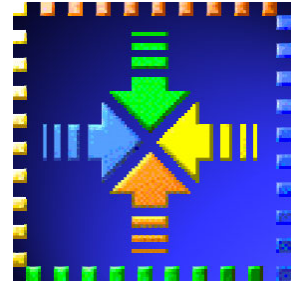# Developing Knowledge Products

The Ergoglyphics® Method
for developing effective knowledge
products on schedule and within
budget

By

William Horton

CONTENTS

PREPARE

Developing knowledge products is a complex, risky business, but the Ergoglyphics® Development Method, combined with hard work and common sense, will help you create effective knowledge products on schedule and within budget. Let's get started.

WHAT IS A KNOWLEDGE PRODUCT?

One obvious question that comes to mind is "What is a knowledge product?"

Here we are talking about electronic products that can deliver education, information, training, entertainment, and a whole lot more.

Examples of knowledge products

Let's look at some examples of knowledge products. Knowledge products include e-learning courses (either Web- or disk-based), informational Web sites, electronic books and other online documents, online help, learning games, and even workplace job-aids. Though different, all these electronic knowledge products can benefit from a common, systematic method of development involving knowledge objects.

SEQUENCE OF DEVELOPMENT

What is the sequence of activities necessary to develop a knowledge product?

There are as many development processes as there are development projects. Although the exact sequence depends on the type of knowledge product, the intended consumers, and many other factors, most successful projects share a family similarity.

Phases of developing knowledge products

Most successful projects involve four main phases of development: analysis, design, building, and evaluating. And all repeat these steps several times in the course of the project.
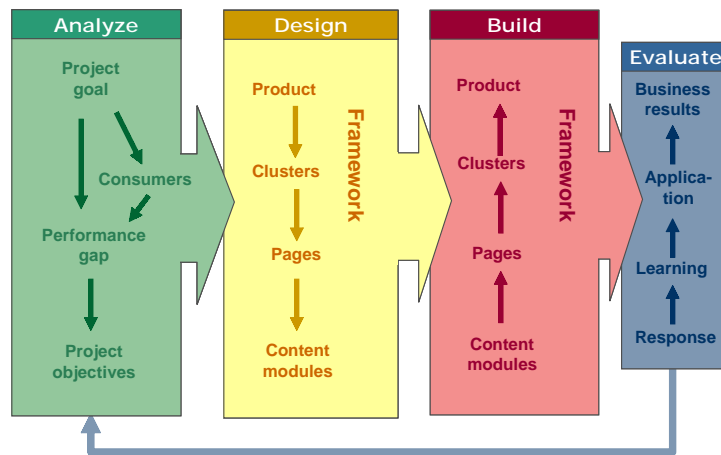
The first activity is analyzing the situation that gives rise to the development process. Analysis usually starts with defining the business goal for the project. From the business goals, we can often derive performance goals. These goals specify activities that people must perform in order to meet the business objectives. We then identify the part of this performance goal that can be accomplished by our knowledge product. This goal we elaborate into the overall objectives for our project. Along the way, we research the target consumers who will use the knowledge product and whose performance we are trying to alter.

The design process is essentially a top-down refinement of the overall goal. The knowledge product is elaborated into clusters of knowledge objects, which are in turn specified as sequences of pages, each containing specific content modules. Meanwhile, the framework necessary to house the content and make it accessible is specified.

While we design top-down, we build bottom up. First, we create first small components, which we integrate into successively larger units. At the end, we have a complete knowledge product. As units are created, the framework is created in parallel.

The final phase, which is often overlooked, involves evaluating the knowledge product to see whether it meets its objective and how it can be improved. We may evaluate at four levels. At the simplest level, we evaluate the responses of users to the knowledge product. Did they like it? A more meaningful evaluation may tell us whether they learned anything. Above that we may track their on-job performance to see if they are applying the knowledge provided by the knowledge product. We may go even further to track whether the knowledge product accomplished its original business objective.

More of a cycle than a path

Development is often thought of as a sequential path from idea to product, but successful projects have much more of a cyclical progression.
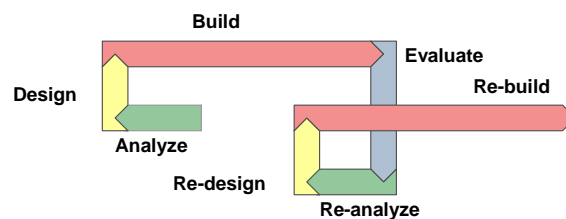

We might start out by analyzing the need for the product. We, then, would design a solution and build it. Next we would evaluate it, only to find our solution lacking in some essential characteristic of effect. This leads us to re-analyze, re-design, and re-build.

Development of most knowledge products is cyclical, empirical, and cumulative. That means we develop through several cycles of analysis, design, building, and evaluation. Much of our final design is based on what was revealed by earlier testing. And, as we develop, we refine and enhance our design ideas.

Repeat and perfect

Such a cyclical development process is often referred to as the two-steps-forward-one-step-back approach.
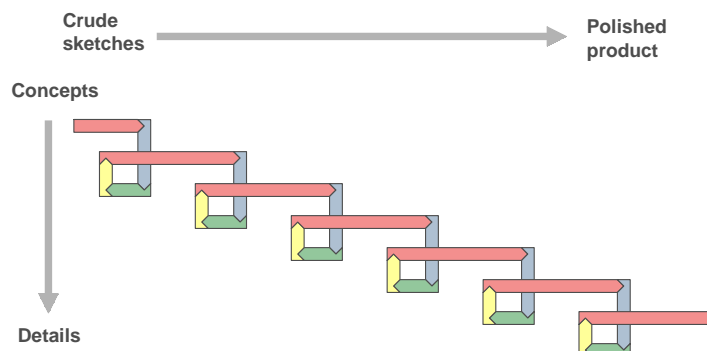
As work cycles again and again through the four phases of development, our product grows more complete and refined. Early cycles may involve only crude

sketches that in no way resemble the polished product we refine in later cycles. Early work may concentrate on overall concepts while later ones focus on minute details.

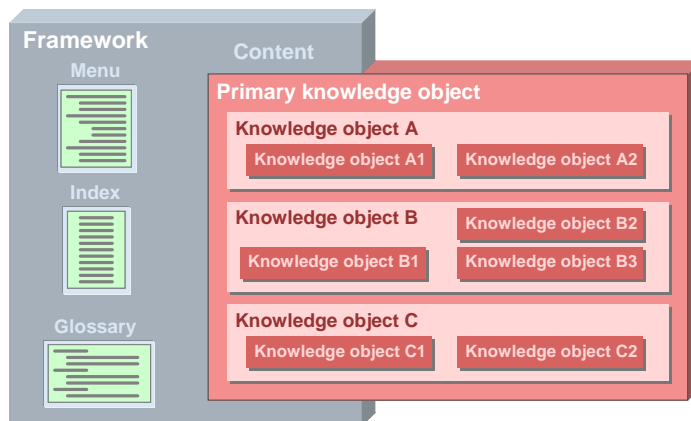# ARCHITECTURE OF KNOWLEDGE PRODUCTS

What lies beneath the skin of a knowledge product? What are its parts and how are they arranged? In other words, what is the architecture of knowledge products?

Architecture of a knowledge-product

Let's look at the architecture of a knowledge product. At the top level, knowledge products consist of a framework and content.


The **framework** of a knowledge product provides a home and a stage for the content. The framework might contain a slot for the actual content as well as mechanisms to display its menu or table of contents, an index, and a glossary.

The **content** is made up of **knowledge objects**. The content as a whole may be represented by the primary knowledge object. This primary knowledge object may contain other, smaller and more specific knowledge objects. In this example, the primary knowledge object contains knowledge objects A, B, and C, which in turn contain even smaller and more specific knowledge objects.

Once all the content is identified, the **menu**, **index**, and **glossary** may be assembled and displayed in the framework.

Outward structure of a knowledge product

What does a knowledge product actually look like? That is, what is its outward structure? Let's take a look at one.

Framework

Links to secondary knowledge objects

Visible manifestation of the knowledge object
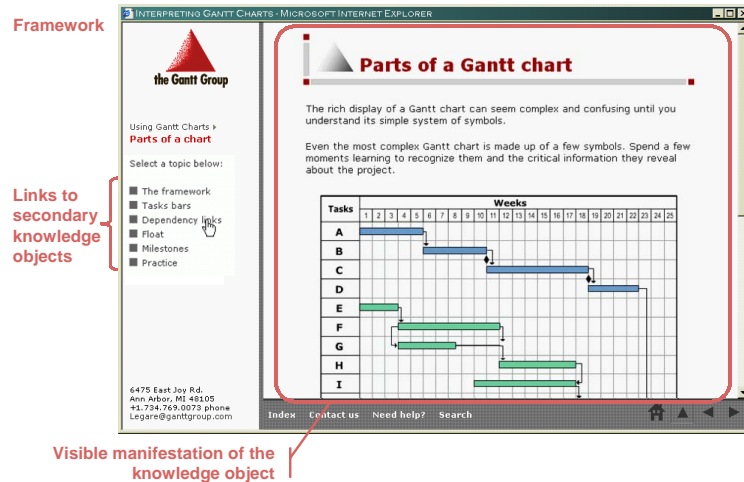
This example is an e-learning course. The framework consists of the basic window. Along the left edge are a title and a slot for displaying the table of contents. At the bottom are some generic links for getting information about the course and are some buttons for displaying the index, sending e-mail, getting help, and searching. Because these actions are not associated with particular parts of the content, we think of them as part of the framework. In the larger area at the right is displayed the currently selected knowledge object. In the table of contents we find links to second level knowledge objects.

Units of knowledge products

Knowledge products are produced in various units of scale and scope ranging from collections of multiple products to individual low-level components. It is important to understand these units because they influence what design techniques we use and tools we employ to create these units.

Collection

Product

Cluster

Knowledge objects

Page

Content module
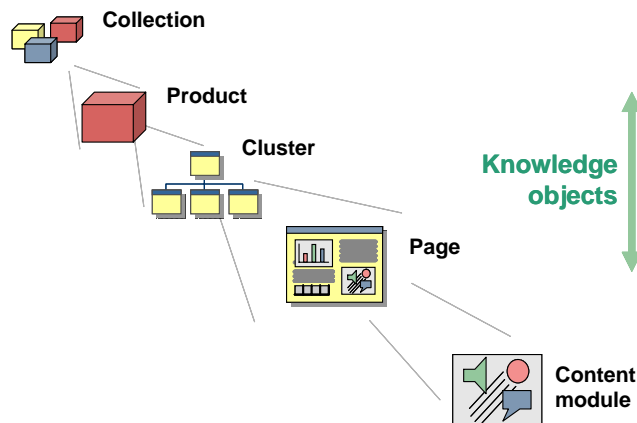
At the top of the pyramid are **collections** of learning products, for example a library of books on a certain subject or an academic program including related courses in a subject area. Collections are composed of knowledge products, such as individual books, courses, and manuals.

Products are typically composed of clusters of smaller components, each organized to accomplish one of the objectives of the product as a whole. In books, clusters are chapters; in courses, they are lessons.

At a lower level are the individual **pages**, or topics, each designed to accomplish a single purpose or answer a single question. Such units may be called screens in multimedia presentations or topics in online Help.

