solve a real-world problem. Typically, that problem is limited in scope to a 30-minute task. For example, the tester may be asked to change a car's engine oil using guidance from an on-line help system (sometimes called EPSS) or WBT.

The user is given all of the tools he or she would have on the job, but no more. The observers do not provide any coaching or additional instruction unless the user is totally stuck. Any need for intervention must be duly noted as a design issue.

The testers are encouraged to use a "think aloud" protocol. In other words, they should talk to themselves as they work with the application so that observers can understand what they are thinking. For example, the user could say, "I think I am supposed to click here, but I'm not sure," or "This question does not make any sense to me." At the end of the testing session, the user can be debriefed to get more insight into any usability issues that were observed.

The observers

The observers usually consist of the instructional designer, an SME, and a programmer, each of whom brings a particular area of expertise to the testing. For example, if an interface issue is revealed, it will be helpful to have the programmer there to pinpoint the issue and its possible resolutions. It goes without saying that each observer should take detailed notes.

The environment

An ideal, dedicated, usability lab includes a physical area for the tester and a separate observation area for the observers. Observers view the test area through one-way glass. Video cameras record the user's actions and the PC screen so that the observers can see them and so that the videotapes can be played later. Microphones allow the observers to hear the user's comments. A telephone is provided so that the user can call for help if necessary. If all of this seems like too much for your organization to take on, there are commercial usability labs that can be employed to test your product.

9.2.2 An adaptive model for usability testing

Although the conditions above are the ideal, they may not be feasible in your situation. You may not have the budget to build or rent a usability lab. That does not mean that you have to forego usability testing altogether. The next best thing is to adapt that ideal to the conditions you face. For example, you can still test the application with a small group of representative users. And you can still observe them passively, without interruption or coaching. The problem is that if you are standing next to them, both of you will be tempted to interact. But, you could videotape the test session. In short, if you keep the goal of usability testing in mind, you can design your own procedures to mimic lab conditions as closely as possible. The fact that you do not have a lab is not really a legitimate excuse for failing to test usability with your users.

9.2.3 The consequences of usability testing

Of course, the whole purpose of usability testing is to discover any usability issues within the application and interfaces before the program is presented to the organization. Therefore, after the testing has been completed, the design team will review the findings and make any necessary modifications to the program. Significant changes can warrant another round of usability testing. This is the time to get it right. Once all usability issues have been addressed, the application can be installed at the client site.

On-line exercise

One of the top experts in the field of on-line usability is Jakob Nielson. Go to his Web site at http://www.useit.com. This site is an excellent source of information about how to conduct usability testing. Also, click on the link "Top 10 Mistakes" for a quick review of common usability issues.

9.3 Installation

The term "installation" is fairly self-explanatory. It includes installation, modification, and configuration of all hardware and software required to run the training program(s). There are three phases to installation:

1. Review and revision of the plan;
2. Installation;
3. Testing.

9.3.1 Review and revision of the plan

Before the team can begin deployment, it must ensure that the organization is ready, not only from a cultural standpoint, but also from a technical standpoint. Of course, preparing the organization's technology means team members will need to modify or install all of the technical components required to run the new program(s). But before setup and installation begins, it is wise to revisit the deployment section of the master plan established during the strategic planning phase.

Revisit and revise the deployment schedule

You might ask, "We have a plan. Why go through all of that again?" The answer is, "Because the conditions and variables that existed when you established the deployment schedule may have changed. It may be helpful to divide these conditions into two categories: management conditions and technical conditions."

Management conditions can effect the timing of the deployment. For example, the project may be running ahead of (not likely, but possible!) or behind schedule. The time and action plan of your project and of any related efforts should be revisited to make any necessary adjustments to the rollout schedule and to communicate any schedule changes to the organization.

As you consider your deployment schedule, it is also wise to take a look at the surrounding business conditions. For example, you may find that you are two months behind schedule and the corporation is now entering its busiest time of the year. The IT department might have a "blackout" period during which they do not rollout any new applications so that they can focus support on the heavy traffic of day-to-day business. Or, the organization may be in the middle of another major rollout, and the support you planned for your project may not be available. Or, your project may be ready to go, but some other unforeseen condition must take precedence.

In short, the right time for deploying a program is when both your project and the organization are ready. While this may seem obvious, it is worth emphasizing. By keeping this in mind and keeping an eye on the business variables, you can proactively plan for change. You can be in control. When the employees are anticipating a rollout only to find out at the last minute that it is not going to happen, with no known ETA, it puts a black smudge on the project before it debuts.

Revisit and revise the technical specs

Another set of variables that may have changed since the strategic planning phase is the technical infrastructure or requirements. Of course, the goal is to explore and outline carefully the technical requirements up front and to openly communicate changes throughout the development process, but it is a good practice to revisit them one more time. Technology can get complex, and it is not uncommon for someone to make a change without realizing that it will affect your project. That person did not forget to tell you; he or she did not even know to tell you! For example, you might have planned to use a server that met your requirements when the strategic plan was laid out. Since then, some other business unit has put an application on the server, and that application has a configuration that conflicts with your application.

Our intent is not to scare you away from technology, but simply to remind you that you're better safe than sorry. Check your technical specs up front, in the middle, and at the end. While you still might not catch everything, you will stand a far better chance of a smooth rollout.

9.3.2 Install the hardware and systems software

Many global corporations continuously review and upgrade their hardware and software systems. The primary driver for these kinds of changes is usually a need to improve the basic business systems for the company. Such systems are used to manage relationships with global suppliers and customers around the world. These systems are also used to support internal processes, such as paying employees in a timely way. These critical business functions are the driver, but WBT development and delivery needs can be considered if the technical assessment provides the IT department with the necessary information. Often, however, the IT department will not be supportive of WBT delivery as the additional bandwidth requirements of the courses may impact the performance of critical business systems.

In such situations, it will make more sense to use outside vendors to provide the technical systems required to deliver WBT globally. Do you need to have redundancy for the servers used for training? Do you need 24/7 technical support? Do you need to have streaming media servers positioned around the world so that localized multimedia content can be delivered at the proper bandwidth to users in those regions? Do you need to provide "dialers" (connection software programs) in the local language

for users around the world? All of these factors might dictate use of an external provider.

If you decide to implement hardware and systems software internally, there will be some significant technical challenges. For example, how will users outside the company firewall access courses? What level of technical support will be provided to ensure that the WBT servers and systems are "up" 24/7 to support anytime-anywhere learning? What software will be required on the workers' PCs? How will this software (including plug-ins, for example) be distributed, installed, and supported? Who will be responsible for ensuring that the WBT courses perform properly over the network, and who will users call if they are not working properly? These challenges can be overcome only with careful planning and the significant and early involvement of IT management and staff.

Installation of WBT can include:

- Installation of the servers;
- Installation of network connections (T1/T3);
- Installation of systems software.

Installation may also require an upgrade to users' desktops. An installation checklist is available at http://www.dr-david-stone.com.

Once the hardware and software have been installed, all interfaces must be configured. Finally, the entire interoperability is tested for compatibility. Once all of the equipment is functioning properly, the actual deployment to the organization can begin. When a large group of users or locations is involved, development groups typically plan a pilot before the corporate-wide rollout.

9.4 The pilot and rollout

The pilot is, in essence, the first phase of the rollout. It is like the dress rehearsal in that it is the first time all of the factors come together in front of a live audience and are played out within a real-world context. It is the first actual deployment. The rollout is then a continuation of the deployment in scheduled increments.

9.4.1 The pilot

The purpose of the pilot is to test the hardware, software, interfaces, and instruction in their final environment with a real user group under real-life conditions. Sometimes this can be considered a "stress test." Sometimes a separate stress test is done internally before deployment to an actual user group. But the idea is the same—to get a sense of how the program functions in the real world before global deployment to the entire organization.

When a stress test is conducted internally, before actual deployment, the identification of real conditions is required in order to simulate those conditions. A test plan is then formulated that provides specific instructions to the testers. For example, how many users can be expected to "hit" the Web site at any one time? That number of simultaneous hits would be part of the formal test plan. What is the expected response time? The actual response times would be recorded during the stress test. If you want to test a server dedicated to multimedia, the test plan could specify that all testers go to a part of the application that invokes that server. Because the stress test is designed to reveal the technical limitations of the installation, a larger pool of users is required than in any prior testing, but the testers can be anyone. They do not have to be real users. As always, any problems discovered during the stress test are addressed before moving on to the pilot.

The actual pilot is the first deployment of the program to a real user group. When separate stress testing is not done, the pilot is your stress test, but there is no test plan. The users are not told what to do; they are using the application in real training situations. But again, because the pilot deploys the application to a target group, such as one division or one location, the exposure is limited and any final bugs can be worked out before the global rollout. Most deployments of any magnitude include a pilot in the rollout schedule.

Because the pilot provides one last chance to test the instruction in its entirety and in its final environment, pretests, post-tests, attitude surveys, and student evaluations are often used as assessment tools. Specifically, it is recommended that item analyses be conducted to determine whether the test items have been properly designed or if there are parts of the instruction that are problematic. Remember that we are not just testing the WBT to ensure that it works technically, but also to ensure that we have fielded a system that actually teaches.

9.4.2 Rollout

The rollout is the final deployment to the rest of the organization. Depending on the size of the project and the organization, the rollout can be phased so that different groups begin to use the program at different times. For example, it may be advisable to begin a global rollout in the country where your organization has its headquarters, because communications with the IT and training departments will be easiest as all users will be speaking the same language and in relatively close physical proximity. A phased deployment also means that initially fewer users will be accessing the system at one time so that you can really test performance under less demanding conditions.

A phased deployment might then proceed to other parts of the world, taking into account any lessons learned in the first phase. A company based in Germany might begin with a deployment in Germany, then proceed to France, then Italy, and so on. This approach will also allow you to ensure that localized content is understood by native speakers as you intended. You can make last minute corrections on a case-by-case basis, rather than having to deal with all languages and cultures at one time.

9.5 Conclusion

The usability testing and pilot are both designed to test the application before it is rolled out to the entire organization. It is better to find mistakes sooner and with a small group of users than to discover them after they have multiplied in magnitude. Often, the users and the infrastructure will be consistent from one location to another, so that if you test with a select group, your findings will be valid for the entire group. It is worth noting, however, that sometimes more than one usability test or pilot is advisable. Consider an international deployment in multiple languages. In such a case, more than one usability test might be needed because the user populations will differ in many ways. Sometimes the technical infrastructure might also vary. For example, users in different environments may be using different browsers or bandwidths.

You may even be testing different Web sites. While typically the Web site exists on a single server, it is possible for different locations to use different Web sites and servers to lighten the traffic to any one site. In other words, when a Web site is heavily trafficked, the site can be “mirrored”

into multiple duplications of the same site. In this case, you would most likely conduct a pilot for each site.

On-line exercise

To see an example of mirrored servers, go to http://www.tucows.com, a heavily trafficked shareware site. You will be asked to select your geographic location for the fastest downloads, because the Web site is duplicated on different servers.

References

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[2] Whalen, T., and D. Wright, *The Business Case for Web-Based Training*, Norwood, MA: Artech House, 2000.

[3] Barnum, C., *Usability Testing*, New York: Longman Publishers, 2000.

Part V
Postproduction

10

Summative evaluation and maintenance

The previous chapters in this book deal with how to plan your WBT, how to produce it, and how to implement it. This chapter deals with the two tasks that come after the program has been deployed: summative evaluation and maintenance (see Figure 10.1). The summative evaluation is the final assessment, and maintenance is a task that is ongoing for the life of the program. This chapter explains how to plan and perform each of these postproduction tasks. (See [1] for a good general source on evaluation.)