At the bottom level are **content modules**. These are the individual pictures, blocks of text, animation sequences, and video passages that contribute to the page.

The middle three units (product, cluster, and page) may all be designed as self-contained knowledge objects.

What is each unit?

Let's review what constitutes each unit: collection, product, cluster, page, and content module.

- A **collection** is a group and sequence of documents or courses. It may go by the name curriculum, program, or library.
- A **product** is an individual course, book, manual, or Website.
- A **cluster** is an organized group of related pages or smaller clusters. In a book, the cluster is called a chapter. Within a course it is a lesson. In a stage play, the cluster might be an act.
- A **page** is the smallest unit that completely accomplishes a significant information or education goal. It is not limited to a single, physical page but may consist of any single explanation, activity, practice, or presentation.
- **Content modules** are media components that contribute to the goal of a page.

Identify units of knowledge products

Let's see how to apply these levels in the real world. Can you identify the various units of knowledge products? Try matching each example on the left with its level on the right.

Match the **example** with its **level**.

"Accounting 101"	**Collection**
"Evaluating assets"	**Product**
MBA program	**Cluster**
Sample spreadsheet	**Page**
"Assets"	**Content module**

Let's take them one at a time. "Accounting 101" sounds like a complete course, which of course, is a product. "Evaluating assets" sounds like a lesson or smaller unit within that course. To decide, we might scan the list and see the broader category "Assets." So, "Evaluating assets" is probably just a page and the other one is the lesson. The MBA program would be made up of several courses, each of which is a knowledge product in its own right. So, the program must be a collection. The sample spreadsheet is definitely not a complete unit in itself, so it is probably a content module within a page. The final item "Assets" is a lesson, as we decided earlier. Since lessons are clusters, "Assets" is a cluster.

What are these units?

To make sure you understand these terms, take a couple of minutes to identify these units as they apply to a knowledge product you are planning or developing.

Collection	*Suite of courses on project management (someday)*
Product	*Course: Reading Gantt Charts*
Cluster	*Lessons within the course*
Page	*Individual pages within each lesson*
Content module	*Animated explanations, blocks of text, test questions*

For the project of developing a Web-based course on reading Gantt charts, here's what the units involved.

■ The collection level consisted of a suite of courses of project management that the client hoped to build someday soon. Our project did not extend to this level.

- At the product level was the whole course we were developing.
- Clusters were the five to seven lessons we envisioned in the course.
- Pages represented the individual Web pages that the learner would see in the course.
- Content modules were the animated explanations, blocks of text, test questions, and pictures that would appear on those pages.

Two parts of the solution

In developing knowledge products, it is worthwhile to remember that any knowledge solution has two parts.
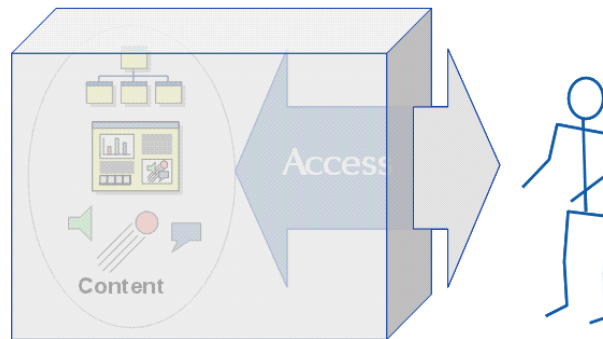
Solution = content + access to that content

One part is the obvious content: the clusters, pages, and content modules that make up the content of the product. The other part of the solution is access to that content. Access may be along a chain of hypertext links, by a menu, through an alphabetical index, or by other mechanisms. Just remember the formula: A knowledge product solution consists of both content and access to that content. Without access, that content is of no effect.

BUSINESS ISSUES

Before you go too far on any project, take a few moments to meet with the client or sponsor and work out a few, very important business details, such as who is paying the bills for the project and what you must do to get that money.

Agree on business details first

Right at the top of our **Project** form, which you fill out at the start of any project, are some questions you should answer before proceeding.
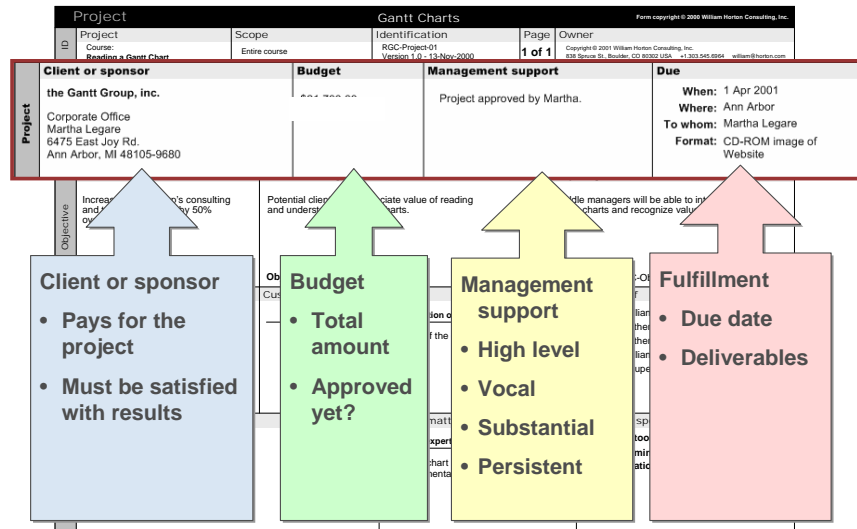
First, who exactly is the client or sponsor? Who is putting up the money for this project and who must be satisfied with the results? Are they the same? Is the client or sponsor an individual or a group? Make sure you know the ultimate authority on the project.

Second, what is the budget for the project? What is the total amount of money available? And how much of that money has been approved and allocated? That is, how much can the person chartering the project authorize?

Third, what degree of management support can you expect? Ideally, management support should come from high executive levels, should be vocal and public, should prove substantial in resources granted and effort expended, and should persist for the length of the project. Is top management's support limited to sending out an e-mail message announcing the project, or will they make personnel and other resources freely available to you?

Finally, how will you achieve fulfillment of the project? Exactly when are the results due? And to whom? And what exactly is it you must deliver? Will the client be satisfied with a CD-ROM full of media, or are they expecting a ten percent improvement in productivity? Make sure expectations are clear on both sides.

THE DEVELOPMENT TEAM

What people do you need on your team? And who should make which decisions? Although the exact mix of skills and abilities will vary, we can identify the main groups of people necessary for a successful project.

Assemble a multitalented team

Any endeavor as complex as developing knowledge products will require a rich mix of talents, skills, knowledge, and instincts. Here are the main groups we have found necessary to pull off such a complex project.

First, you need a manager, someone with a big-picture view of the project. The manager makes the hard decisions, keeps the project on schedule and to budget, and oversees the work of the rest of the team—in short, a traditional project manager.

Next, you must involve the actual consumers of the knowledge product, too. Although it is seldom practical to have large numbers of consumers directly involved in the development, you can at least have representatives of two main types of consumers: those who buy the product and those who will use it. Keep in mind that these two groups of consumers may have different viewpoints and conflicting goals. The buyer may want an inexpensive knowledge product that boosts workplace productivity while the user just wants it to be fun.

Every project needs a lead designer, typically an instructional designer for learning products or an information architect for information products. The lead designer may have assistants and may delegate some design decisions. The lead designer listens carefully to the needs of consumers. But, the lead designer makes all major design decisions. Committee design seldom works for knowledge products.

To realize the designer's vision, builders must construct the knowledge product. Builders include writers, multimedia developers, and technology experts. The exact mix will depend on the design as specified by the designer.

Who controls at each level?

Picking the right people for your team is important. Just as important, however, is deciding what part of the project each group should control.
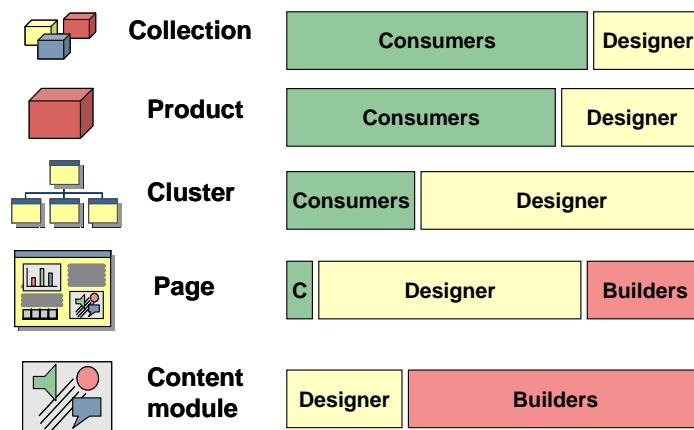
Typically, at the level of the collection, consumers are in control with assistance from the designer. At this level, consumers are either picking from available

knowledge products or specifying their high-level requirements. At this level, the designer can only listen carefully, take good notes, and ask probing questions.

At the level of the product, the role of the designer is stronger, but not dominant. At the product level, it is the consumers who must articulate their needs, concerns, and constraints. The designer will be active in eliciting this information and in helping consumers imagine what the knowledge product could accomplish for them.

Below the level of the product, the designer moves to the fore. The designer sketches out high-level components, such as individual lessons or chapters. The designer may even construct a simple model or prototype for the consumers to review and consider.

At the level of the individual page, the designer is still in control, though the involvement of the consumer has largely faded to that of Okaying the resulting pages. At the level of the page, the builders may be quite active, especially if constructing pages requires specialized knowledge of a technology, tool, or coding language.

At the content-module level, the builders are in control. Working from specifications provided by the designer, builders take considerable responsibility for executing the design. Work at this level requires esoteric knowledge of multimedia authoring tools, file formats, and technical standards. The designer will still ensure that the resulting content modules meet specified requirements; however, the designer will seldom actually create them.

In summary, at the highest levels, consumers make most of the decisions. Designers call the shots at middle levels. And, at the bottom, builders do the hands-on work.

When are team members involved?

The influence of various team members will vary during the phases of development. Let's look at when we would expect each part of the team to be most active. Let's look at the four phases (analyze, design, build, and evaluate) and the team members (consumers, designers, and builders) to see who controls during each phase.
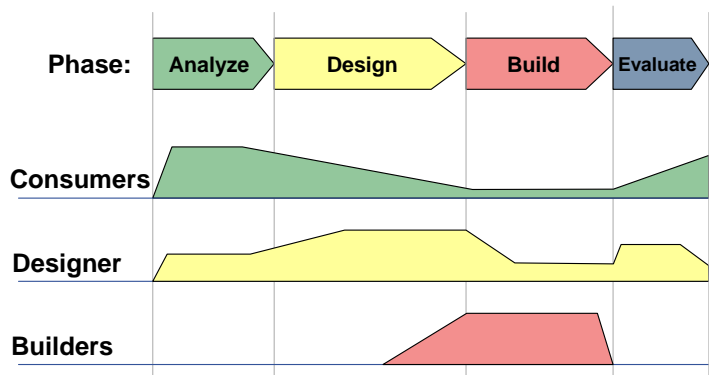
Looking at the profile of consumers' activity, you notice that they are highly active during the analysis phase, but their activity trails off during the design phase, especially as design focuses on smaller units such as individual pages. During the build phase, consumers are not very active at all and become highly involved only during the evaluation process, where they test and comment on the resulting knowledge product.