10.1 Evaluation

In the classic instructional design model, there are two types of evaluation: formative and summative. Formative evaluation tests the effectiveness of the program during development so that improvements can be made in the design. Summative evaluation takes place after the development has been completed and is called "summative" because it looks at the effectiveness of the entire program—the sum of all of the parts. The summative evaluation is used to make future strategic decisions.

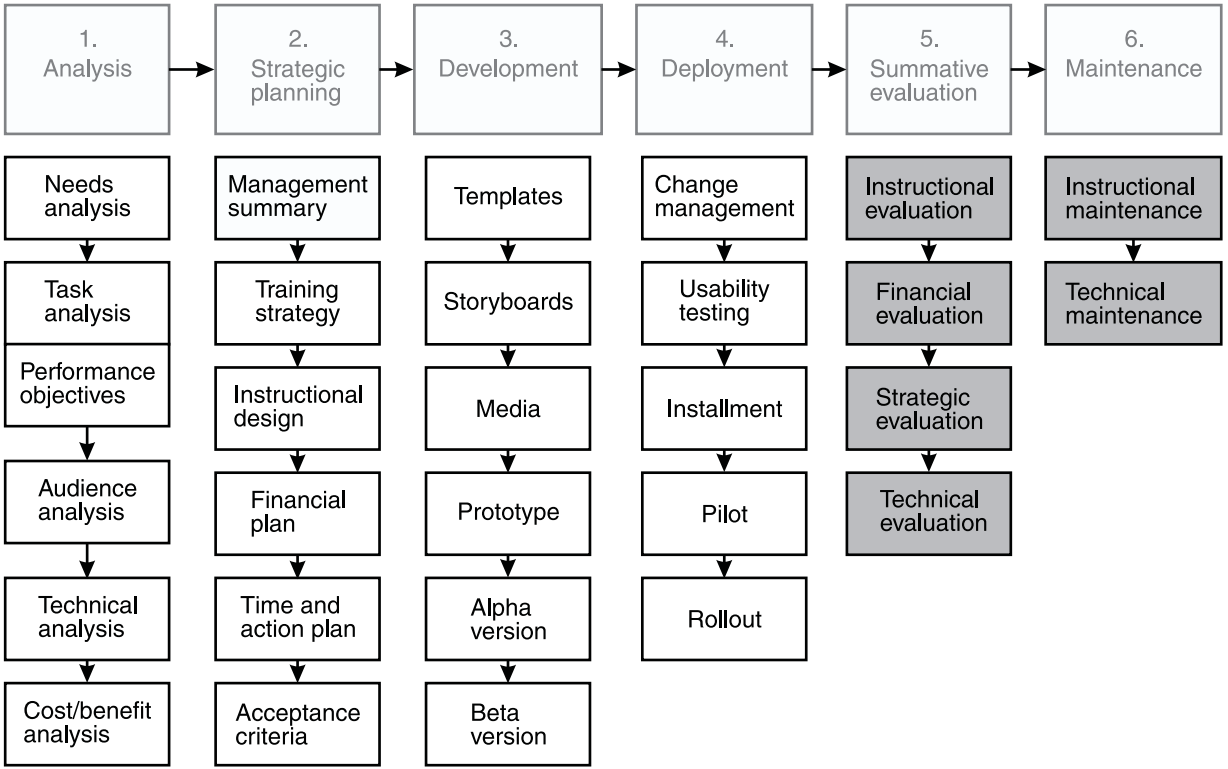

Figure 10.1 Evaluation and maintenance phases of the WBT model.

10.1.1 Formative evaluation

In both the traditional ISD model and the WBT model, formative evaluations take place several times during the development process, and the number of learners using the product increases as the product moves forward to completion. When you evaluate WBT, however, you must evaluate not only the instructional effectiveness, but also the effectiveness, operability and ease of use of the technology as well. For that reason, formative evaluation for WBT is called usability testing (see Section 9.2).

Usability testing should take place earlier in WBT than formative evaluation does with traditional instruction. WBT usability testing resembles the testing that takes place for software development. Like software development, the longer you wait to discover WBT design flaws, the harder and more expensive they are to correct. It's like building a house. You can change the floor plans before the frame is built, but it gets increasingly difficult to change the basic framework as you move along in the project.

You may recall from Chapter 9 that, during the usability test, team members observe a small number of representative learners as they interact with a portion of the instruction. Later, the team conducts a pilot with a larger user group to test the complete program. Both the usability test and the pilot are iterative stages of formative evaluation. If changes are made to the design as a result of the formative evaluation, the program is tested again.

Keep in mind that unless you involve representative end users at critical stages in the creation of WBT, you may find that your product does not meet their needs. The history of both education and technology contains many examples of expensive and sophisticated educational innovations that have failed. One of the best ways to mitigate the risk of creating a costly failure is to ensure that your WBT is really usable and effective with real end users.

On-line exercise

Go to http://webreview.com/ and scroll down to the heading "Design." There you will find several articles on usability, including "Why Is Usability Important?"

10.1.2 Summative evaluation

In summative evaluation some of the same aspects of WBT are assessed as during the formative evaluation. You are still looking at the effectiveness

of the instruction and the usability of the technology; however, summative evaluation takes place after your WBT goes into production, so the intention is not to correct the existing program but to use what you learn from your summative evaluation to improve future programs. Because summative evaluation looks at all aspects of your WBT, it also includes some elements not assessed during the development stage: the cost-benefit and strategic value of the WBT.

With WBT, the postproduction, or summative evaluation, comprises an instructional, technical, financial, and strategic evaluation and answers the following questions:

- How well has the instruction worked?
- How well has the technology worked?
- Are the benefits worth the cost?
- How well has the program met the strategic objectives?

The instructional evaluation

When planning the instructional evaluation, the team and stakeholders will need to decide what to measure and how to measure it. Certainly, when instruction includes a competency measurement, that testing measurement is one obvious tool for assessing the effectiveness of instruction. Remember the five levels of WBT discussed in Section 1.1.3? The test information you have will depend in part on the level at which you have implemented WBT.

If you are implementing independent, nonintegrated courses, most authoring tools will write test scores out to a data file. For example, you will receive one data file for John, one for Mary, and so on. A number of WBT authoring tools allow you to specify the level of detail you want that data file to include. For example, you may want only total scores, or you may want to know how many times each user took the test, which questions they missed, and how long it took them to the complete the test. The more details you ask for, the more difficult it is to compare them. This is one advantage of using an LMS, which will perform detailed item analysis and create reports for you.

Detailed item data analysis allows you to run reports that look at each question as part of what is called a "discrimination index." For example, if 90% of the learners who failed the test answered a given question correctly, but 90% of learners who passed the test answered the same question

incorrectly, you will want to examine and revise the question. Such a test item "discriminates" in the wrong direction. Ideally, each test item will properly discriminate between those who know more and those who know less.

Even without an LMS, however, there are ways to use the data you get from your program to assess both your learners' competence and the effectiveness of your program:

- You can design your own reports to aggregate the individual chunks of data.
- You can load them into a spreadsheet so that you can compare scores and compute averages.
- You use skill assessment software to compare pre- and post-training tests (see Section 1.2.2).

Exercise

Look at the simple spreadsheet presented in Table 10.1. Assume that 85% is the passing score. Based on the information compiled, ask the following questions:

- Are there any questions that the majority of learners missed?
- Are there any questions that most of the learners who failed the test missed?
- Is there a relationship between time spent taking the test and success?
- Is the success rate as high as it needs to be?
- Is there other data you would like to capture?

Regardless of whether you are implementing one course or an enterprisewide system, test data is a great tool for assessing the effectiveness of the instruction. It is important to remember, however, that it is real job performance that counts. Measurements of on-the-job performance will give you a much deeper understanding of any given instruction's long-term effectiveness—of how well it transfers to the job. Error reports, calls to the help desk, productivity reports, and performance appraisals are all tools that can measure actual job performance. The key to measuring the impact of instruction on job performance, however, is to measure change, which means you must capture the "before" picture.

TABLE 10.1 Test Data Compiled by a WBT Authoring Tool

TRAINEE	COMPLETION TIME (MINUTES)	NUMBER OF CORRECT ANSWERS	NUMBER OF WRONG ANSWERS	QUESTIONS ANSWERED INCORRECTLY	SCORE
John	30	18	2	3, 8	90%
Mary	25	16	4	2, 7, 8, 15	80%
Roger	20	15	5	2, 7, 8, 19	75%
Susan	35	17	3	3, 8, 15	85%
Nikra	37	19	1	8	95%
Robert	35	20	0	0	100%
Sillia	35	14	6	2, 4, 7, 8, 12, 15	70%
Fred	40	12	8	2, 4, 7, 8, 12, 15, 19, 20	60%

Furthermore, it is important to take into account such noninstructional conditions that can affect learning as the following:

- Did the learners and the facilitators follow the prescribed processes?
- How did the organization accept the new training program?
- Did the learners get appropriate support from their line managers?
- Did the learners have an environment conducive to learning?
- Did the learners have the necessary aptitude?
- Were the prerequisites enforced and measured?

These are just some of the external variables that can influence the effectiveness of the instruction, and they should be measured as well so that they can be considered when interpreting the instructional outcome. It is not a bad idea to arrange a formal assessment of these external variables by an objective outside consultant. Such a person will be free of the organizational pressures that might affect an internal review. Structured interviews of representative learners, surveys of supervisors and managers, and visits to selected locations are all part of such an assessment, and recommendations based on these observations can determine whether the WBT system needs to be changed or additional managerial support of the effort to gain acceptance for the system is needed.

Cost-benefit evaluation

Another variable that must be considered in order to determine the effectiveness of the program is the ROI. Did the project cost more or less than you budgeted? Are you getting the financial gain you predicted? In Chapter 1 we discussed the cost-benefit analysis as one aspect of the analysis stage. During the up-front analysis, you examine the various cost factors and estimate the benefits. In the strategic plan, you plan the budget and estimate the ROI for your plan. Now, in the post-production evaluation, it is time to circle back and measure the actual ROI.

This financial evaluation is closely linked to the instructional evaluation. Certainly, when you can measure things like increased sales, the financial benefit of the instruction can be measured in monetary terms. But there are other cost-benefit factors to consider beyond improved performance. For example, perhaps your instructional evaluation determines that the WBT model is as effective as previous training methods, but not more so. Your cost analysis verifies, however, that the WBT is much more cost-effective. In that case, the WBT instruction can be deemed preferable to prior methods.

Strategic evaluation

During the needs analysis, you carefully aligned the objectives of your training program with the business objectives of the corporation. Presumably, you selected WBT as your delivery vehicle because it partnered well with those strategic objectives. It is now time to go back to assess how well those business objectives were met.

Think about the example we have used throughout this book in which WBT is used to train financial consultants on new financial-planning software. That scenario might include the following business objectives:

- That all consultants be trained and actually using the software within one month of the application rollout;
- That financial plans generated by the new software be more accurate than prior plans;
- That consultants be able to engage in the training anytime, anywhere;
- That consultants go on-line for ongoing support, thus reducing customer support calls.

Of course, little in this world is ever black and white. Business objectives often include instructional, financial, and technical objectives, so your analyses will sometimes overlap. All the same, it is helpful to think of the strategic evaluation as a separate entity so that you don't miss key assessment factors.

Technical evaluation

Like the other types of evaluation, the elements that need to be assessed in the technical evaluation will depend on the sophistication of the training program. It goes almost without saying that the technology is less complex when you install independent courses than when you install an LMS or interface with an ERP system. There are, however, technical factors common to all levels of WBT that should be included in your summative evaluation:

- *System response time for student interactions.* System response time for student interactions is best measured by taking direct observations at specific locations at different times of day to ensure that variations in network performance are captured.
- *Launching, tracking, and reporting of the developed courses.* Again, the launching of courses from the LMS is best observed by direct observations at different student locations at different times of day. The tracking and reporting of results is best measured by a review of the data collected by the LMS.
- *Launching, tracking, and reporting of any third-party courses.* The launching of third-party courses from the LMS is best observed by direct observations at different student locations at different times of day. The tracking and reporting of results is best measured by a review of the data collected by the LMS.
- *Interfaces with other systems (LMS, ERP, KMS, and training databases).* If your LMS is truly an enterprisewide application, it will have been built so as to be easily integrated into the other enterprisewide applications that you use—for instance, to manage personnel records. No significant nonrecurring engineering should be needed if you have purchased the right system.

The technical evaluation is a "health check" to ensure that all of the software, hardware, and interfaces are functioning according to the standards established in the acceptance criteria.

10.2 Maintenance

You should plan and budget for ongoing maintenance, the need for which can be driven by the following:

- Efforts to improve the instruction;
- Changes to the content;
- Changes to the associated hardware and software;
- Changes to interfaced systems.

10.2.1 Improving the instruction

While the summative evaluation is defined as an evaluation of the final program, that definition should not be interpreted to mean that the instruction will not change. The summative evaluation is a stake in the ground that indicates at a given point whether an instructional program has been determined effective. It allows stakeholders to make decisions about future training strategies; it does not mean that the instruction cannot be further improved. To the contrary, feedback from student records, the item data analysis, and job performance measurements will provide opportunities to pinpoint areas where the instruction should be improved.

For example, suppose almost every learner missed question eight after a given instruction. Was that because it was a poorly designed question, or was the instructional content confusing? Either would be sufficient cause to change a subsequent release. The instructional designer can review the content and the question and discuss them with representative learners. Such interviews often make the source of the problem clear in short order.

10.2.2 Content changes

One benefit of WBT is the ability to quickly update and distribute new content. In today's environment, as soon as you train one version of a process or business application, it changes—job roles change, businesses

reorganize, and so forth. A change in the content requires maintenance to the courseware. You should plan who will make the content changes. For example, if you are using customized courseware developed by a third party, who will own the code? Will you update the course, or will the third party? You will need to budget accordingly.

While content changes certainly involve changes to the courseware, with an LMS, content changes can also mean changes to the management data. Who will maintain a list of facilities, contacts, facilitators, course listings, and prerequisites? The LMS can manage the information, but someone needs to maintain the data.

Practical tip: *In Chapter 5 we talked about the value of carefully labeling your media files. (See also Sections 7.3 and 8.3) When you have to make content changes, carefully constructed storyboards, file structures, and naming conventions will make it easy for you to swap files. For example, you may have created a course that teaches a software application. Now there is a new version of the software. You can easily swap out your graphic files by naming the new file with the same name as the old and storing it in the same place. That way you will not need to reprogram the way your WBT displays the graphic.*

10.2.3 Hardware or software changes

Changes to the browser, servers, and PC operating platforms will require maintenance. Keeping communications open with the IT department can help you anticipate and plan for these changes.

10.2.4 System interface changes

If your instruction interfaces with external systems, changes to those associated systems may require maintenance to the WBT. Say, for example, your LMS interfaces with HR's ERP system; these interfaces must be maintained. Beyond the technical maintenance, you will need to determine what revisions to the ERP data will automatically update your LMS data, and what information, if any, will need to be maintained by an administrator.

Reference

[1] ASTD, "Info-Line Guide to Training Evaluation," available at http://www.astd.org.

11

Localization[1]

Leading companies in every field are attempting to leverage the Internet to enable them to work with suppliers and customers around the globe. However, single-language Web sites and single-language WBT is a major barrier to penetration of global markets. Although a single selected language (e.g., French) may be acceptable for speakers of that selected language in many parts of the world (e.g., France, Switzerland, Canada, and Senegal), it is a barrier to communication and commerce with those that do not read or speak the language. If a Web site features spoken audio content, the accent used in the spoken content may be different from that of certain site users, and those users may not be able to understand fully the spoken content. For example, a French Canadian site using spoken audio may not be totally understood by users in France.

For these reasons, companies seek to create multiple language versions of Web content for WBT applications, a process known as localization. "Localization is the process of converting material (whether training content, software, Web sites, or any other source product) into a format that is

1. Portions of this chapter are © 2001, Transware and Gladstone, PLC, used with permission. Portions of this chapter are © 2001, Bjorn Austraat, Senior Manager, Globalization Consulting Services, eTranslate, Inc., used with permission.

technically, linguistically and culturally appropriate for countries outside the original market" [1].

11.1 Localization of existing WBT

11.1.1 Cultural differences

Existing single-language WBT products are commonly converted for use in different countries. In such conversions, localization teams carefully evaluate and adapt any elements of the original product that could offend or confuse a target audience. Colors, slang, humor, gestures, units of measure, law, taboos, and etiquette are among the elements that must be evaluated and, if necessary, modified.

In China, for example, red is the most popular and auspicious color. Some believe that it helps to keep evil away. By contrast, those from a European cultural background may associate red with evil (e.g., a red devil). For the Chinese, yellow connotes royalty, prosperity, and luck. However, for English speakers, yellow denotes cowardice and weakness. While Westerners use black to signify mourning, the Chinese use white. Knowing these color preferences can make a difference in the selection of colors used in WBT.

Yet, color is just one element that should be considered; language is another. For example, when an American beer company translated into Spanish its advertising slogan to "Get Loose," the advertising agency failed to realize that the translation was a Mexican colloquialism that means to have diarrhea. (See [2] for a handy book on cultural references.)

Other localization elements especially important to trainers are teaching and learning styles and structures. Teaching methods vary from country to country, primarily because these education systems have evolved differently. For example, in many countries educational systems have evolved from particular religions. In Iran, Islam has had a profound influence on the educational system (as well as other cultural institutions). In Spanish-speaking countries, especially those in the Americas, the Catholic Church has played a significant role in the development of educational institutions. In other countries, political systems have had a profound effect on learning styles. Americans who have taught in Chinese universities, for example, have commented that Chinese students may be unwilling or unable to solve problems or express ideas in a way that reflects a certain amount of individual character. This deference to group or collec-

tive thinking is also characteristic of the Japanese. It may be that Chinese and Japanese show this learning trait because their culture places a high value on social order and loyalty.

School structures in the United States, Europe, Asia, Africa and the Middle East differ, as do the subjects taught. Differences in pedagogy may include the use of exploratory learning through class projects versus rote learning. WBT designed and developed by and for adults in these different cultures can reflect these differences.

Digital literacy is also a cultural issue. Scandinavian countries are known to very digitally literate compared to their Polish neighbors across the Baltic Sea. The level of digital literacy will affect WBT design, user documentation, and the training required to use the product, as well as the subject-matter content and use of such tools as glossaries. Language and culture are dynamic, and no one understands better what is current and correct in a particular environment than native speakers living in their countries. The best localization companies work only with localization partners who are native-speaking, professional translators living and working in the target country.

As part of the localization process, SMEs are matched with the content area of each project to assure the best and most accurate translation of technical or industry-specific terms. Success in localization is achieved when a localized product appears to have been originally designed and produced in the target country, not imported and converted from another.

11.1.2 Technical issues

Access and connectivity varies from continent to continent and from country to country. In the United States, local calls are almost always free (after a basic monthly fee) and, therefore, connection to the Internet is free. In Europe, local calls are not free, and there is a significant financial disincentive to connect to the Internet. Also, DSL is not freely available. Designers and developers need to be aware of their target market's infrastructure and accessibility.

It is also important to be aware of the technical issues associated with distribution of multimedia worldwide. Background music, ambient sounds, and other audio characteristics contain cues for learners about the locale used in WBT content. It may be necessary to change some of these audio characteristics in postproduction to create the sense that the WBT was produced locally. In a similar manner, video sequences may contain cues that signal that the WBT was created in some other locale. Learners

may note that a calendar on the wall of an office is not in their language, even if they can't read every word. These sorts of issues can be handled in the design of WBT if it is being created for use internationally, but they must be overcome later if the WBT already exists.

The references used in WBT must also be international. That is, content needs to use globally recognized reference sites, brands, people, and experts. Where that is not possible, local equivalents should be found and referenced. For specialized subject matter this can be highly important.

In establishing communities on the Web, it is ideal to establish them as local communities where people can communicate in the same language, rather than having an English-only chat area. This is somewhat dependent on content. Hi-tech or scientific users of WBT may expect content to be only in English. The authors believe, however, that this is changing and that the chat areas of the future will increasingly need to be organized around local language communities.

The use of computer-generated translations is a technical issue of great interest, as this approach has long been held out as the key to translating large amounts of content at very low cost. The fact that language is so dynamic and complex, however, has made computer-generated translation inappropriate in cases where the localized content must appear to have been locally generated. There are simply too many errors in computer-generated translations that are readily apparent to the learner. However, computer technology can certainly provide support to translators during the translation process.

What role do computer-generated translations (called "gists") play at the current level of the technology? According to Alis Technologies, Inc., "A gist is intended to instantly deliver the meaning of electronic texts written in a language a reader does not understand by converting the text into the reader's preferred language. This allows the reader to immediately understand and act upon the information contained in the original document" [3]. Alis Technologies, Inc. uses the following terms:

1. *Gist (noun):* A document that has been translated by a translation software. Such a document can also be referred to as a *gisted document*.
2. *Gist (transitive verb) gisting; gisted:* The action of generating a translation through purely electronic means (*the gisting of a document*, *a gisted document*).
3. *Gisting software (noun*): A translation software.

4. *Gist-In-Time (noun)*: A server-based language-comprehension solution for corporate and Web environments, developed by Alis Technologies, Inc. Users of Gist-In-Time will enjoy the highest level of comprehension available today.

While gisting technology is improving every day, the authors believe that this technology is best applied when an immediate, but imprecise translation is needed. It is our view that gisting technology does not yet produce the level of quality required for instruction.

Practical tip: *Although most localization of WBT occurs after the production of a single-language WBT course, it may be more cost-effective to plan for multiple language and cultural versions before producing the first course. It is recommended to use design and development technology that supports multiple-language implementation. (See Section 12.2 for a discussion of the application of content management technology to localization.)*

11.1.3 A case study

In preparation for writing this chapter, one of the authors visited Transware (http://www.transwareplc.com) based in Dublin, Ireland, to observe the localization process and to discuss localization issues with the experts in that company. One of Transware's customers is Gladstone, PLC (http://www.gladstoneplc.com). Transware localized Gladstone's Web site for multiple markets—Figures 11.1, 11.2, and 11.3 show examples of localized versions of the Web site. The rest of this section describes the processes Transware uses to localize existing Web content.

Evaluation

In the case of localization of an existing course, Transware first assigns a team from its Evaluation Department to conduct a thorough qualitative, quantitative, and process analysis of the course to be localized. This process results in two sets of outputs called "kits." The asset kit and the supporting documentation kit are used for resource planning and are handed off to project management. The asset kit contains all of the localizable and nonlocalizable assets and tools for the project. The evaluation team's quantitative analysis has indicated the number of assets by type (e.g., the number and type of audio files). It's qualitative analysis has indicates the complexity of these assets (e.g., the sophistication of graphics used or

Figure 11.1 Gladstone's French-language home page.

the number of actors used). This information is transferred directly to the asset management system and project management is notified.

The documentation kit contains statistical, instructional, and reference information. The kit also includes file-naming conventions and a guide for the production staff describing how to localize the product. Other information contained in the kit includes project management documentation, vendor documentation, instructions to the translator, character profiles, and graphic procedure documentation. The kit also contains software tools for extracting or injecting text and graphics from the original WBT course, along with documentation for their use.