The designer's profile shows a different pattern. It should come as no surprise that the designer is most active during the design phase and somewhat active during the Analyze and Evaluate phases. Problems can often occur when the designer is too active during non-design activities. For instance, the designer can disrupt a project by dominating analysis, second guessing builders, or defending the design during evaluation.

Builders are most effective when their activity ramps up during the later phases of design and down at the end of the build phase. Involving builders too early can be counter productive. Until the design is well along, it is hard to know what skills builders will be need. Involving builders too early can warp the design to feature capabilities that the builders are strongest at providing rather than the ones consumers really need.

To recap, during analysis the consumer is most active, with help from the designer. During design, the consumer's influence wanes as the designer takes over, and builders join in for detailed design consultation. During the build phase, builders dominate while consumers and designers monitor progress. Finally, during evaluation, designers set up the evaluation process but consumers make evaluation decisions.

Who are the people you need?

Who are the people you need on your project? Take a few minutes to identify tentatively the manager, customers, designer, and builders for your project.

p   p

Manager   *Katherine Horton*

Consumers   *Martha, CEO of Gantt Group*

Designer   *William Horton*

Builders   *Katherine Horton*

For the project of designing a course on reading Gantt Charts, the project manager was Katherine Horton. The customers were represented by Kelly and Martha, owners of the Gantt Group consulting firm. They were the buyers of the course and also represented the learners who would be taking the course. The

designer was William Horton. Builders included Katherine Horton, who created the necessary HTML pages, JavaScript files, and Flash animations.

What can you let others do?

Developing knowledge products is a complex and expensive business. Some organizations choose to do it all themselves. They analyze, design, build, and evaluate their own knowledge products. Many other organizations, especially smaller companies and departments, find they can be more effective by hiring others to do parts of the development. Although all development could be farmed out, some phases are more commonly handed over to outside organizations.
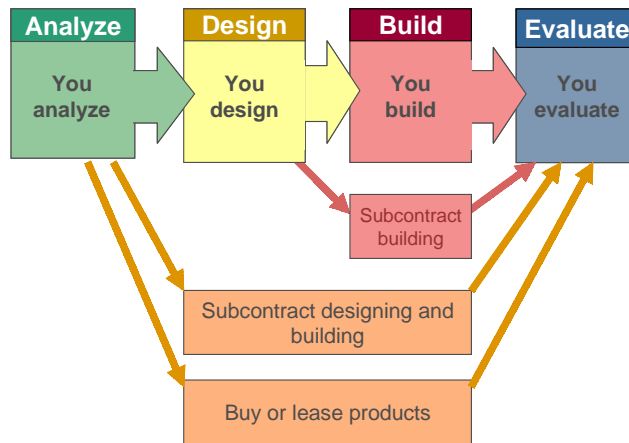
One common option is to subcontract the building of the course to a firm specializing in multimedia or Website construction. This relieves you of having to maintain a staff of technical specialists. It also lets you pick the firm whose capabilities match precisely the design you have created.

Another common approach is to subcontract both the design and build phases. In this approach, you turn to a systems integrator or consultant to deliver a turn-key solution. By subcontracting both design and building, you keep your focus entirely on results and away from the details of how those results are to be achieved. These advantages come at the cost: a loss of control over the details of the result.

Instead of subcontracting the design and build phases, you may choose to buy or lease existing courses or other knowledge products from an applications service provider (ASP) or a portal. This approach works well when your training needs can be met by generic courses.

Whichever approach you take, you will almost certainly need to be involved in the analysis phase which sets the objectives for your project and the evaluation phase that determines whether they were met. These phases concern the intimate needs of your organization and are not efficiently performed by outsiders.

Record your team and resources

Once you have decided upon your team members, record and announce that decision. It is important that you document and clearly communicate such decisions.

Project		Gantt Charts			Form copyright © 2000 William Horton Consulting, Inc.

	Project	Scope	Identification	Page	Owner
ID	Course: **Reading a Gantt Chart**	Entire course	RGC-Project-01 Version 1.0 – 13-Nov-2000	**1 of 1**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6984 william@horton.com

	Client or sponsor	Budget	Management support	Due
Project	**the Gantt Group, inc.** Corporate Office Martha Legare 6475 East Joy Rd. Ann Arbor, MI 48105-9680		Project approved by Martha.	**When:** 1 Apr 2001 **Where:** Ann Arbor **To whom:** Martha Legare **Format:** CD-ROM image of Website

	Business goal	Performance goal	Project goal
Objective	Increase Gantt Group's consulting and training revenues by 50% over the next two years.	Potential clients will appreciate value of reading and understanding Gantt Charts.	Middle managers will be able to interpret Gantt charts and recognize value in using them.

	Designer	Customer representatives		Production staff
Team	William Horton Katherine Horton	**Person** Martha Legare	**Position or expertise** CEO of the corporation	**Writing:** William Horton **Illustrating:** Katherine Horton & Kandyba **Animation:** Katherine Horton **Video:** William Horton **Sound:** Coupe Studio

	Knowledge assets	Subject-matter experts		Technical specialists
Resources	**Slides:** None **Handouts:** Class notes **Video or audio:** **Documents:** **Others:**	**Area of expertise** Gantt chart fundementals	**Person or group** Martha Legare William Horton	**Authoring tools:** Katherine Horton **Programming:** William Horton **Integration:** Katherine Horton

This form is at available at www.designingwbt.com/html/designforms.htm.

This example shows where we have entered the identity of team members on the Project form. We will discuss how other decisions are entered on this form later. It is not important that you use a form exactly like this one. It is important, however, that responsibilities and participation is agreed upon at the beginning of the project.

ANALYZE

Know where you are going before you plot your course

The natural tendency is to immediately jump in and start designing and building things without first analyzing the situation that gave rise to the project. This tendency is especially common when there are tight deadlines. However, without this up-front analysis, a project lacks the clear, concise objectives needed to guide it to a successful conclusion. In short, you have to know where you are going before you plot your course.

Fear that analysis will take too long is usually unfounded. A good analysis saves more time and money than it costs. A thorough analysis reduces errors and rework, targets activities more precisely, and gives everyone on the project a common goal to work toward.

Overview of the analysis process

The analysis process follows a zigzag path from vague business needs to precise project objectives. The first step, one often omitted until the project is too far off track, over budget, and behind schedule, is to record the business goals that gave rise to the project. Such goals are by nature vague, specifying benefits to the organization but not prescribing an exact solution.
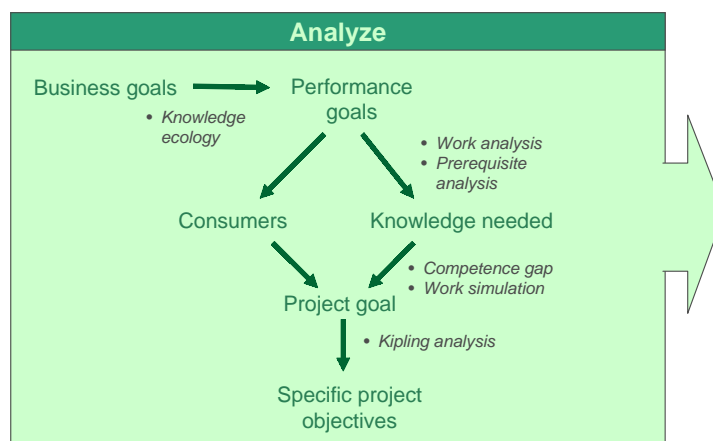
From the business goals, you can often derive performance goals. These goals specify activities that people must perform in order to meet the business

objectives. Once you have your performance goals, you can proceed to identify your knowledge consumers. An in-depth analysis of your knowledge consumers will be critical to the design decisions you make later. At the same time you will need to identify the knowledge needed by these consumers to achieve the performance goals. Providing the needed knowledge to the consumers becomes the goal of your project. To accomplish this goal, though, may require elaborating it to derive very specific project objectives.

It is important to realize that meeting all the performance goals may require other solutions as well. It is good to explicitly recognize these other solutions, especially if the success of your project depends on these other solutions being in place.

To accomplish this analysis, you may employ several specialized techniques. To derive performance goals and state them clearly, you may use a technique called knowledge ecology, which traces the flows of knowledge, information, and control in both the current situation and the desired one. To identify the knowledge needed to meet these performance goals, you may use techniques of work analysis and prerequisite analysis, both of which reveal the specific components of knowledge needed to perform work. To define what knowledge must be conveyed to consumers, we may use techniques of competence gap analysis and work simulation. Competence gap analysis attempts to identify the difference between what people need to know and what they already know. Work simulation actually measures this difference by observing people performing work. To set precise project objectives and state them clearly, we may use Kipling analysis, which prompts us to ask who, what, where, when, why, and how people must perform.

Cascade of goals

A knowledge product may have several direct and indirect goals. For success, a knowledge product should be able to trace its goal back to valuable and recognized business goals. One reason that many projects cannot do this is that they begin without a clear analysis of the cascade of goals that lead to the project in the first place. Let's look at this cascade of dependent goals in more detail. We will see its mirror image when we talk about how to do level 4 evaluations.

First are the business goals. These state what the organization wants to accomplish. Business goals are usually stated in economic term, such as the profit

the company wants to make, costs it wants to cut, the market share it hopes to achieve, or the return it promises its stockholders.

Next come the performance goals, which state what must happen for the business goals to be met. Performance goals concern people and what they must do. These people may be inside the organization (employees) and outside the organization (customers). Performance goals specify exactly what actions they must take or what behaviors they must change.

The third tier in our cascade contains the project goal. The project goal specifies what the knowledge object must accomplish. For example, the project goal for a training course is achieved by the learning objectives. A project goal can include the skills, abilities, concepts, attitudes, and beliefs the knowledge product is to convey. It is important to remember that your project may not be the only one aimed at accomplishing the performance goals. Other initiatives may be striving to accomplish or assist in accomplishing the same performance goals as your project. You must be aware of these projects and what they will contribute.

A fourth level of goals is often added, even if just in the minds of the creators of the project. These goals concern how users of the knowledge product will respond. Will they like it? Will they enjoy using it? Though useful for marketing purposes, such goals are secondary in importance. These are superficial responses that have much less effect on the long-term success of the product than higher-level goals.

DERIVE PERFORMANCE GOALS FROM BUSINESS GOALS

Successful projects start with worthy business goals. Such business goals guide decision making at all levels. Adherence to such goals helps build support for the project and win it the budget and other resources it requires. So, before formulating the performance goals for your project, answer this question: "Why should your organization invest in your project?"

In many cases, you may not be involved in a project until after its performance goals have been set. Ascertaining its underlying business goals may be more a matter of corporate archaeology than forward planning. Nevertheless, knowing the business goals is essential to proceeding on a project.

Examine the knowledge ecology

Crafting complex knowledge solutions is seldom simple. This is especially true when the solution must span the knowledge needed and shared by many people within several different organizations.

One form of analysis can help us pinpoint the performance changes necessary to accomplish a business goal. This analysis method is called knowledge ecology and it analyzes the flow of knowledge within an organization or a population.

Knowledge ecology can, for example, analyze both direct and indirect flows of information among different departments or between an organization and various groups of its customers.

Tie your project to business goals

Let's see how the goal for a knowledge project can derive from a business goal and how other goals may be involved as well.