Project management uses this information for resource planning and project scheduling. During the resource planning process, project management develops budget information on a per-project basis with the use of historical throughput information and statistical information from the evaluation stage. Once project schedules and budgets are completed, the assets groups are assigned target dates (in association with workflow) and

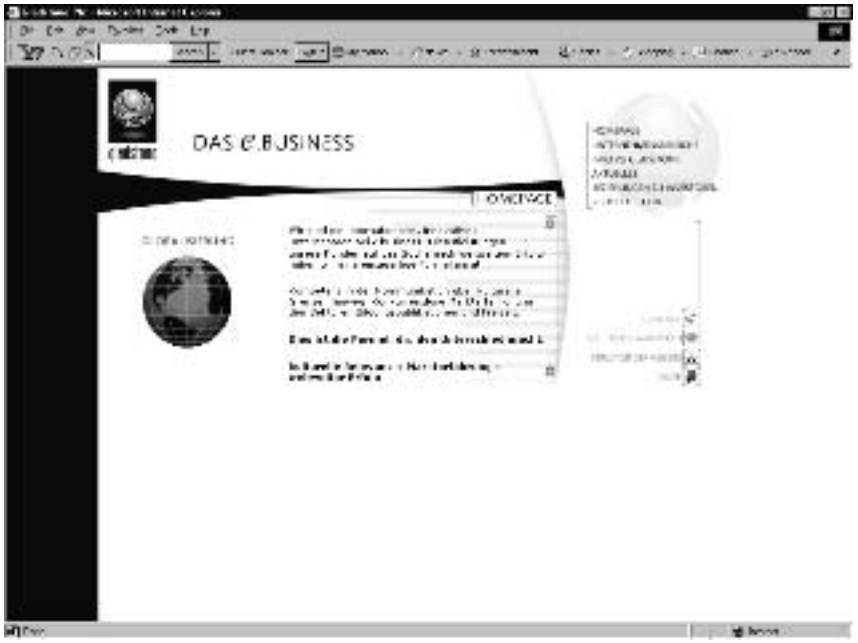

Figure 11.2 Gladstone's German-language home page.

budget targets. The schedule's start date drives the beginning of the production process.

Production

Glossary and style-guide creation take place at the beginning of the production process. This is the first chance for the client to buy into the terminology to be used in the target-language versions of the WBT. The key terminology used can be indicative of the brand. In a differentiated product market, brand identity becomes very important. The production process consists of a variety of production line–type processes, such as creating audio and graphics, translating, editing, and proofing. These last three activities, translating, editing, and proofing, are treated as single process, which is typically outsourced.

Once sufficient assets have been localized, the technical integration phase begins and the original product is rebuilt as localized products. During this phase, each of newly localized assets replaces the original

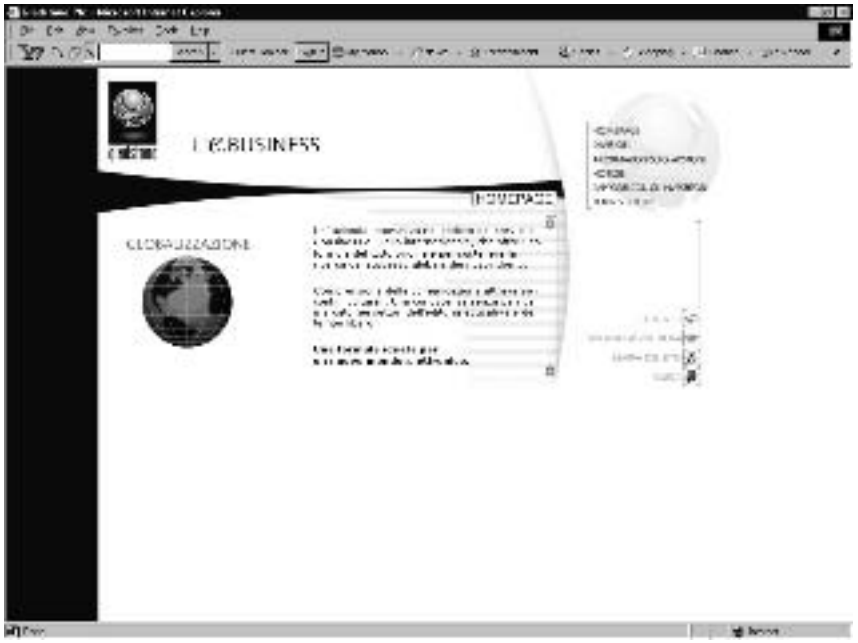

Figure 11.3 Gladstone's Italian-language home page.

source asset, and the final localized product is compiled. A variety of software engineering and testing processes occur at this point.

The WBT product can be viewed with a browser by production staff and the client during all phases of the production process. Web access to the product depends on how the client defined access to the content. That is, if the WBT contains some content that is designed to run locally, it must be downloaded and viewed locally during the review process. It is possible to set up an auto download from the Web, but such downloads can take time, depending on the connection speed.

Quality assurance

Transware conducts business globally and is certified as ISO compliant. As this book went to press, the company was awaiting certification for compliance with a new ISO standard, ISO 9002:2000. To achieve this quality standard, the company must undergo two audits every year. ISO is an emerging standard that certifies that companies are using the best existing

business practices in all phases of their operation. It is a standard to consider when selecting a vendor for any kind of service or product.

When a localized product is rebuilt, a quality assurance (QA) process is completed on the running product by external language vendors and other SMEs. Feedback from this process drives an additional, smaller production cycle. Once production has been completed, the product is handed off to the client through a project management QA cycle. The project is then subject to acceptance by the client. Should further production be required, the project is fed back through project management to the production system and a mini-production cycle takes place. Once the project has been accepted by the client, the project is completed.

11.2 Designing world-ready WBT

Now that we have looked at the localization of WBT from the perspective of converting and localizing existing courses, we will now consider how one might create world-ready courses from the start. World-ready courses have the following characteristics:

- They are ready to display multiple languages and character sets.
- They are culturally portable through the use of modular or universally acceptable graphics, colors, and icons.
- They are ready to provide data input and output consistent with properly internationalized middleware and database back-end systems.

Before world-ready WBT courses can be built, content must be analyzed and "content liquidity" must be measured. That is, how much effort will it take to isolate, extract, and reintegrate elements that have to be customized for use in target markets? There are three degrees of content liquidity:

1. "Solid" content might be expressed in Flash, non–world-ready graphics, hard-coded and concatenated scripting, and missing or non–world-ready business processes.
2. "Gel" content might be expressed as world-ready scripted files, Macromedia Generator components, and world-ready page templates.

3. "Liquid" content would include well-formed markup (e.g., valid XML documents), pure text, world-ready graphics, and world-ready business processes.

Proper design of world-ready WBT shows a high degree of separation between language, design, and code logic. It makes no intrinsic assumption about source language, culture, or locale of data, and it incorporates a flexible hardware and software architecture. A proper design of world-ready WBT includes the following components:

- A world-ready presentation layer;
- World-ready middleware components;
- A world-ready database back-end.

11.2.1 World-ready presentation layer and Unicode

A world-ready presentation layer uses foreign-language display and character sets. Different language families use various collections of characters or ideographs to encode information. For use with computers, these collections are grouped into "character sets." Providing incorrect information about the character set or required font in the presentation layer leads to "corrupted" character presentation. As discussed in Chapter 10, new software tools are necessary to properly display multiple languages and character sets properly.

Modern software tools for creating WBT support Unicode. Fundamentally, computers just deal with numbers. They store letters and other characters by assigning a number to each one. Before Unicode was invented, there were hundreds of different encoding systems for assigning these numbers. No single encoding could contain enough characters. For example, the European Union alone requires several different encodings to cover all its languages. Even for a single language like English, no single encoding was adequate for all the letters, punctuation, and technical symbols in common use. These encoding systems also conflicted with one another. That is, two encodings used the same number for two different characters, or used different numbers for the same character. Historically, all computers, especially servers, have needed to support many different encodings.

Whenever data is passed between different encodings or platforms, however, it always runs the risk of corruption; therefore, encoding schemes were devised. Uuencode, Mime, or base 64 encoding will prevent

8-bit data from being transformed into 7-bit data in an uncontrolled fashion if 8-bit data passes through an ASCII handling server. These encoding schemes were developed to maintain the integrity of any 8-bit or greater character-encoding system. Sometimes, however, these schemes failed to maintain integrity, and sometimes client computers did not have the appropriate encoding software. Therefore, there was need for a single encoding standard, which gave rise to the creation of Unicode.

According to the Unicode Consortium, "Unicode provides a unique number for every character, no matter what the platform, no matter what the program, no matter what the language" [4]. The Unicode Standard has been adopted by such industry leaders as Apple, HP, IBM, JustSystem, Microsoft, Oracle, SAP, Sun, Sybase, and Unisys, among others. Unicode is required by modern standards such as XML, Java, JavaScript (also known as ECMAScript), LDAP, CORBA 3.0, and WML. It is the official way to implement ISO/IEC 10646, and it is supported in many operating systems, all modern browsers, and many other products. The emergence of the Unicode standard and the availability of supporting tools are global trends in software technology.

Incorporating Unicode into client/server or multitiered applications and Web sites offers significant cost savings over the use of legacy character sets. Unicode enables a single software product or a single Web site to be targeted across multiple platforms, languages, and countries without reengineering. It allows data to be transported through many different systems without corruption.

Tips for designing and developing a world-ready presentation layer

1. The authors strongly advise against the use of WBT development tools that do not support Unicode. WBT development tools that support Unicode are listed on the Web site associated with this book (http://www.dr-david-stone.com).
2. Be aware of user-interface design and text swell. Translated text is sometimes larger than its source. Less commonly, translated text gets smaller; mostly it increases in volume by 30% to 60%. Therefore, design graphical elements with text expansion in mind.
3. Design columns and frames with enough space for long words in the target language.
4. Create input fields that can accommodate long first and last names and street addresses.

5. Allow for a variable number of address fields; remember that different countries may use postal codes that contain more or fewer than five digits, or they may not use a postal code at all. Also, in some areas the postal code is not at the end of the address.
6. Check graphical elements for cultural acceptability in target countries.
7. Check color schemes for cultural acceptability in target countries.

11.2.2 World-ready middleware components

Data passes through middleware components. On the back end of these components are Web servers and databases. On the front end are the WBT users' browsers. A middleware component is software that performs many data processing functions. They convert data formats and structures used by back-end databases and servers to those that can be properly displayed by a WBT user's browser. Likewise, they return data from users' browsers to the databases and servers in a format that the servers can process and the databases can store.

These components process data so that it is ready to be searched, parsed, collated, and compared in multiple language encodings. By making text ready to be searched, collated, and parsed, these components can sort in a given order the letters of various languages. Sorting Asian languages may require manual indexing of records (e.g., records containing Japanese Kanji characters). Search engines and spell-checking modules used in middleware must be able to parse text correctly and break it into meaningful units.

Middleware components are said to be "aware of their locale" for formatting numbers, dates, and text.

They must be able to present date information in various formats used throughout the world. For example, they can ensure that U.S. users see "February 2, 2005" and French users see "le 2 février 2005" on their browsers. They can show numbers in the proper format (e.g., 2,500.75 for U.S. locales and 2.500,75 for some European and South American locales). Likewise, they can handle different currency formats. To be able to perform these functions, these components are designed with properly externalized (liquid), translatable text and design elements, and they are configured to recognize and maintain language and encoding information passed between the presentation layer and database back-end system.

11.2.3 World-ready database back end

World-ready database interaction requires the following:

- Locale-awareness in data processing, input, and output;
- Unicode capability;
- Database schemas portable for multiple cultures;
- High scalability of hardware and software setup.

World-ready databases must be aware of the locale of the user (client), the data being passed around, and the server. This awareness enables data input and output functions, such as searching, sorting, and comparing records containing text, dates, and numbers. For example, a user in Japan requests a quote on products manufactured in Germany from a U.S. business to business (B2B) exchange server. The database must be able to identify and serve records that are relevant to the user based on location, culture, and demographics.

Although Unicode processing holds the promise of world-ready database interaction, it varies by database manufacturer and version. Unfortunately, Unicode does not solve sorting problems in some multi-byte languages, and migration of existing U.S. ASCII databases to Unicode can cause data expansion of up to 300%.

Back-end database systems must demonstrate scalability for several reasons:

- Unicode conversion can cause huge data swell.
- Fields need to accommodate longer translated text.
- Adding languages in multiple encodings may overload hardware resources and load balancers.
- Multiple copies of databases may need mirrored hosting close to the target market to avoid performance lag across different time zones.

11.3 Conclusion

In conclusion, the drive by leading companies in every field to operate globally has created a compelling need to develop WBT in the local language

and culture of most of the world's countries. Rather than use a "brute force" approach to localization, forward-thinking companies are adopting new software tools, such as the content management systems discussed in detail in Section 12.2, and methodologies for delivering their content globally in a form palatable to all of their suppliers and clients. Because few companies have the resources to design and develop localized WBT internally, they are increasingly turning to external companies to perform this function.

References

[1] http://www.transwareplc.com.

[2] Axtell, Roger E. (ed.), *Do's and Taboos Around the World*, New York: John Wiley & Sons, 1993.

[3] http://www.teletranslator.com:8060.

[4] http://www.unicode.org.

Part VI
The future

12

What's next?

As you begin to formulate an on-line learning strategy, it is wise to plan for the future, as well as for today. You will recall from Section 1.1 that a thorough needs analysis asks the stakeholders not only about their short-term needs and objectives, but about their long-term needs as well. This is particularly important when you are considering technology-delivered instruction; you can save yourself undue expense and headache if the program you install today is compatible with the program you will be running tomorrow. For example, your foray into the world of WBT may begin with a few third-party courses delivered over an independent Web site, or you may develop a few simple courses of your own. If you are planning to install an LMS down the road, though, you will want the vendor or authoring tool you choose to use industry standards compatible with industry-standard LMS software.

To plan for the future, it is helpful to understand what the future is likely to bring. Therefore, this chapter discusses some of the key trends in Web-based learning. Of course, there is a myriad of exciting and far-out innovations in the world of digital communication, but our objective is not to cover those innovations that are still esoteric experiments. Rather, it is our intent to provide an overview of techniques, approaches, and trends that are happening in the corporate world right now—those trends that

are real and that are poised to become mainstream technologies or strategies in the not so distant future. In short, this chapter talks about the trends that you can plan for now.

12.1 Business factors

In order to anticipate what future business solutions will entail, you must understand what future requirements may be. The key business trends that are shaping the future of adult learning include the following:

- An increasingly global economy;
- The emergence of the lifelong, self-directed learner;
- The integration of knowledge, learning, and support systems;
- Increased pressures for rapid development;
- Increased collaboration.

According to Grady Means and David Schneider, the beginning of this century "will represent the single greatest change in worldwide economic and business conditions ever. . . . If companies (and countries) do not change their assumptions and strategies, they will almost certainly fall behind and probably be left behind" [1]. They credit this sweeping change to the following factors:

- Globalization of the economy and the integration of worldwide capital markets through widespread privatization, the lowering of trade and capital barriers, and the development of global market and investment strategies;
- Dramatic restructuring of companies over the past 20 years through business-process standardization, simplification, and refocusing under the rubrics of cost reduction, business-process reengineering, supply chain synchronization, ERP, and customer understanding and management;
- Increasing installation of and reliance on information technologies for business management that are based on the economics of Moore's law, and whose applications will continue to increase exponentially in power and usefulness, thereby leading to a transformation of business systems;

- Growing acceptance of the need to focus on core business skills and processes and the resulting movement toward spinning off or outsourcing noncore processes;
- Exponential growth of business-to-consumer e-business, accelerating use and acceptance of the Internet, and the rise of e-retail and e-finance as accepted consumer activities.

This new era will transform the way business is conducted globally. In this new era, companies will (1) use Internet software applications in their global e-business operations; (2) seek the best suppliers in the world irrespective of language; and (3) seek to build long-term relationships with customers irrespective of language.

As corporations leverage the power of Web-based software to communicate globally with suppliers and customers, there will be an increasing need for WBT to teach both suppliers and clients how to use these Web-based software applications. Accordingly, the new Web-based global market will require the following of WBT:

- That it be deployed globally in the appropriate language and culture;
- That its contents be developed quickly, easily, and collaboratively;
- That it be "future-proofed;" that is, that training content must be designed with a long shelf life;
- That its maintenance process ripple changes automatically through different language versions;
- That its content be expressible automatically as performance support.

12.2 Global markets, localization, and content management

WORLDSPAN Travelatitudes, L.P., based in Atlanta, Georgia (http://www.worldspan.com), is a classic example of a company using the Internet to do business globally. WORLDSPAN provides e-commerce travel reservations and has annual revenues in excess of $600 million. The company operates one of the world's largest computerized reservation systems, with a network of nearly 18,000 affiliated travel agencies in more than 70 countries. It provides reservation services for approximately 455 airlines,

200 hotel firms, and 45 car rental companies. The company's WORLDSPAN GO! service allows access to travel databases by the Internet, extranets, fax, or e-mail. WORLDSPAN also offers specialized products and services for planning and managing business travel.

WORLDSPAN now faces one of the fundamental business challenges that all twenty-first–century companies must. The global nature of business and WBT requires that companies communicate in the language and cultural context that is local to each supplier and customer, wherever the supplier or customer may be located. As Forrester Research forecasts, by 2005 less than 35% of Internet users will be able to speak English. Despite its global nature, almost all of WORLDSPAN's Web sites are in English and all of its e-learning is in English. Yet, to increase global market share, all of WORLDSPAN's Web site and e-learning content will have to be localized and maintained in more than 20 languages. WORLDSPAN and similar global companies that need to leverage the Internet to deliver information to both suppliers and clients in their local language and within their local cultural context, are learning that they lack the technical infrastructure to either localize content or maintain it once it has been localized. They have discovered that once-standard design and development technology cannot meet the requirements of content localization.

For WBT planners and developers in global companies like WORLDSPAN, the major new challenge is not only to create multiple language-versions of WBT content for a host of Web-based business applications; it is also to be able to maintain the WBT content as those applications change. Traditional authoring systems do not have any of the content management functions required for such a challenge. Instead, they "hard-code" lessons and do not provide any tools for version control, searching, browsing, archiving, purging, reviewing, revising, or tracking and auditing files. A review by the authors of many of the new content management software packages that might be used to support global WBT indicates that almost all of them fail to provide for the support of double-byte characters (needed for Japanese and Chinese, for example) or for leftward writing (needed for Arabic).

Let's step away from this challenge facing WBT planners and developers and take a break by looking at some of the basic goals and principles established for the Web by its creators, the W3C. In October 1994, Tim Berners-Lee, inventor of the Web, founded the W3C at the Massachusetts Institute of Technology, Laboratory for Computer Science (MIT/LCS). According to the W3C's Web site (http://www.w3.org/Consortium), it was

founded in collaboration with CERN in Switzerland, where the Web originated, and had the support of the U.S. Department of Defense DARPA agency and the European Commission. The W3C's site lists the following goals and principles:

- *Universal access.* The W3C defines the Web as the universe of network-accessible information (available through your computer, phone, or television).
- *Semantic Web.* People currently share their knowledge on the Web in language intended for other people. On the semantic Web ("semantic" means "having to do with meaning"), users will be able to express themselves in terms that computers can interpret and exchange. By doing so, Web users will be able to solve problems that are tedious and find quickly what they are looking for (e.g., find pertinent medical information, list the latest movie reviews, or track a book purchase order). The W3C languages (including XML) are the building blocks of the Semantic Web.
- *Trust.* To promote a more collaborative environment, the Web community must build a "Web of trust" that offers confidentiality, instills confidence, and makes it possible for people to take responsibility for (or be accountable for) what they publish on the Web. These goals drive much of W3C's work around digital signatures, annotation mechanisms, group authoring, and versioning.
- *Interoperability.* The W3C, a vendor-neutral organization, promotes interoperability by designing and promoting open (nonproprietary) computer languages and protocols that avoid the market fragmentation of the past. This is achieved through industry consensus and encouraging an open forum for discussion.
- *Evolvability.* The W3C aims for technical excellence, but is well aware that what we know and need today may be insufficient to solve tomorrow's problems. It therefore strives to build a Web that can easily evolve into an even better Web, without disrupting what already works. The principles of simplicity, modularity, compatibility, and extensibility guide all W3C designs.
- *Decentralization.* Decentralization is a principle of modern distributed systems, including societies. In a centralized system, every message or action has to pass through a central authority, causing

bottlenecks when the traffic increases. In design, the W3C therefore limits the number of central Web facilities to reduce the vulnerability of the Web as a whole.

- *Developing multimedia.* Through its membership, W3C listens to end-users and works toward providing a solid framework for the development of the cooler Web through languages such as the SVG (http://www.w3.org/Graphics/SVG/Overview.htm8) and SMIL (http://www.w3.org/AudioVideo).

In response to the needs of companies attempting to do business globally, but frustrated by the challenges of creating and managing vast amounts of multiple-language WBT, several companies have created WBT content development and content management systems. These systems provide the technology platform necessary to overcome this daunting management task, and many of them are fully compliant with the principles put forth by the W3C.

12.2.1 Content management systems

Content management systems can help WBT developers shorten development times by automating all of the tasks associated with orchestrating the creation of content by a globally distributed team of developers, while managing the changes in content that are inevitable over time. Traditional authoring systems have been designed to produce "hard-coded" WBT and include no tools for searching, browsing, archiving, purging, reviewing, or revising content. Content management systems include such tools.

Imagine the challenge of maintaining WBT for 30 Web-based B2B software applications in 30 languages. That's 900 WBT courses! Each time a new version of one of the 30 software applications is released, all 30 WBT courses associated with that application must be updated. However, imagine that each WBT course consists of reusable learning objects (RLOs) and reusable information objects (RIOs) that are uniquely tagged with metatags. The editor who reviews the English-language WBT can mark those portions of the content to be changed, and the content management system can automatically mark the appropriate portions of the localized versions of the WBT for editing by translators. As this book goes to press, the authors are aware of many content management systems designed to manage English content. We are aware of only one, however, that provides the ability to create and manage content in over 40 languages. (See http://www.transwareplc.com for more information.)

12.2.2 Evaluating content management systems providers

Globalization, localization, and the ability to manage content are all factors that will shape the future of WBT. They should also shape your decision in choosing an e-learning company. As you consider potential suppliers and partners for your WBT project, consider the following factors:

- *People.* Does the company's leadership team have the vision, business experience, and technical knowledge necessary?
- *Process.* Has the company developed definable, repeatable processes that produce high-quality products and services?
- *Technology.* Has the company adopted world-class technology that provides a competitive advantage?

Obviously, the rules have changed for WBT design and development. Companies that create and use old style "hard-coded" WBT are in for a rude awakening. In order to thrive in the twenty-first century, WBT companies will have to embrace content management technology for globalized e-learning design and development. You should be targeting those companies that have already done so when searching for help with your WBT systems.