We were asked to develop a course for the Gantt Group on reading Gantt charts. We started by interviewing our client to learn the underlying business reasons for developing such a course. They told us that their business goal was to increase their consulting and training revenues by 50 percent over the next couple of years.
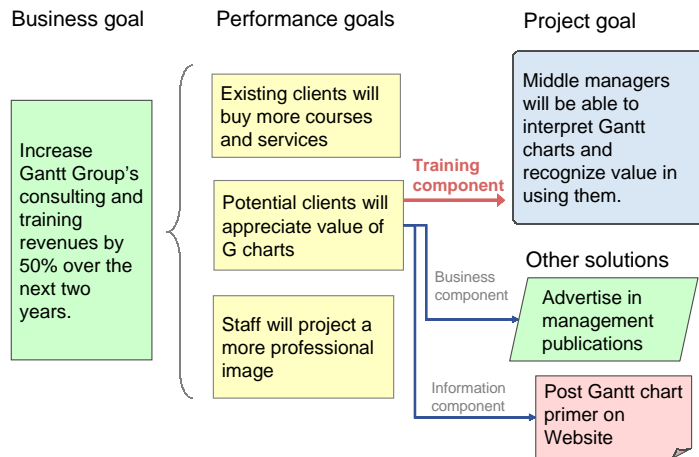
To that end, they had identified three things that must happen. Though they did not identify them as such, these three intermediate goals were performance goals. The first was that existing clients would buy more of the Gantt Group's classroom courses and consulting services. The second performance goal was that potential clients would appreciate the value of Gantt charts to them in their business and thereby see the value in the kinds of training and services offered by the Gantt group. It was this goal that gave rise to our project.

A third performance goal was that the staff of the Gantt group project a more professional image.

All three performance goals had their own initiatives for accomplishing them. We will look at the initiatives for the second goal. The first initiative was our project. Its goal was to teach middle managers to interpret Gantt charts and recognize the value in using them. This was the training component of meeting the performance goal.

Other solutions were to be pursued in parallel with our project. These included advertising in management publications (a business component) and posting a primer on Gantt charts on the Website of the Gantt Group (an information component).

This kind of analysis can reveal what your project is to accomplish and how it fits into a matrix of related efforts.

Derive your goals

Now, take a few minutes to spell out the goals for your project and how they depend on other related goals.

For your project spell out your goals:

Business goal	Performance goals	Project goal
What does the business want to accomplish?	To meet the business goal, who must do what?	What must your project accomplish?

Other solutions
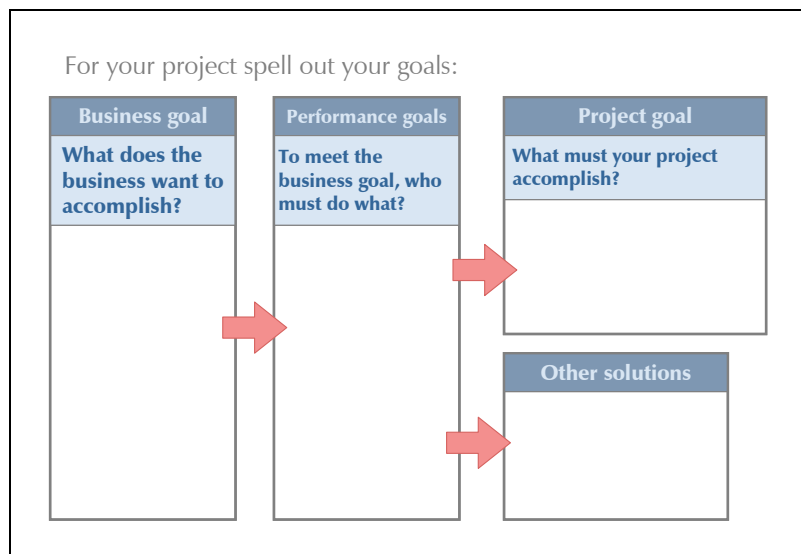
1. First, list your main business goal. What does the business want to accomplish?

2. Next, derive the performance goals necessary to accomplish that business goal. Who must do what in order for the organization to meet the business goal?

3. Pick the one performance goal that your project aims to accomplish.

4. Next, set the project goal for your knowledge product. What must it do? What must it teach or communicate? To whom?

5. Finally, list other solutions necessary to accomplish the performance goal you have chosen.

Record your goals

Once you have agreed upon the business, performance, and project goals as they apply to your effort, record them and communicate them to everyone working on the project. We like to enter them directly on the **Project** form, which serves as the charter for the overall project.

This form is available from: www.designingwbt.com/html/designforms.htm.

Notice that the slots for performance and project goals have entries for an Objectives specification form, which elaborates these goals in more detail. We will talk more about this form later.

LEARN ABOUT CONSUMERS

On any project, you must know about your consumers in great detail. It is hard to know too much about the people who will be using your knowledge product.

Why use your knowledge product?

One of the first questions you must ask is: "Why consumers will consumers buy and use my knowledge product?" What is their motivation?

■ Is it to maintain the skills and knowledge they apply in their current job?

- Do they use your knowledge product because they have been ordered to by their supervisor or manager? For example, were they enrolled in your class by the boss of their department?

- Is their goal to qualify for promotion or a new job?

- Are they preparing for a certification test, such as that for technicians who install Cisco hardware or Microsoft software?

- Do they hope to make more money in their current job, for instance, by increased sales commissions from higher margin products?

- Or, are their goals less specific? Are they interested in general self-improvement?

- Are they just curious?

- Is there some other goal?

For the course on reading Gantt charts, we estimated that the primary goal was maintaining current job skills. This goal applied to 50% of the learners. Other goals included qualifying for promotion (20%), general self-improvement (10%), and curiosity (20%).

Two more questions of importance are: "Will consumers be paid for the time they spend taking your knowledge product?" and "How much of the cost of the knowledge product be paid by the individual users rather than by their organizations?"

The answers to all these questions will give you a good idea of how much explicit motivation you must build into your product and how to make that motivation work for your consumers.

Where will your knowledge product be used?

Another question to ask is where consumers will use the knowledge product? This is not always the same place as where they will apply the knowledge.

Will they use it in a private office, in a public cubicle, on a noisy factory floor, in a corporate training center, from a hotel room while traveling, from a home

computer, or from some other location? Each environment implies different levels of noise, interruptions, and access to other resources.

In our example, we believed that most of our consumers would take the course from a private office (50%) or a cubicle (30%). A few would take it from a hotel while traveling (5%) and the balance would take it from home (15%). Where will your consumers use your knowledge product?

Once you identify where consumers will use your knowledge product, investigate further to identify what type of computer they will use. Specifically, what processor, memory, operating system, display, sound system, and connection speed will it have? For our example, we assumed a Pentium II processor running at 366 megahertz, 48 megabytes of RAM, Windows 2000 operating system, a 1024 by 768 pixel display showing thousands of colors, a 16-bit stereo sound system, and a 100 Kbps speed Internet connection.

How geographically distributed?

Another critical factor is how geographically distributed are the consumers of your knowledge product. Are they all in one corporate office or on one campus so that convening requires just a short walk? Or, are they scattered across a metropolitan area, where they must drive an hour or so to get together? Are they distributed over 1 to 4 time zones, where online meetings would be practical? Or, are they distributed over 5 to 24 time zones, where even online meetings would prove difficult to schedule?

In our example case, we estimated that 60% of our consumers will be within 1 to 4 time zones of one another. The rest will be scattered around the globe.

When will they use your knowledge product?

Before you design your knowledge product, you need to know when consumers will use it. Will they use it at times specifically set aside for learning during the work day? Or, must they sandwich using your knowledge product among daily work activities? Will they use it from home during the evenings and weekends? Or, take it some other time?

When will consumers use the knowledge product?

❏ At times specifically set aside for learning during the workday

☑ Sandwiched in among normal work activities *85%*

☑ Evenings *5%*

☑ Weekends *10%*

❏ Other: _____

For our example case, we estimated that 85% of our consumers would have to fit the course into their busy work schedules. The rest would take it in the evenings (5%) and on weekends (10%).

What are their computer skills?

For electronic knowledge products, it is important to know what computer skills your consumers possess. A knowledge product that requires users to learn many new skills is likely to face resistance. So, ask how advanced are consumer's computer skills? Can they perform simple operations like sending and receiving e-mail, browsing the Web, and operating a word-processor or other common desktop application? Can they use collaboration tools, such as newsgroups and discussion forums or chat and instant messaging? How advanced are their technical skills? Can they download and install software by themselves? Can they write macros or scripts to automate operation? Or are they accomplished programmers in languages like Java, C++, or Visual Basic? In our example case, potential learners were skilled at only the first four activities listed. How about for your situation?

How advanced are consumers' computer skills? Can they:

- ☑ Send and receive e-mail
- ☑ Browse the Web
- ☑ Operate a word-processor
- ☑ Operate other desktop applications
- ❑ Contribute to newsgroups and discussion forums
- ❑ Use chat and instant messaging
- ❑ Download and install software
- ❑ Write macros and scripts
- ❑ Program in Java, C++, Visual Basic, etc.

> How fast and accurately can they type? What is their typing speed for "e-mail quality" messages: ___15___ words per minute

If your product requires users to type in information, you may want to learn how fast your users can type. For example, what is their typing speed for e-mail quality messages, which tolerate minor typos and misspellings? In our case we felt that consumers were fairly rapid typists averaging about 15 words per minute.

What are their language skills?

Language skills are crucial for the consumers of any knowledge product that displays text or speaks words aloud. How well can your consumers use the language of your knowledge product to understand and communicate? We have found it helpful to consider four different language skills: reading displayed text, listen to spoken words, writing text, and speaking aloud. For each of these skills, you should rate the proficiency of your consumers. Proficiency can be at significantly different levels for the different skills, especially if many of your learners speak the language of your knowledge product as a second language.

How well can consumers use language to understand and communicate?

Skill	Proficiency
Reading	10th grade level
Listening	9th grade level
Writing	10th grade level
Speaking	10th grade level

> What fraction of consumers speak your language as a second language? ___25___ %

In our case, we believed that consumers would read at a U.S. 10th grade level, sufficient for basic business terminology. They would not, however, have an advanced vocabulary or be able to parse complex sentences.

We also believed that a significant percentage of our consumers would have English as a second language. Therefore, we estimated listening skills would be a bit lower than reading skills; say at a 9th grade level.

We estimated that writing and speaking skills would be at a 10th grade level.

An important note to add is the percentage of consumers who speak your knowledge product's language as a second language. In our example case, we estimated one quarter of learners to speak English as a second language.

Estimating your consumers' skill levels will guide your use of language and choice of media.

Analyze consumers thoroughly

Consumers		Gantt chart readers			Form copyright © 2001 William Horton Consulting, Inc.