12.3 The lifelong, self-directed learner

The rapid rate of change in today's Information Age has sent a clear message to the workforce. Employees are increasingly aware that they must continue to advance and update their skills if they want to stay current in their fields and remain valuable to their organizations. Many are not waiting for the training department to tell them what learning they need; they are actively seeking training and information outside their corporate environment.

What does this trend mean to the future of on-line learning? It means that learners will be more and more sophisticated, motivated, and self-directed, and they will want access to what they need when they need it. No longer content to sit passively through stand-up training designed to appeal to an entire audience, they will want learning opportunities custom designed to fit their needs and learning styles. How are some companies meeting this demand?

- ERP systems are being designed to build learner profiles that customize a learning path for a specific individual.
- EPSS provide just-in-time training.
- Learning portals provide democratic access to a wide variety of self-directed learning options.
- KMSs include searchable databases that allow users to search for information when they need it.

More sophisticated learners means specifically in the context of WBT that more training will be "chunked," permitting learners to decide what chunks they need and when. Competency measurement may rely more on skill assessments than individual test scores from individual courses. It also means that the bar will be raised regarding the learner's expectations. A more sophisticated audience will demand more sophisticated programs.

12.4 The integration of knowledge, learning, and support systems

Many corporations are moving toward the integration of all of their learning and knowledge systems. After all, learning is the objective whether an employee uses a wizard within an application, accesses a KMS to review the best practices documented by another business unit, or goes to a course on the Web to determine how to complete a task.

The difficulty occurs when all of these independent learning efforts exist without coordination or interfaces. Efforts are duplicated, expertise is not shared, and users cannot maximize the resources available, because there is no single access point that helps them determine where to go for information. Any successful business needs to leverage its resources rather than duplicate them with independent efforts.

Although it makes sense to coordinate efforts, the ever-growing availability of technology is complicating these efforts by providing a plethora of tools for developers and users. The ever-growing number of options is also further blurring the lines between knowledge management, performance support, and training. For example, wireless application protocol (WAP) is making it possible for mobile workers to access Internet content by such hand-held devices as cell phones and tablet-sized computers. Beyond hand-held devices, there are even wearable PCs that allow workers

to access information "hands free." Imagine a repairman viewing a video as he repairs a piece of complex equipment. The implications for just-in-time information are tremendous. It means that although what we need to know is becoming more complex and our ability to memorize it all via training is becoming more dubious, our access to information when we need it is becoming virtual and limitless.

The recent proliferation of learning portals is a direct result of the effort to "marry" training and information and to provide a central access point. Elliot Maise in his on-line newsletter, *TechTrends* (October 18, 1999), defines a learning portal as "any site that offers a learner or an organization a consolidated access to learning and training resources" [3]. (For a list of learning portals, see Appendix A.)

What does all of this mean for training? Again, it means that the lines are blurring between learning and knowledge activities. It means that the training departments will need to come out of isolation and become strategic partners with upper management and IT departments. Although the actual creation of WBT is becoming easier and more intuitive, the planning side is becoming increasingly complex and strategic.

12.5 Increased pressures for rapid development

No one in the training profession needs to be told that pressures exist in the workplace to produce better and faster. The proliferation of user-friendly authoring tools is a direct response to consumer demand for more rapid development. But the pressure does not stop there. Other trends have surfaced in response to the need for rapid development:

- The pushing of content development down to the business units;
- The development of learning objects.

With traditional training development, the SME must educate the course developer, who then designs the course. Of course, this process includes iterative drafts, reviews, and rewrites—all of which take time and money. In today's fast-paced business environment, managers have figured out that they can cut down on process time and expense if the SME's develop courses.

This approach may rankle professional instructional designers, but before they denounce these business managers as mercenaries interested

only in the bottom line, they should consider the pressures on companies to keep pace with change and to provide just-in-time training. Rapid development addresses the need not only for cost-effective development, but also the need to keep pace with rapidly changing information.

Easy-to-use authoring tools with ISD capabilities and built-in templates have enabled nondesigners to create WBT. Even when these tools are used, the development process and the resulting products do not usually vary much from the typical WBT model for development and product. Still, as the need for rapid development increases, so will the variations to the typical WBT model.

Jan Utterstrom, Manager of Skill Training Applications at click2learn.com, Inc., has created a process to meet the requirements of rapid development [4]. Called "skills training," it is used to capture expert skills for new-hire training. How does this process differ from the traditional WBT development model?

1. There is no front-end analysis. Instead, the focus is on capturing the job process on video as it is performed.
2. Users have complete control over the media.
3. The video and narrative are "rough." For example, factory workers would describe how they perform a task in their own words right on the factory floor without special effects or scripted narratives.
4. Assessment is not always included. When it is included, it is used for self-assessment, rather than score reporting (i.e., the assessment is the actual job performance).

While this type of skills training relies heavily on video, currently an obstacle to Web deployment, a hybrid solution can be used whereby the video content resides on CD-ROM and other media resides on the Web. And certainly, in the future, these obstacles will be resolved.

Utterstrom's skills-training process is one response to the need for rapid development, in which development is pushed down to business units. This trend is not going to go away—other models will be developed. Again, a training department should not see this trend as a replacement for traditional course development, but as one more tool within a suite of tools. Working as a strategic partner, a training department can help facil-

itate the development of templates and tools, ensure the consistency and quality of the product, and integrate tools with LMSs.

The need for rapid development has spurred the need for Reusable Learning Objects (RLOs). If the information exists in one place, why should developers have to recreate it to use it in another environment? Cisco Systems (http://www.cisco.com) has been a pioneer in this area and has developed reusable information objects (RIOs) in order to leverage the benefits of reuse in its training programs. (See http://www.dr-david-stone.com for a more comprehensive discussion of RLOs and RIOs.)

Currently, there is a difference between what a learning object is in theory and what it is in reality. In theory, a learning object is a self-contained digital piece of information that can be used by someone to learn something. A course, a lesson, a page, a document—even an animation sequence—can be considered a learning object. And, in theory, a learning object is something anyone can transfer, share, and learn from. It is here that theory differs from reality. Today, many learning objects are created using proprietary software. Certainly, in today's Information Age, platform-independent learning objects could contribute greatly to collaboration, increased access, improved quality, and reduced training costs. However, platform dependence is still the norm.

In August 1999, the Instructional Management Systems (IMS) Project announced the release of the IMS Metadata Specification. The most recent version of the specification is Version 1.2, which was released in June 2001. Metadata is a means of tagging learning objects for cataloging, interoperability, and reuse.[1] Several learning-system companies are already taking steps to ensure that both their authoring and management products are compliant to these open-architecture standards. This is goods news for learning consumers and developers. Platform-independent learning objects could eventually lead to training managers "shopping" the Internet for learning objects guaranteed to run within their LMSs or to developers marketing objects that run on any number of different platforms without plug-ins. And learning resources could freely exchange learning data without worrying about incompatibility. (For more information about the IMS Metadata Specification, see [5].)

1. For additional information on metadata and learning objects, visit the following Web sites: W3C (http://www.w3.org), ADL/SCORM (http://www.adlnet.org/Scorm/scorm_index.cfm), IEEE (http://wwww.ieee.org), Learning Resource Interchange (http://www.microsoft.com/elearn), and AICC (http://www.aicc.org).

12.6 Increased collaboration

The need for increased collaboration results directly from two of the business factors discussed earlier in this chapter. First, an increasingly global economy means that teams are geographically dispersed. The increased pressure for rapid development means that the speed of communications must likewise speed up—they must become instant, real-time dialogues rather than laborious, time-consuming faxes and letters. Second, advances in technology and the sheer complexity of today's business environment have necessitated group work, or teamwork. In many business projects, not one single project member can know it all. Business leaders have discovered that "group think" is more powerful than individual efforts and sharing knowledge is an important means of protecting a company's intellectual assets.

As collaborative software has gained acceptance and sophistication, its impact has already spilled over into the training arena. We are now seeing more sophisticated training programs that integrate the benefits of both asynchronous and synchronous learning. Web-based collaborative software is used not only because it can be, but because business objectives will include increasing the level of collaboration among teams. In other words, in order to mimic reality, training will need to mimic the preferred tools and processes—including groupware applications and collaboration processes.

SmartForce's Web site (http://www.smartforce.com) features collaborative learning capabilities and includes examples of asynchronous and synchronous learning. SmartForce provides on-line support staff (available 24/7) to respond to student questions regarding the operation of the learning system. Chat rooms are also available (and staffed) to facilitate interaction among learners.

12.7 Conclusion

To date, the development of Web-based learning systems has focused on skill and curriculum management. LMSs have been created to register students, launch courses, track student activity, and generate reports. From an instructional perspective, earlier LMSs that ran on local area networks (LANs) were in some ways much more sophisticated than those developed for Web-based learning. Future releases of WBT systems should include features of LAN-based systems, such as intelligent tutoring, improved test-

ing (including adaptive testing), statistical analysis, and individual learning paths.

WBT has really only been mainstream for the past few years, and companies around the world are now embracing the concept, but others are still reluctant to climb onboard. However, advances in Web technology will soon make increasingly sophisticated training programs possible, and business needs and the demand for individualized instruction will make them necessary.

The next generation of WBT is not far away. And who knows, it may not even be called WBT. The lines will blur between training and such areas as collaboration, knowledge management, and resource planning. The future of WBT is integrated, sophisticated, and collaborative. It will be as open, flexible, and democratic as its medium—the World Wide Web—itself.

New tools such as the recent generation of content management systems with localization capabilities are enabling WBT to meet the requirements of global business practices. As you develop your WBT program, you cannot forget that what you develop today should be reused again tomorrow. You may have to alter content for a different group of trainees in a different part of the world, but what you develop today should always be ready for future business requirements, which will dictate use of the Web to reach a worldwide workforce.

References

[1] Means, G., and D. Schneider, *MetaCapitalism: The E-Business Revolution and the Design of 21st-Century Companies and Markets*, New York: John Wiley & Sons, 2000.

[2] Forrester Research; cited on http://www.gladstoneplc.com.

[3] Maise, E., *TechTrends,* October 18, 1999.

[4] http//www.click2learn.com.

[5] http://www.imsproject.org/metadata/index.html.

Appendix A
WBT resources

A.1 Content development—media

3D	PRODUCT NAME	URL
3D characters, virtual/ synthetic actors	VirtualFriend	http://www.haptek.com
3D graphics	Adobe Dimensions	http://www.adobe.com
3D graphics	Simply 3D	http://www.micrografx.com
3D graphics and animation	3D Impact Pro	http://www.crystalgraphics.com
3D, interactive	egi.3D.art	http://www.egisys.com
3D interactive animation	Shell Interactive	http://www.doitin3d.com
3D modeling	Form-Z	http://www.formz.com
3D modeling and animation	Poser	http://www.curiouslabs.com
3D animation	3ds max	http://www2.discreet.com/products

Animations	Product name	URL
Animations, GIF	GIF Dispenser	http://davecentral.com/8679.html
Animations, GIF	GIF Construction Set	http://www.mindworkshop.com/alchemy/alchemy.html
Animations, DHTML	Flash	http://macromedia.com

Audio	Product name	URL
Audio, recording	Sound Forge, Audio Anywhere	http://www.sonicfoundry.com
Audio, recording	SoundEdit	http://www.macromedia.com/software/sound
Audio, compression	Qdesign Pro	http://www.qdesign.com

Games	Product name	URL
Games	Gameshow P.A.L.	http://learningware.com
Games, quizzes	Quia	http://www.quia.com

Graphics	Product name	URL
Graphics (bitmap and vector)	Fireworks	http://www.macromedia.com
Graphics (image editing)	Paint Shop Pro	http://www.jasc.com
Graphics (image editing)	PhotoShop	http://www.adobe.com
Graphics (charts)	Harvard Instant Charts	http://www.harvardgraphics.com
Graphics (diagrams, flow charts)	Visio	http://www.visio.com
Graphics (screen captures)	SnagIt	http://www.techsmith.com
Graphics (technical illustration/Web graphics)	iGrafx Designer	http://www.micrografx.com
Graphics (vector)	Illustrator	http://www.adobe.com
Graphics (vector)	Freehand	http://www.macromedia.com

Assessment	Product name	URL
Skill assessment	InfoCheck	http://www.howtomaster.com
Skill assessment	Prove It	http://www.knowitallinc.com
Skill assessment	Skill Assessment	http://www.individualsoftware.com
Skill assessment	SkillsTree	http://www.learningtree.com
Tests	Question Mark	http://www.questionmark.com
Tests	Quia	http://www.quia.com
Tests	Quiz Factory	http://www.learningware.com
Tests	Test Pilot	http://www.clearcutsoft.com

Streaming	Product name	URL
Streaming media	Adobe Streaming Media Collection	http://www.adobe.com
Streaming media	Cleaner 5	http://www.terran.com
Streaming media	Clipstream	http://www.clipstream.com
Streaming media	RealProducer Plus	http://www.real.com
Streaming media	Streaming Anywhere	http://www.sonicfoundry.com
Streaming media	Windows Media Player	http://www.microsoft.com/windows/windowsmedia

Video	Product name	URL
Video, digital editing	Adobe Premier	http://www.adobe.com
Video, digital editing	QuickTime Pro	http://www.apple.com/quicktime
Video, screen captures	HyperCam/HyperSnap	http://www.hyperionics.com
Video, screen captures	Camtasia, SnagIt	http://www.techsmith.com

Virtual reality	Product name	URL
Virtual reality	Cosmo Worlds	http://www.sgi.com
Virtual reality	VRT, 3D Webmaster, Do 3D	http://www.superscape.com
Virtual reality, natural language bots	Smart Bots	http://www.artificial-life.com
Virtual reality, 360° simulation	QuickTime VR Authoring Studio	http://www.apple.com/quicktime/qtvr/authoringstudio

A.2 Content development—WBT authoring tools

COMPANY	PRODUCT	URL
Allen Communications	Net Synergy/Quest	http://www.allencomm.com
Click2Learn	ToolBook	http://www.click2learn.com
Macromedia	Authorware/Course-builder	http://www.macromedia.com
MicroMedium, Inc.	Trainersoft	http://www.micromedium.com
VuePoint Corp.	VLS Content Creator	http://www.vuepoint.com

A.3 Content development—Web site

COMPANY	PRODUCT	URL
Adobe	GoLive/PageMill	http://www.adobe.com
Apple	WebObjects	http://www.apple.com/webobjects
Macromedia	Dreamweaver	http://www.macromedia.com
Microsoft	FrontPage	http://www.microsoft.com
NetObjects, Inc.	NetObjects Fusion	http://www.netobjects.com
Trellix Corporation	Trellix Web Express	http://www.trellix.com

A.4 Content providers—learning portals

DESCRIPTION	URL	BLACKBOARD.COM
http://www.black-board.com/	Blue Web'n	http://www.bluewebn.com/
Free-ed.net	http://www.free-ed.net/	Learn.com
http://www.learn.com/	Learn2.com	http://www.learn2.com/
Teamscape	http://www.team-scape.com/	UNext.com
http://www.unext.com/	emind.com	http://www.emind.com/

A.5 Content provider—on-line learning centers, commercial

COMPANY	URL	COURSE TECHNOLOGY
http://www.course.com/	DigitalThink	http://www.digitalthink.com/
elementk	http://www.elementk.com	GeoLearning, Inc.
http://www.geolearning.com/	McGraw-Hill Life Time Learning	http://www.mhlifetimelearning.com/
NetG	http://www.netg.com	SmartForce
http://www.smartforce.com/	ThinkQ	http://learning.thinq.com/

A.6 Deployment—LMSs

COMPANY	PRODUCT	URL
Allen Communications	Manager's Edge	http://www.allencomm.com
Click2Learn	Ingenium	http://www.click2learn.com
CBM Technologies	TEDS Administrator	http://www.cbm.com
Docent	Docent Enterprise	http://www.docent.com
Generation21	Total Knowledge Management	http://www.gen21.com
Gyrus Systems	Training Wizard	http://www.gyrus.com
ITC Learning	Pinnacle Learning Manager	http://www.itclearning.com
KnowledgeSoft	Learning and Performance Management System	http://www.knowledgesoft.com
Lotus Development Corp.	LearningSpace	http://www.lotus.com
Phoenix	Pathlore Software	http://www.pathlore.com
Plateau Systems, LTD	Plateau Training Management System	http://www.plateausystems.com

COMPANY	PRODUCT	URL
Saba Software	Education Management System	http://www.saba.com
ThinkQ	Training Server	http://learning.thinq.com
Vuepoint	Performance Learning System	http://www.vuepoint.com

A.7 Deployment—Web conferencing/synchronous-classroom hosting services

COMPANY	PRODUCT	URL
Centra	Centra Symposium	http://www.centra.com
LearnLink Corp.	LearnLink	http://www.learnlinc.com
Microsoft	NetMeeting	http://www.microsoft.com
Placeware, Inc.	Placeware	http://www.placeware.com

Glossary

ActiveX A programming language developed by Microsoft. Like JavaScript, it is interpreted by the browser.

Alpha test The first test of your WBT when all pages, media, and functionality are present.

Androgogy Self-directed learning.

Applets Mini applications created by programming object-oriented, platform-independent languages, such as Java. Applets can be embedded in other applications to enhance interaction and functionality.

Application sharing A feature that allows two or more people in different locations to share a single live software application simultaneously. While the application runs on the PC of the person who launched it, all users have the ability to input information and manipulate the application using the keyboard and mouse.

Artificial intelligence Computer systems that perform functions normally associated with human deductive reasoning and learning.

ASCII Text (.txt) A plaintext file without formatting that can be imported into a wide variety of applications.

Asynchronous Communication that occurs with a time delay, allowing participants to access the materials and respond independently at any time.

Asynchronous transfer mode (ATM) A data transportation technique that integrates multiple data types (voice, data, video, and text) through variable bandwidth allocation, allowing each application to use the same transmission method regardless of data type or bandwidth requirements.

Authoring software or tools High-level computer programs designed for creating computer-based training, interactive presentations, and multimedia. A user-friendly interface presents commands as simple terms, concepts, and icons. The software translates these commands into programming code.

Avatar An intelligent agent programmed to identify your interests and preferences that travels the Web on your behalf seeking things of interest to you.

AVI (.avi) Audio-Video Interleave. A standard windows video and audio file type in which video and sound elements are stored in alternate, or interleaved, chunks. An .avi file is actually a series of bitmaps displayed in rapid succession to give the illusion of movement.

Bandwidth The amount of information that a cable or electronic system can transmit at one time.

Beta test The formal testing of courseware under development and draft documentation by selected users before external testing or distribution. Users test the functionality to determine whether operational errors still exist. Beta testing is one of the last steps before the product's release.

Bitmap graphics A standard image format created by placing pixels, or dots, of color on the screen. Also known as raster graphics.

Cascading style sheets (CSS) A style sheet mechanism that allows Web site designers to use common desktop-publishing terminology to attach graphic-design attributes to HTML documents, thereby allowing designers to address these attributes separately from the Web-page structure. CSS gives the author much more control over fonts, colors, margins, typefaces, and positioning. CSS can also create templates used to format various pages.

Chat Synchronous, text-based communication between two or more individuals connected on-line. As participants type, their words are displayed to the other members of the chat group who can then respond.

Chroma key A special effect produced by filming figures or objects against a monochrome background, which is later replaced by images from another source. The foreground images appear as though they were actually shot against the simulated background.

Codec Compression/decompression algorithm; programs used to convert and compress analog sources into digital signals and then decompress them upon playback.

Collaborative software Software that allows users to collaborate via discussions, application sharing, whiteboards, and chat functions. On-line collaboration can be asynchronous or synchronous.

Compressed video Video that has been compressed to eliminate redundant information in order to reduce the amount of bandwidth required for transmission.

Computer-assisted instruction (CAI) Teaching process in which a computer is used to assist students in gaining mastery over a specific skill.

Computer-based training (CBT) Any interactive instruction in which a computer provides training stimuli to the student and then provides feedback based on the student's response.

Computer-supported cooperative work (CSCW) The study of how people use computer technology to collaborate. Typical collaborative applications include e-mail, notification systems, video conferencing, chat systems, multiplayer games, and synchronously shared applications..

Course map A document that outlines a course and shows the hierarchical relationships between the lessons and modules, usually presented in the form of a diagram or flow chart.

Data source name (DSN) The name that applications use to request a connection to an ODBC data source. An example of an ODBC data source is a SQL Server database, the server on which it resides, and the network used to access that server. A DSN consists of a number of parameters that supply information about the database server to which you are connecting and the ODBC driver you are using.

Database A collection of information stored in one or more tables. Database tables organize information so that your computer can find it quickly.

Desktop videoconferencing Videoconferencing using PCs, an Internet connection, a microphone, and video camera(s). Video and audio can be two-way or multiway, depending upon the hardware and software of the participants.

Distance learning Learning systems and processes that connect learners and instructors separated by distance, time, or both. It may include both synchronous and asynchronous elements. Also called "distributed learning."

Dithering The process of reducing a full-color image to a limited palette via an algorithm that assigns new color values to each pixel based on mathematical averages.

Dynamic HTML (DTHML) An "improved" HTML that allows Web authors to update content and users to see the updates without reloading the page with the browser.

Electronic performance support systems (EPSS) Customized software that provides just-in-time, integrated information, tools, and procedures to support users as they actually perform a task. Often used when decision-making is required, procedures are complex, or users are new to a process.

Extensible Markup Language (XML) A general syntax for describing hierarchical data that is human-readable, machine-understandable, and applicable to a wide range of applications (databases, e-commerce, Java, Web development, and searching). Custom tags enable the definition, transmission, validation, and interpretation of data between applications and between organizations. In other words, content tagged with XML can be accessed and used by a variety of applications.

Facilitator A person trained to help a group focus upon and solve a problem. Collaborative software often requires one participant to facilitate.

File Transfer Protocol (FTP) A file exchange protocol used to upload or download files from one computer to another via the Internet. An FTP site is actually storage space on a server that is accessible via the Internet.

Firewall Software, hardware, or both that add security to a proprietary system connected to the Internet. Most corporate intranets use a firewall to control incoming and outgoing access. Firewalls can reduce response time when communications have to cross that wall.

Formative evaluation Evaluation that is performed as part of product development to identify opportunities for improved content revisions before the final product is released.

GIF Graphical Interface Format. A platform-independent, graphic image file format that compresses the image to 8-bit pixels, which it can then reproduce at a maximum of 256 colors. GIFs compress images without quality loss, but they do not support images of more than 256 colors.

Graphical user interface (GUI) A user-friendly interface technique that uses a mouse, icons, and menus to select computer functions. (Abbreviation pronounced "goo-e".)

Groupware Groupware is any computer technology that helps groups communicate, cooperate, coordinate, solve problems, compete, or negotiate. Examples of asynchronous groupware include e-mail, newsgroups, group calendars, collaborative writing, and workflow systems. Synchronous examples include videoconferencing or Web conferencing, chat functions, application sharing, shared whiteboards, decision support systems, and multiplayer games.

Host The central processing unit that provides the computer power for the terminals and peripheral devices that are connected to it.