ID

Project	Scope	Identification	Page	Owner
Course: **Reading Gantt Charts**	Just this course	RGC-Consumers-01 Version 1.1 - 20-Mar-2001	**1 of 1**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Consumers

Description	Job function	Demographics	Related specifications
Middle and upper managers who need to read and interpret Gantt charts. Typically supervise those who actually construct the Gantt charts. **Size:** 100%	General management duties, including management of complex projects **Time value:** ___$100K___ **per** ___year___	**Age range:** 85% are 30-60 **Gender mix:** 60% male **Education level:** 60% B-degree **Nationality:** 60% US, Canada? **First language:** 60% English	Technology: RGC-Technology-01 Other consumers: RGC-Consumers-XX

Goals

What do they hope to gain?	Why do they use your knowledge product?		Financial involvement
Learn to interpret Gantt charts, especially how to use them to make better decisions regarding the scheduling and supervision of complex projects	☒ To accomplish current job 65% ☐ Because ordered to by the boss ☒ To qualify for promotion or new job 20% ☐ To pass certification test	☐ To make more money ☒ Curiosity & self-improvement 15% ☐ Other:	☒ Consumers are paid for the time they spend learning Costs they pay themselves: None, unless self-employed

When and where

When will they use this k-product?	Where will they use it?	Geographic distribution	Environment
☐ At times set aside for learning ☒ During normal work activities ☒ Evenings 5% ☒ Weekends 10% ☐ Other: 85%	☒ Private office 50% ☒ Cubicle 30% ☐ Factory floor ☐ Corporate training center ☒ Hotel 5% ☒ Home 15% ☐ Other:	☐ All in one corporate office ☐ All on one campus ☐ All in one metropolitan area ☒ All in one country: _____ 60% ☒ Globally distributed over: __24__ time zones 40%	**Space:** No room for more than one piece of paper beside the computer. **Lighting:** OK **Noise and interruptions:** Normal office noise with frequent interruptions (every 10 minutes or so)

Abilities

Computer skills	Communications skills	Experience	Special concerns
☒ Send and receive e-mail ☒ Browse the Web ☒ Operate a word processor ☒ Operate other desktop applications ☐ Contribute to discussion groups ☐ Use chat and instant messaging ☐ Download and install software ☐ Write macros and scripts ☐ Program in a high-level language	**Language** **Reading:** 10th grade level **Listening:** 9th grade level **Writing:** 10th grade level **Speaking:** 10th grade level **Typing** **E-mail quality:** __15__ words/min **Letter quality:** __10__ words/min	85% of the target managers have seen Gantt charts, understand that they show project schedules, and perhaps recognize task bars. **Training** The target managers have had no training in reading or constructing Gantt charts.	**Blindness:** __0__ % legally blind **Visual acuity:** __20__ % < 20/20 corrected **Color blindness:** __6__ % Red-Green **No hearing:** __1__ % Deaf **Limited hearing:** __4__ % need amplification **Motor control:** __3__ % lack fine control **Limited speech:** __0__ % mute **Other:** Note: This course is not required to comply with Amer. with Diabilities Act.

This form is available from: www.designingwbt.com/html/designforms.htm.

Continue researching consumers and recording information about them. Use the **Consumers** form to record your profile. Share this profile with everyone on the project. You will be surprised how many arguments it settles.

IDENTIFY THE KNOWLEDGE NEEDED

Before we can design any knowledge product, we must identify the specific knowledge it is to convey to consumers. What facts, concepts, skills, beliefs, and attitudes do consumers need?

Work analysis

Work analysis is a technique for understanding the nature of work and the types of knowledge required to perform it. Work analysis views work as a hierarchy of goals, each requiring workers to complete jobs, which are made up of specific tasks, which are mixtures of decisions and actions. Three kinds of knowledge are required: strategic, procedural, and conceptual.
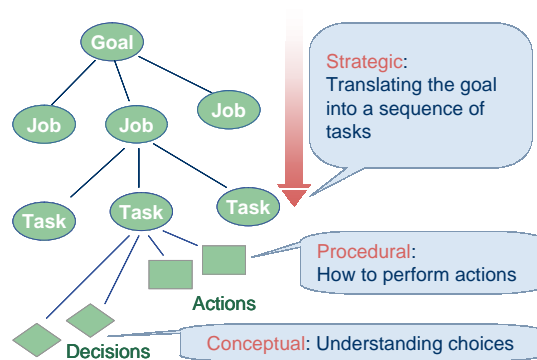
Strategic knowledge is necessary to translate the goal into a sequence of tasks. At the task level, workers need procedural knowledge to be able to perform the steps of required tasks. And to make the necessary decisions about what actions to take, workers need conceptual knowledge to understand the choices they must make.

Prerequisite analysis

In prerequisite analysis, you ask three simple questions:
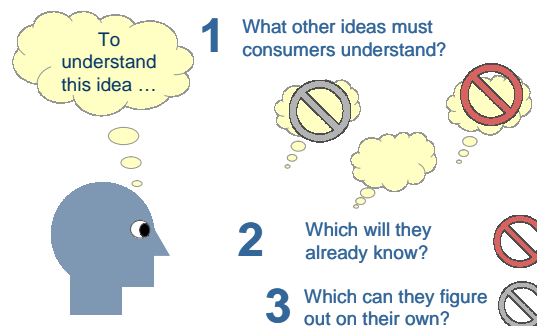
1. For each idea the consumer must understand, what other ideas must the consumer understand? These are the prerequisite ideas.

2. Next, which of these prerequisite ideas does the consumer already know? These you do not need to include in our knowledge product.

3. Finally, which prerequisite ideas can consumers figure out on their own? These you may want to omit as well. Or, you may want to provide guidance in figuring them out.

Repeat prerequisite analysis on each idea uncovered until you have identified all the necessary ideas.

STATE YOUR PROJECT GOAL

Now you are ready to state your project goal. The project goal summarizes what the knowledge product must accomplish.

Chart the competence gap

You have analyzed the consumers who will use your knowledge products. You have determined what they should know to do their work. Now you must identify what knowledge consumers lack that prevents them from performing that work. To help you determine that knowledge, you chart the competence gap.

Compentence gap

Technical supervisors	Level of expertise		
Area of expertise	Needed	Current	Gap
Recruiting	5	4	1
Budgeting	7	5	2
Scheduling	8	3	5
Motivating	5	3	2
Conflict resolution	6	5	1
Technical skill	5	8	-3
Supervising	7	5	2
Teamwork	10	8	2
Legal knowledge	4	2	2

Competence Gap radar chart with axes: Recruiting, Budgeting, Scheduling, Motivating, Conflict resolution, Technical skill, Supervising, Teamwork, Legal knowledge

Competence gap analysis analyzes the difference between what people should know and what they do know. Knowing the competence gap, we can set a precise goal for our project. Our knowledge product must enable consumers who have the initial levels of knowledge to obtain or function at the target levels. It must bridge the gap.

Observe simulated work

Another technique is to observe directly the knowledge needed to perform work. The technique for simulating work is quite simple. You give a typical worker an authentic task to perform and observe what knowledge they need to complete that task. For each point where the worker needs knowledge, you must decide how we will provide it in our knowledge product.

Set the general project goal

Once you know who must learn what, you are ready to state the general project goal.
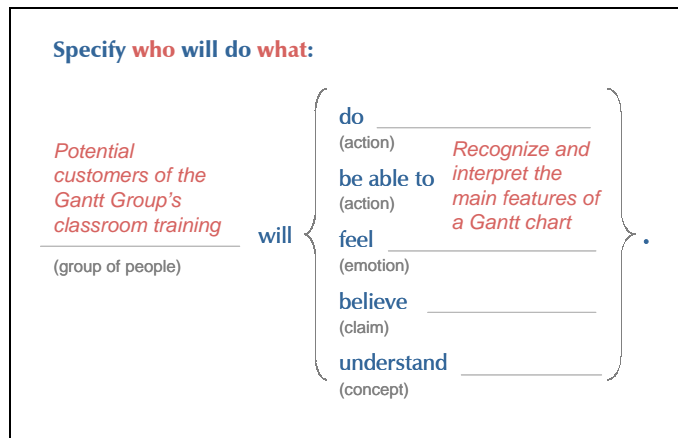
Here's a formula that works well in stating such goals. Specify what group of people will:

- ■ Do what action.
- ■ Or be able to do what action.
- ■ Or feel what emotion.
- ■ Or believe what claim.
- ■ Or understand what concept.

Just pick on of the alternatives and fill in the two blanks. For example, for the Gantt chart training project, our goal is that potential customers of the Gantt group's classroom training (the group of people) will be able to recognize and interpret the main features of a Gantt chart (the action).

Take a few minutes to fill in the blanks to specify a general goal for your project.

SET PROJECT OBJECTIVES

After a lot of analysis, you are ready to set project objectives. Project objectives state precisely what people must do differently. They form the underlying rationale of every knowledge project, every knowledge product, and every knowledge object. You provide knowledge in order that people will perform certain acts. By specifying those acts precisely, you can better target your efforts.

Turn goals into objectives

To turn a general goal into a precise objective, you must add specific criteria that help you know when the goal is met. In other words, an objective is a goal plus criteria that determine how it is met.

Objective =   Goal   +   Criteria

Objective =   Who + What   +   When + Where + How + Why

Under what circumstances?

In what environment? With what resources available?

By what method? How quickly, accurately, economically?

For what reasons?
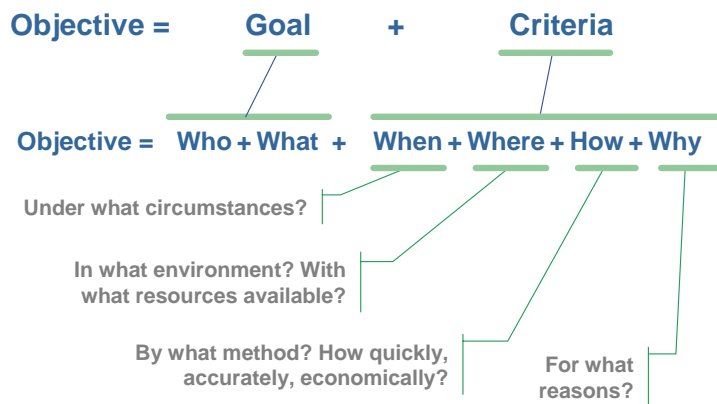
The goal specifies the *who* and *what*. That is, who must do what. To that, the criteria add four additional components: *when*, *where*, *how*, and *why*.

When asks under what circumstances the act is performed. *Where* asks in what environment it is performed and what resources are available there. *How* concerns the method by which the act is performed and how quickly, accurately, and economically it must be done. *Why* asks what will motivate the person to perform.

Just remember, an objective requires you to specify who must do what as well as when, where, how, and why they must do it.

Set clear project objectives

Take the time necessary to state clearly the project objectives necessary to meet the business goal behind your project. First write down the business goal. Next add the who, what, when, where, how, and why necessary to accomplish that objective.

For example, for the course on reading Gantt charts, the business goal was to increase sales of the Gantt group's seminars by making more managers appreciate the value of fully understanding Gantt charts.

Business goal	Increase sales of Gantt Group's seminars by making more managers appreciate value of fully understanding Gantt charts.				
Who	**What**	**When**	**Where**	**How**	**Why**
Business managers who need to use Gantt charts as part of their project management duties	Be able to read a conventional Gantt chart	Given a Gantt chart prepared by someone else, say an assistant or sub-contractor.	In the manager's office, in someone else's office, at a job site. No reference materials available.	85% will note crucial features and react to their significance.	To keep projects on schedule and within budget.