Hypermedia A program that gives the user control over nonlinear, linked media (text, graphics, audio, and video).

Hypertext A program that gives the user control over nonlinear, linked text.

Hypertext Markup Language (HTML) A standard document format used to create Web pages. The format uses HTML tags to specify the properties of the document. A Web browser can interpret the HTML tags and graphics on a Web page. HTML includes provisions to specify links to other Web pages.

Icon A symbolic object. In icon-driven programs, these objects are used to embed user-controlled functionality. For example, the user may click on a house symbol to return to a home page.

Image map A graphic navigational interface that allows the site visitor to click on hot spots within a graphic, or "map," to link to other pages.

Interactive video A video-computer program that allows the user to input and control how the program runs.

Interlaced GIF A noninterlaced GIF displays in a browser one pixel at a time, starting from left to right. An interlaced GIF displays a low-resolution version of the image quickly and then fills in the details as the file downloads. While interlaced GIFs don't actually download any faster than noninterlaced GIFs, they give the illusion of faster download times.

Java An object-oriented programming language developed by Sun Microsystems used to create interactive, multiplatform functionality that is executable on Web pages by Java-enabled Web browsers. Java source code is compiled into bytecode, which is executed by a Java interpreter.

JavaScript JavaScript is a simplified version of the Java programming language that is used to develop client and server Internet applications. JavaScript statements can be embedded directly into an HTML page. These statements can recognize and respond to user events, such as mouse clicks, form input, and page navigation.

Job aid Any tool that an employee uses on the job to perform a given task and that is designed to reduce the amount of information that must be memorized. Quick reference cards and electronic performance support are both job aids.

JPEG A universal graphics file format defined by the Joint Photographic Experts Group that uses lossy compression to discard redundant data. This format works best for images with many varied colors, such as scanned photos.

Knowledge management systems (KMS) Systems that capture group or individual expertise or solutions so that they can be shared with the entire organization.

Learning management systems (LMS) Applications or systems that centralize all training functions at one access point. These systems typically include registration, course management, and student-record keeping functions.

Learning object The development of learning objects is based on the concept of content recycling and driven by the need for faster, more cost-

efficient course development. Learning objects are platform-independent chunks of content that have been tagged according to industry standards and stored in a central database to be catalogued and reused. The content can be a chapter, course, media component, or template. The tagged objects are sometimes known as "metadata."

Learning portal A public or internal single-point access site for learning from multiple sources.

Linear A sequence of events designed to follow a predetermined path from beginning to end without branching.

Listserv An e-mail program that allows multiple computer users to connect onto a single, on-line discussion.

Local area network (LAN) A system that connects two or more computers, allowing them to share resources in a relatively limited environment, usually the same geographic location. *Note:* Large corporations often have a number of LANs within one WAN.

Lossy compression A compression technique that optimizes data reduction by discarding redundant information in an image. JPEGs use lossy compression to reduce file size.

MIDI Musical Instrument Digital Interface. A type of electronic audio file that provides a industry standards for passing detailed musical information. A MIDI is not sound, but a series of time-stamped commands that require a playback device. MIDIs are typically small files compared to WAVs.

Modeling An educational process whereby CBT is used to represent or "model" another system or process. The learner can change values and observe the effects of the change on the system.

MPEG The Moving Pictures Experts Group's international standard for audio and video compression

Multimedia A general term that usually refers to computer programs that use a combination of sound, video, animation, graphics, and text.

Multiplatform The ability of software to work or play on more than one hardware platform.

Multipoint Electronic communications in which more than two terminals or stations are connected. See *Point-to-point*.

Natural-language A term used to describe certain types of software that will interpret the natural language used when a user types a response or inquiry in his or her own words.

Object Anything that can be independently manipulated by a designer or a user of an application. Objects have "physical" properties, such as size, shape, color, etc. Most objects can store scripts, which can be run during the use of an application. For example, Java applets are interactive objects that WBT authors can customize and add to their programs.

Pilot An evaluative test conducted after the usability test and before rollout whereby a select, small group of real users test the effectiveness of the instruction or software.

Pixel The screen-dot used to create a computer image. Color resolution in an image is determined by the number of bits of data used to create one pixel (1, 8, 16, or 24). Thus, 24-bit color is much more realistic than 8-bit color, but requires more data, that is, a larger file size.

Plug-in A program written to run within a larger application in order to add functionality or enhance performance. For example, streaming media and animation require plug-ins to run.

Point-to-point Electronic communication between two stations.

Portable Document Format (PDF) A proprietary file format developed by Adobe in which texts and still-frame files can be saved, printed, and viewed exactly as they were created, regardless of the computer platform used. To read them, the user needs Acrobat Reader software.

Push technology Technology that "pushes" the information to the user so that they do not have to seek it out. For example, on-line help documentation is a "pull" technology that requires users to find the information they need. An electronic support system is an example of "push" technology whereby the user support information is presented to the user as an integral part of the application. When used specifically in reference to the Internet, the term refers to technology that allows users to subscribe to theme channels through which they automatically receive continuous updates in multimedia, such as texts, images, and animations.

QuickTime Movie A popular, ubiquitous Web video format originally developed by Apple computer.

QuickTime Virtual Reality (QTVR) Apple's technology used to create a simulated 360° view from a group of individual, electronic images.

Raster graphics Computer graphics that are rendered by assigning a color to each dot or pixel.

RealAudio A popular audio player plug-in.

RealPlayer A popular plug-in used to download and play streaming video.

Real time See *synchronous*.

Run time A user version of a development program, such as an authoring system, that allows a lesson to be delivered to a learner, but not modified by the learner.

Sampling rate Rate at which measurable slices are taken from analog signals when converting to digital. The higher sampling rates result in higher quality but more data and larger file sizes.

Scalability A feature of certain encoding formats that allows content to be displayed at higher quality on more powerful computers while still supporting lower-level quality on low-end machines.

Self-paced learning Education in which learners study at their own pace without interaction with others. CBT is the most common form of self-paced learning. Often self-paced learning is also "self-directed" in that the learner has navigational and content options.

Server A computer or a software package that provides a service to client software running on other computers. For example, the server can store data retrieved and used by the client PC. The term can refer to a particular piece of software or to the machine on which the software resides.

Shockwave A program that enables animation created with Macromedia Director to be displayed on the Internet and viewed with a Web browser. This type of animation is typically used for on-line advertising, games, tutorials, and animated logos.

Simulation A representation of a situation, equipment, system, or environment in a realistic form. A simulation that represents a subset of the total real-world scenario is often referred to as "part-task simulation," while a "whole-part simulation" represents all of components of the real world situation.

Storyboard A series of sequential graphic and descriptive sketches used to communicate and plan the production of film, video, or CBT.

Streaming A technology whereby an application or plug-in can begin playing back the contents of a media file before it is fully downloaded.

Stress test A type of testing in which the applications, interfaces, and infrastructure are tested by actual users under real conditions, such as a realistic number of simultaneous users.

Subject matter expert (SME) A content expert used as a consultant during course development.

Summative evaluation The evaluation that takes place after a project has been completed and implemented in which decision-makers analyze the effectiveness of the product to determine whether it should continued, enhanced, or discontinued, much like a "postmortem." See also *Formative evaluation*.

Synchronized Multimedia Integration Language (SMIL) SMIL is a language recommended by the W3C that allows for the creation of time-based multimedia delivery over the Web. Based on XML, it allows developers to mix many types of media, text, video, graphics, audio, and vector-based animation and synchronize them to a timeline.

Synchronous Same-time, or synchronous, communication in which the processing of information is so rapid that the interaction appears to be instantaneous. Web conferencing, chat, videoconferencing, and application sharing are examples of real-time applications.

T-1 The fastest commonly used connection to the Internet capable of carrying data at 1,544,000 bps.

Tag Image Format (.tif) Created to become the industry standard raster image format, this file format is supported by a wide variety of platforms and desktop publishing applications (unlike the bitmap, which is proprietary to Windows PCs.)

Template A preformatted structure or shell that defines certain visual and functional elements in order to provide consistency in look, usage, or instructional methods. The shell is copied and specific unique data entered to create a unique page or record. A WBT author can build his or her own templates, or use templates provided by an authoring tool or third party.

Threaded discussion A series of messages in an on-line discussion that are posted as replies to each other.

Transmission control protocol/Internet protocol (TCP/IP) The group of communications protocols used to connect hosts on the Internet.

Unified messaging A central service that consists of an electronic inbox that handles all types of messages—voice, e-mail, and fax.

Uniform resource locator (URL) An address used to locate a Web page on the Internet. Much as your area code and telephone number identify your region and then your location, the URL of a Web page identifies a computer and then a specific document.

Usability The ease of use. For example, there are usability guidelines for Web design that, when followed, make a site easier to use.

Usability testing Usability testing is an evaluative stage of development that ideally involves several typical users who individually review the product in a controlled, observable environment so that improvements can be made to the product.

User-friendly A term that refers to systems and programs that are easy to use by users without a technical background.

Vector graphics Graphics comprising lines defined by two endpoints. These graphics can be anything from complex diagrams and illustrations to simple shapes. There are no Internet-standard file formats for vector graphics; the graphic must be converted to an Internet-compatible bitmap file format, such as GIF or JPEG.

Virtual classroom A teaching and learning environment constructed via computer technology that supports collaborative learning among students who participate at times and places of their choosing through computer networks. Although WBT, chat, e-mail, shared databases, and other on-line communication tools may be included within the scope of the virtual classroom, the virtual classroom usually incorporates many aspects of traditional classroom communication, including a syllabus, prerequisites, course descriptions, registration procedures, and assignments.

Virtual reality The digital simulation of a complete world or environment, either real or imaginary, via the 3D rendering of objects and places.

Virtual Reality Modeling Language (VRML) The Internet standard used to describe interactive, 3D objects or worlds. VRML files have the .wrl extension. To view VRML files, Internet browsers occasionally need a plug-in like Cosmo Player, Live3d, or WorldView.

WAN Wide area network; the integration of diverse LANs. For example, in a large corporation, PCs within each geographical location are connected by a LAN, while each LAN is networked to the rest of the corporation via the WAN. See also *local area network*.

WAV (.wav) The Windows standard for wave form audio files.

Web-based training (WBT) A form of CBT in which the training material resides on the Web.

Web browser A program used to view resources on the Internet. A Web browser interprets the HTML tags in a file and translates the code into formatted text and graphics that users can view.

Web conferencing Synchronous, group conferencing via a Web site that typically includes audio exchange, application sharing, whiteboard, chat, polling, and hand-raising features. Web conferencing differs from desktop videoconferencing in that it does not include the use of video cameras.

Web server A software application installed on a computer connected to the Internet that finds Web pages and delivers them to a Web browser. There are many Web server software applications available, including public-domain software and commercial applications from Microsoft, Netscape, and others.

Whiteboarding A term used to describe the placement of shared material on a PC-screen "whiteboard." Desktop Web- and videoconferencing softwares often include tools that enable you to capture entire windows or portions of windows and place them on a shared electronic whiteboard that can be marked up and annotated much like a traditional whiteboard.

Wireless Application Protocol (WAP) A standard that allows wireless, handheld devices, such as cell phones and tablet size PCs, to display and interact with Web-based content.

World Wide Web (the Web) A part of the Internet with the capacity to handle multimedia (text, graphic, video, and sound) information. The content of the Web consists of documents, called Web pages, which are stored on computers around the world.

World Wide Web Consortium (W3C) The World Wide Web Consortium (http://www.w3.org/) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential as a forum for information, commerce, communication, and collective understanding. On this page, you'll find W3C news as well as links to information about W3C technologies and getting involved in W3C. We encourage you to learn more about W3C.

About the authors

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