In this case, the *who* were business managers who had to use such charts as part of their jobs. The *what* was being able to read a conventional Gantt chart. *When* was at any time they were presented such a chart, typically one prepared by an assistant or sub-contractor on the project. *Where* could be in the manager's office, in someone else's office, or at a job site. We could not assume that reference materials would be available. For *how* we said that 85% of the managers would note critical features and react to their significance. *Why* stated that their motivation would be to keep projects on schedule and within budget.

Stress job performance

Here is a tip. In writing project objectives, avoid the trap of writing purely educational objectives. Although your goal may need education as a component, it is important to keep the end goal of performance clearly in mind.

Check to see if you are using too many words relating solely to education, words like recall, list, see, know, understand, and describe. Few people bounce out of bed excited about learning to recall, list, or describe things.

Educational objectives use words like:	Performance objectives use words like:
Recall	Do
List	Decide
See	Plan
Know	Manage
Understand	Complete
Describe	Create

Favor active words that stress performance, words like do, decide, plan, manage, complete, or create. Such words represent the kinds of actions that contribute directly to business goals.

Set your project objectives

Setting performance objectives is not a short, simple activity. But it is a worthwhile one. Take the time to specify the performance objectives necessary to accomplish your business goal. To that end, you may want to use the **Objectives** form.

Objectives					Gantt Chart			Form copyright © 2000 William Horton Consulting, Inc.

ID

Project		Scope		Identification		Page	Owner	
Course: Reading a Gantt Chart		Entire course		RGC-Objectives-01 Version 1.0 - 13-Nov-2000		1 of 1	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com	

Goal

This group of people	Will acomplish this business objective	To this degree
The Gantt Group principals ...	Will increase their revenues from training by...	50% over the previous year.

Objectives

Who? Group of people	What? Action or change required		When? Time or event	Where? Environment	How? Method or technique	Why? Motivation
Business managers with the ability to hire consultants ...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Hire the Gantt Group to train their team leaders in Project Management.	After reviewing the course and reading the Manager's Only section.	In their office.	By accessing the schedule and booking information located at the end of the course.	Because they are impressed with the quality of the course and the sound advice presented by Martha in the Managers Only section
Business managers who need to use Gantt charts as part of their project management duties ...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Hire the Gantt Group to train their team leaders in Project Management.	After taking the course.	In their their work environment.	By clicking the more information link at the end of the course and receiving a follow-up evaluation form.	Because they are impressed with the quality of instruction.
Project team members who are given Gantt charts to read...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Find that this course meets their needs and recommends more training to managers.	In the course of their work.	In their office.	By finding the course and taking it.	Because they enjoyed the learning experience and the approach to training.
Business managers who need to use Gantt charts as part of their project management duties ...	☐ do: ☐ be able to: ☒ believe: ☐ feel: ☐ understand:	That there is more to project management than reading Gantt charts and they need more training.	While taking the course.	In their office or at home.	By learning that the Gantt chart is the result of much preliminary research and looking at links to other training.	To better understand the processes of project management.
Individuals who wish to advance to management.	☐ do: ☒ be able to: ☐ believe: ☐ feel: ☐ understand:	Read a conventional Gantt chart, noting crucial features and reacting to their significance.	In the course of their training time.	In their office or at home.	By looking at the symbols on the chart.	To increase competency and get a higher paying job.

This form is available from: www.designingwbt.com/designforms.htm

CHARTER THE PROJECT

The last step of analysis is to actually charter the project. This is the point where you pull together all the information, agreements, compromises, and decisions of the analysis phase into a single written document that servers as the keystone for the project. The charter should cover the design issues as well as practical business matters like staff, budget, schedule, resources, and requirements.

Record the project charter

Project			Gantt Charts			Form copyright © 2000 William Horton Consulting, Inc.

ID

Project	Scope		Identification	Page	Owner
Course: **Reading a Gantt Chart**	Entire course		RGC-Project-01 Version 1.0 - 13-Nov-2000	**1 of 1**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Project

Client or sponsor	Budget	Management support	Due
the Gantt Group, inc. Corporate Office Martha Legare 6475 East Joy Rd. Ann Arbor, MI 48105-9680		Project approved by Martha.	**When:** 1 Apr 2001 **Where:** Ann Arbor **To whom:** Martha Legare **Format:** CD-ROM image of Website

Objective

Business goal	Performance goal	Project goal
Increase Gantt Group's consulting and training revenues by 50% over the next two years.	Potential clients will appreciate value of reading and understanding Gantt Charts.	Middle managers will be able to interpret Gantt charts and recognize value in using them.
	Objectives: RGC-Objectives-01	**Objectives:** RGC-Objectives-01

Team

Designer	Customer representatives		Production staff
William Horton Katherine Horton	**Person** Martha Legare	**Position or expertise** CEO of the corporation	**Writing:** William Horton **Illustrating:** Katherine Horton & Kandyba **Animation:** Katherine Horton **Video:** William Horton **Sound:** Coupe Studio

Resources

Knowledge assets	Subject-matter experts		Technical specialists
Slides: None **Handouts:** Class notes **Video or audio:** **Documents:** **Others:**	**Area of expertise** Gantt chart fundementals	**Person or group** Martha Legare William Horton	**Authoring tools:** Katherine Horton **Programming:** William Horton **Integration:** Katherine Horton

This form is available from: www.designingwbt.com/html/designforms.htm.

We use the **Project** form to record key details about the project, including its sponsor, its objective, and required human and financial resources. By the end of the project, this form is wrinkled, smudged, annotated, and almost worn out. It records the core assumptions that keep the project on track.

DESIGN

Specify the content and framework of your knowledge product in detail

Design is the second phase of developing knowledge products. In this phase, you use what you have learned in the analysis phase to specify the content of the knowledge product and the framework that will house and present that content.

Overview of the design process

The design process transforms the project objectives into detailed specifications for a knowledge product. The design process is not simple, but it is methodical and systematic. Starting with project objectives, you determine a knowledge strategy that will accomplish these objectives. One strategy might be to teach consumers conceptual information while another might be to enable them to look up specific facts. You can further clarify your strategy by deciding what kind of knowledge product (course, Help system, job-aid) can best accomplish your objectives.

With your strategy articulated, you can turn to the task of designing the required modules of content. Starting with a top-level module, we decompose it into progressively smaller modules. These modules are composed of compound knowledge objects, simple knowledge objects, and, at the lowest level, specific content modules.
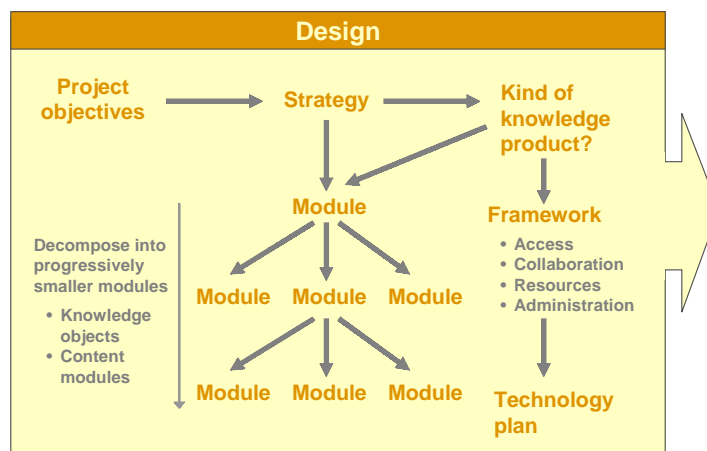
Along a parallel path, you specify the framework. You list the components of the framework, such as access mechanisms (menu, index, map), collaboration mechanisms (e-mail, discussion groups, chat), related resources (glossary, library), and administration tools (registration, billing, certification).

Once you have specified the framework and content modules, you can put together the technology plan that will describe the required hardware, network connection, and software needed.

Although some of these activities proceed in parallel, they are not independent. Decisions along one path will depend on choices made on the other paths. Successful projects have quite a bit of cross-talk among these parallel activities.

SELECT YOUR STRATEGY

The first step in design is to select a strategy. A strategy is a general approach or philosophy for accomplishing your project objectives. Having a clear strategy will allow a consistent, coherent product and foster an efficient and harmonious development process. In fact, it will simplify the whole development process by narrowing the range of choices for subsequent design decisions. Because a strategy can also constrain you, you must pick one carefully.

Popular knowledge strategies

Many strategies are possible, but four are especially popular. The four main strategies used for knowledge products are informational, behavioral, cognitive, and constructivist.

Informational	Behavioral	Cognitive	Constructivist
Help consumers find info when they need it	Reward and reinforce desired behaviors	Engineer transfer to long-term memory	Allow learners construct knowledge by discovery and exploration
Use for: • Just-in-time training • Rapidly changing knowledge • Incremental learning	Use for: • Overcoming instincts and habits • Component skills • Quick and reliable recall	Use for: • Well defined facts, concepts, principles, procedures, and processes • Other "hard" knowledge	Use for: • Higher-order skills • Problem-solving and decision-making skills • Learning to learn independently

In an informational strategy, you help consumers find information when they need it, rather than teaching it to them ahead of time. In a behavioral strategy, you teach by rewarding and reinforcing desired behaviors. A cognitive strategy relies on research in the psychology of learning to engineer transfer of

information to long-term memory. Constructivist strategies aim to help learners construct their own knowledge by discovery and exploration.

Where might you use each strategy? Informational strategies are especially well suited for just-in-time learning where learners look up facts and concepts just when they need them. This strategy is also good for rapidly changing knowledge where learning short-lived knowledge could be dangerous. It is also good for incremental learning to help consumers round out or top up their already substantial knowledge in a field.

A behavioral strategy is good for overcoming instincts and habits, through a process of sensitization or desensitization. This same strategy is good for learning component skills that must be applied without conscious attention as part of a higher level skill. It is also good for low-level facts and figures that must be recalled quickly and reliably.

Cognitive strategies work well for well-defined facts, concepts, principles, procedures, and processes. And for other "hard" knowledge that can be expressed in words, pictures, formulas, or other symbol systems.

Constructivist approaches seem to work best for higher-order skills. This strategy is frequently used to teach problem-solving and decision-making. One valuable aspect of constructivist approaches is that learners learn to learn on their own.

As you consider these strategies, just keep in mind that many treat them as religious faiths. Devotees of one strategy may find little value in other strategies. As a wise designer, though, you should pick your strategy as carefully and logically as you pick your tools and technologies.

PICK THE TYPE OF KNOWLEDGE PRODUCT

Your strategy will guide you in your next design decision: What kind of knowledge product will best accomplish my goal? Before picking one of the established or emerging types of knowledge products, take a few minutes to consider three characteristics that differentiate types of knowledge products.

Producer-led vs. consumer-led

One fundamental decision about your knowledge product is who leads. Is the knowledge product paced and directed by the producer or does the consumer decide the sequence of activities and set the pace? As with many design decisions, this is not an either-or decision. Options range along a spectrum from pure producer-led to pure learner-led products.
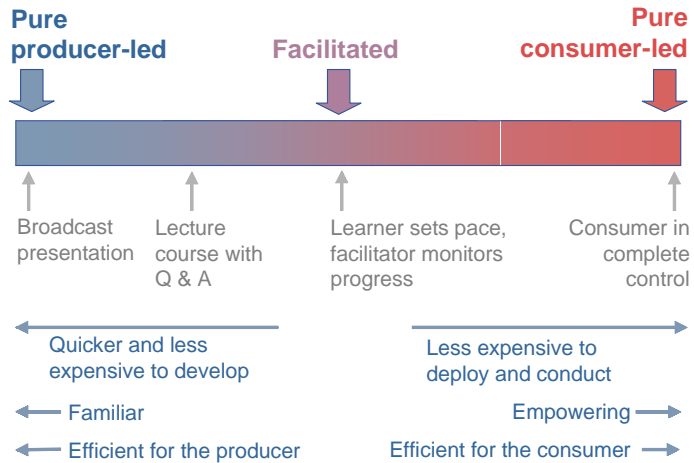
Only broadcast presentations are truly producer-led, with the producer totally controlling the content and pace while the consumer is completely passive. Standalone e-learning courses, at least traditional ones, are taught with no instructor. The consumer decides when to take the course, which activities to perform, and when to quit. Between these two extremes are several alternatives. A degree of consumer-leadership enters when lecture courses include question-and-answer activities. Some courses may have a designated instructor or facilitator who monitors the progress of individual learners as they proceed through the course at their own pace.

Which approach should you favor? Let's look at some advantages of moving one way or the other along this spectrum. Producer-led approaches are quicker and less expensive to develop, but consumer-led solutions are less expensive to deploy and conduct. Producer-led approaches, especially in the field of training, may seem more familiar to consumers. They certainly provide reassuring guidance. Consumer-led approaches can empower consumers to pursue their own goals. Producer-led approaches are efficient for the producer; consumer-led approaches are efficient for the consumer.

Synchronous vs. asynchronous

One of the most important design decisions is whether to make knowledge products and their activities synchronous or asynchronous. Unfortunately, no two terms cause more confusion than synchronous and asynchronous. One expert will call a knowledge product synchronous while another will call the same product asynchronous. This confusion masks an important design issue: Can consumers control when they interact with the knowledge product?

In a strict sense, the term synchronous means that everyone involved in an activity must perform their part at the same time. Such events are sometimes called real-time or live events. Such events include chat sessions, screen-sharing and whiteboard sessions, and videoconferences.

Asynchronous activities are ones that participants can experience whenever they want. Permanently posted Web pages and automatically scored tests are clearly asynchronous—consumers can read them at any time.

Synchronous — ± hours — ± days — **Asynchronous**

Everybody at same place in knowledge product

Everybody at different point in the product

On-the-job

Globally distributed consumers
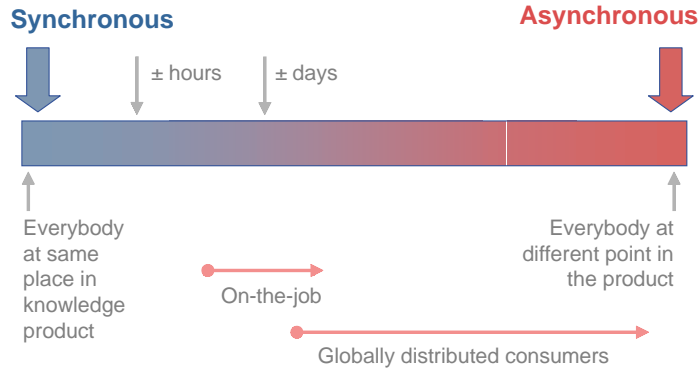
The problem with these definitions is the meaning of "at the same time." Some take it to mean within minutes or seconds, while others take it to mean a span of hours or days. Is an e-mail message answered in two days asynchronous or synchronous? How about a discussion group where learners can add to messages at any time but require checking every day or so to keep up with discussions?

Knowledge products are not purely synchronous or asynchronous. Knowledge products may be made up of a mix of activities and events that can be synchronous or asynchronous. Still other events and activities take place over a different period of time for each participant. Rather than considering synchronous and asynchronous as mutually exclusive terms, perhaps we should use a scale indicating how much latitude consumers have in completing activities.

Knowledge products considered synchronous probably include some activities and events that consumers can partake of at their own pace. An "asynchronous" course can still have deadlines, timed tests, and "respond immediately" messages.

Busy people must fit their use of knowledge products around meetings and other scheduled events. Such knowledge products can only be synchronous only within a few hours. If consumers are distributed around the globe, in many different time zones, in countries with different business and religious holidays, it will be difficult for participants to stay in synch closer than a day or two with one another.

Number of cohorts (Class size)

In a knowledge product, the term cohorts refers to the group of individuals with whom consumers can communicate and collaborate. In e-learning, cohorts are the class of students who are studying the same material together. Unlike physical meetings, the size of an online meeting or collaboration community is not constrained by physical architecture but by decisions of the course designer. Communities of ten thousand are technically feasible, though seldom wise.

Many　　　　　　　　　　　　　　　　　　**Solo**

1000s　　　　100　　　20　　10　　　　1

←— More economical　　　　　More customized —→

←— More social interaction　　　　More independence —→
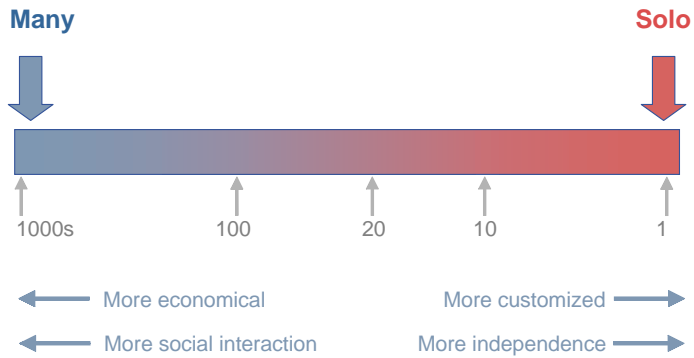
While larger groups are more economical, they provide consumers with less individual attention. The number of cohorts also affects the possibilities for collaboration. With very small numbers, most work must be done by individuals. With moderate numbers, say up to 30, the group as a whole can participate in activities. In larger groups, consumers must be divided into teams. Clearly the size affects the design of activities and other materials.

Make design decisions

Before you pick a specific type of knowledge product, take a few minutes to stake out positions along these scales. Then you can go looking for types of knowledge products that correspond to these positions. Answer three questions:

1. Should your knowledge product be producer-led, facilitated, or consumer-led?

2. Should it be synchronous, asynchronous, or somewhere in between?

3. How many cohorts will consumers interact with?

Let's look at the decisions we made on a recent project. Our goal was to teach middle-managers to read and interpret Gantt-style project-planning charts. Because the matter was factual, it employed a cognitive strategy. Our first decision was one of leadership. Because this course was to be offered for free by a small firm, which could not afford to provide instructors or even much facilitation, the course was put toward the consumer-led end of the scale. It was not put at the extreme position because the staff of the sponsor wanted to be available to field questions from consumers.

Producer-led　　　　Facilitated　　　　Consumer-led

Synchronous　　　　　　　　　　Asynchronous

Many cohorts　　　　　　　　　　　　Solo
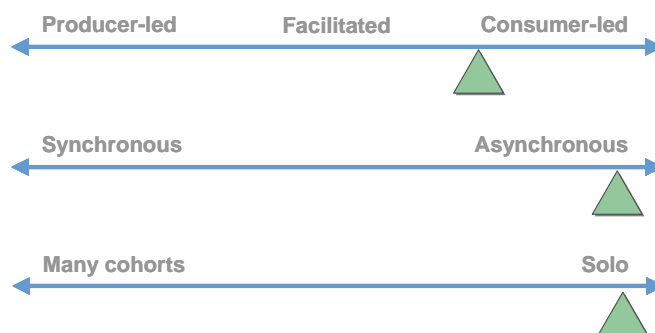
The course was made asynchronous because clients of the firm are distributed around the globe. The range of time zones and the number of inconsistent holidays made asynchronous events impractical.

The decision on cohorts was influenced by the previous decision. Because learners were so scattered and because initial enrollment would be relatively low, there was no reliable way to ensure that a core of learners would be at the same position within the course at the same time. And, because the material was primarily factual and procedural, the need for social interaction was not critical. Hence, the course was designed for solo learning. Eventually, though, we would like to add some collaboration features to support participants and alumni.

Common kinds of knowledge products

Now, you can pick the kind of knowledge product that best accomplishes your goal. Take a few minutes to consider whether one of the established or emerging kinds of knowledge products will suffice.

The advantages of picking an existing type are strong. They are more familiar to consumers. Producers understand these forms too. Tools are honed and workers trained to create these forms.

Pick one of these common types of knowledge products:

☐ Web-conducted class	☐ Online document
☐ Standalone e-learning	☐ Help facility
☐ Facilitated e-learning	☐ Job-aid
☐ Discussion group seminar	☐ Marketing Website
☐ Guided tour	☐ Support Website
☐ Telementoring program	☐ Informational Website
☐ Online community	☐ Electronic performance support sys.

Some established kinds of knowledge products include various forms of e-learning, such as Web-conducted classroom classes, standalone e-learning courses, facilitated e-learning courses, discussion-group seminars, guided tours, and telementoring programs. Other kinds of knowledge products include online communities, online documents, Help facilities, online job-aids, marketing Websites, product-support Websites, informational Websites, and electronic performance support systems. If one of these forms will meet your goals, pick it.

As you consider each of these types, think of how its characteristics match the ideal characteristics you specified earlier.

Keep in mind that you may need to integrate multiple types into a coherent solution. Or, you may have to invent a new solution. It would be silly to think that all the forms of knowledge products have been invented already.

SPECIFY KNOWLEDGE OBJECTS

Let's step through the design process for specifying knowledge objects. Along the way you will see how to turn objectives into prescriptions for knowledge objects.

"Knowledge object" defined

How do I define the term knowledge object? A knowledge object is a chunk of electronic content. But so too are Web pages, snippets of multimedia, and Help files. What makes a knowledge object an object? Knowledge objects have two more important characteristics. They can be accessed individually and each completely accomplishes a single goal.

When I say that a knowledge object can be accessed individually, I mean that the consumer can navigate to this object without having to go through other items of content to get there. The consumer might navigate to a knowledge object by picking it out from a menu or looking it up in an alphabetical index, or by following a trail of hypertext links. If a chunk of electronic content always appears within another unit and can be accessed only within that other chunk, it lacks the independence that makes it an object.

Knowledge objects do not exist completely apart from the purposes for which they are created. Each knowledge object centers upon a specific goal. That goal may be to teach a particular concept or to answer a certain question. The goal for the knowledge object determines what knowledge objects and other content the knowledge object may rightfully contain.

What does a knowledge object contain?

What does a knowledge object contain? And how do you start to design one?

You start with the goal. The goal tells you what the knowledge object will accomplish. The object's goal tells you what concept it must teach, what skill it must convey, or what question it must answer.

Once you have defined the goal, you can begin to specify the content necessary to meet that goal. There are two ways you can specify content. For a high-level knowledge object, you may specify sub-modules, that is, a structured sequence of knowledge objects for more specific goals. You might draw a diagram showing the relationship among these sub-modules or the consumer's potential paths through them.
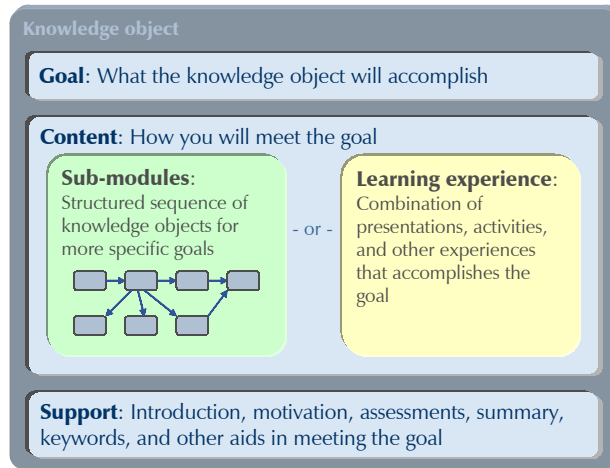
For low-level knowledge objects, you may specify the specific learning experiences that will directly accomplish the goal of the knowledge object. These learning experiences may consist of a combination of presentations, activities and other experiences.

In addition to content, the knowledge object may require other components such as an introduction, motivation techniques, exercises and assessments, a summary, indexing keywords, and so forth. Though not directly part of the content, these components assist in meeting the goal by making the knowledge object easier to find, understand, and remember.

Anatomy of 1-page knowledge object

Let's look at the components you might find in a low-level, 1-page knowledge object. This list is comprehensive, so don't try to include all these items in every knowledge object you create.
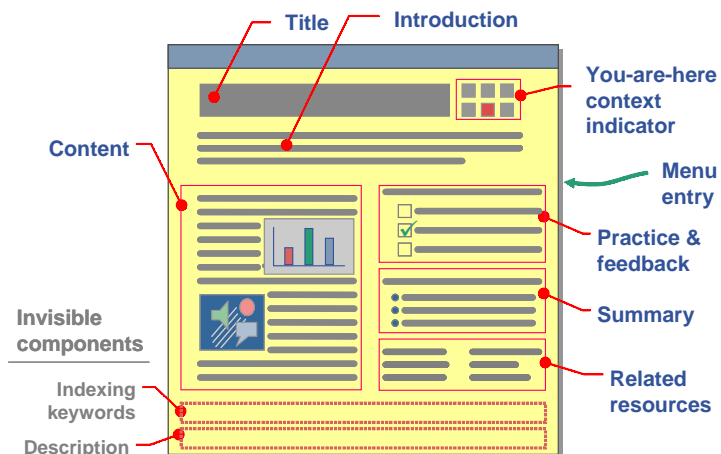
The first thing the consumer might notice would be the **title** of the object displayed as a banner or headline at the top of the page.

Following the title might be a brief **introduction** to help put the content in context or motivate the consumer to consider it carefully. Further contextual information might be provided by some kind of your-are-here indicator.

The primary focus of the page will be the actual **content**. This may consist of text, graphics, and multimedia content modules.

Another part of the knowledge object is the **menu entry** that the consumer clicked on to jump to this object. Although the entry is displayed separately, it is properly thought of as part of a self-contained object.

Other components may include **practice activities**, exercises, and assessments—and their accompanying feedback, which lets consumers monitor how well they understand the content of the object.

A **summary** may be included to help consumers retain key ideas from the object and to make sure that those merely skimming are exposed to all critical ideas.

To be completely self-contained, the object would need to contain a lot of material of interest to only a few consumers. As a compromise, the knowledge object may contain links to **related resources** for those who want to follow up on personal interests or to dig deeper into the main subject.

In addition to these visible components, the page may have invisible items, typically to make it easier for consumers to find the page. The object may contain **indexing keywords** that can be compiled to present an alphabetical index or that may be searched for by search engines. The object may also have a **description** that can, for example, be scooped up and displayed as a catalog of available objects. Invisible items like keywords and description are part of what are called metadata, that is, information about the knowledge object.

Anatomy of a multi-page knowledge object

More complex knowledge objects may include other knowledge objects and may require multiple pages to display. Here is a schematic view of such a multi-page knowledge object.
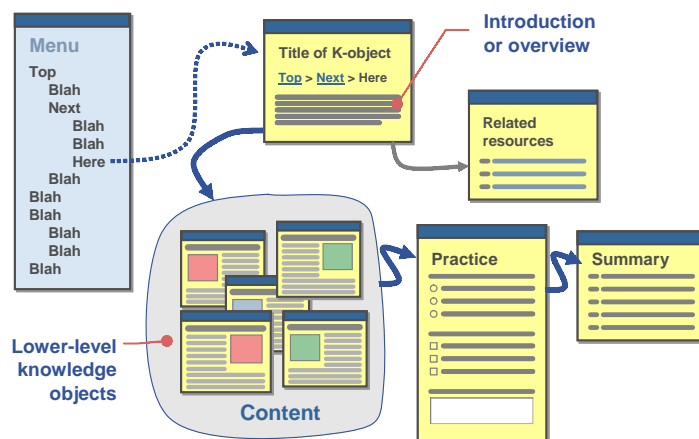
The consumer might start at the **home page** of the object. There the consumer would see the **title** of the object, a **location indicator**, and an **introduction** or overview.

From this page, the consumer might jump through the pages that contain the actual **content** of the object. These may represent lower-level knowledge objects.

After experiencing the content, the consumer may be directed to a **practice page**. The practice page may contain multiple exercises or test questions to assess understanding of the content or the ability to integrate what was learned in the individual lower-level knowledge objects.

Following the practice may be a **summary page** to recap the main content of the object.

The home page may contain a link to display a list of **related resources**.

The **menu entry** for the current knowledge object may appear in a separately displayed menu. Clicking on this entry would display the home page for the knowledge object.

Hierarchy of knowledge objects

The first step in designing knowledge objects is to sketch out our hierarchy of goals. Each goal will require a knowledge object. For an example, let's look at a course teaching how to read Gantt charts. The overall goal of the course becomes the goal of the primary knowledge object. That goal is that middle managers will be able to recognize and interpret the main features of Gantt charts.
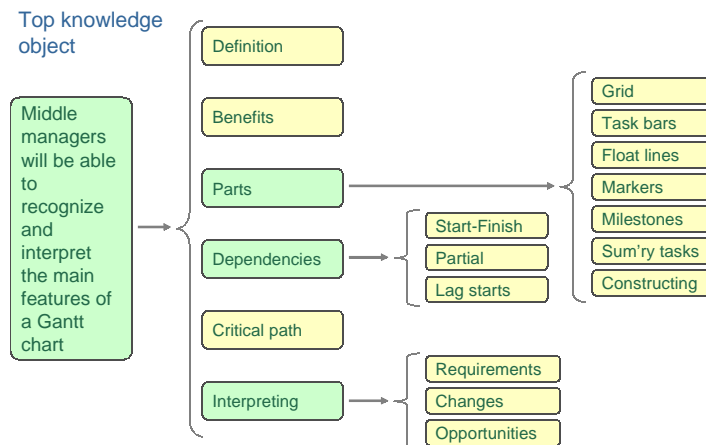
Achieving that goal will require accomplishment of several sub-goals, each of which requires a knowledge object. Consumers must know what a Gantt chart is (Definition), how it can help them (Benefits), what it contains (Parts), the ways that one task can depend on another (Dependencies), how to recognize which tasks determine the completion date (Critical path), and how to spot important conditions on a Gantt chart (Interpreting). These goals will lead to our second-level knowledge objects.

Some of the second-tier goals have sub-goals themselves. Understanding the parts of Gantt charts may require learning about each part (Grid through Summary tasks) and how they are assembled to construct a chart (Constructing). For Dependencies, consumers may need to understand each of the common types of dependencies. Interpreting Gantt charts will require knowing how to spot the requirements implied in a chart (Requirements), predicting the effects of changes (Changes), and identifying ways to improve on the schedule (Opportunities).

Top-level knowledge object

The top-level knowledge object represents the content of the course. Its goal is the goal of the course as a whole. Its content consists of the next-level knowledge objects.
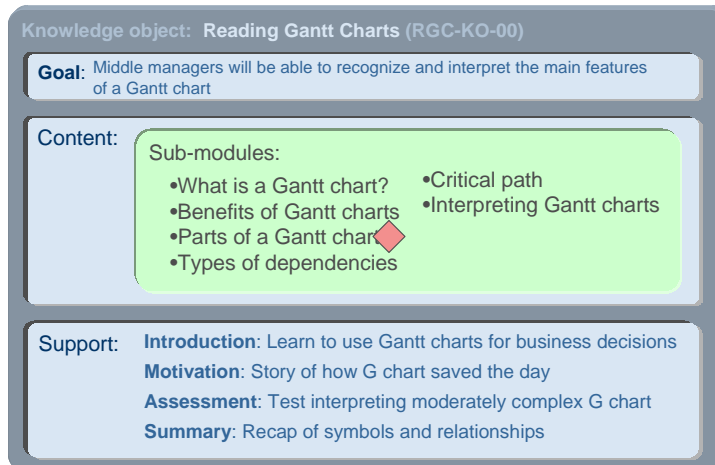
Its support components consist of an introduction promising that consumers will learn to use Gantt charts to help make business decisions. To motivate learners, the object will also include a story of how understanding Gantt charts saved a project. To let learners know whether they have mastered the material, the object will contain a test requiring them to interpret a moderately complex Gantt chart. For a summary, it will include a list of the important symbols and relationships found in Gantt charts.

Later you will look at the mid-level knowledge object explaining the parts of a chart, but for now let's concentrate on this top-level object.

Top-level knowledge object form

The actual specification for this top-level knowledge object is more complete. It refers to other specifications for certain low-level design concerns such as typography and layout. It also refers to a template file to use as a starting point in creating this object.

Knowledge object — Reading Gantt Charts course — Form copyright © 2000 William Horton Consulting, Inc.

ID	Project	Scope	Identification	Page	Owner
	Course: **Reading Gantt Charts**	This knowledge object only	RGC-KO-00 Version 1.0 - 1 Feb 2000	1 of 1	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Meta-info

Goal	Prerequisites	Output formats	Related specifications
Learners will be able to read and interpret Gantt charts. See RGC-Objectives-01.	(none)	☒ Web (HTML) ☐ Slides (PPT) ☐ Paper (Word) ☐	**Parent:** (None. This is the root level.) **Typography:** RGC-Typo-01 **Layout:** RGC-Layout-01 **Template:** RGCtopic.htm

Content

Title (& subtitle)	Content (how you will meet the goal)	Practice & feedback (test or activity)
Reading Gantt Charts	☒ **Cluster of knowledge objects** Spec: RGC-Cluster-00 ☐ **Learning activity** Spec: ☐ **Content modules** List:	Given a moderately complex Gantt chart in MS Project format, correctly interpret the meaning of symbols, infer relationships among tasks, and predict simple changes. **Question specifications:** KO-T1-Q1 thru KO-T1-Q5
Introduction Learn what a Gantt chart shows and how to make decisions using it.	Note: RGC-Cluster-00 supercedes the parent listed on all the KO forms.	
Motivation Have Kelly or Martha tell a story about how understanding Gantt charts saved the day on a large, complex, expensive project.		**Summary** or reflection (Your turn) Recap of symbols and relationships, formatted as a quick-reference summary for printing out.
Context (location indicator) (Provided by the table of contents for the course.)		**Related resources** • Bibliography from the classroom course

Access

Keywords (index terms)	Menu entry	Description	Related knowledge objects
Gantt chart	(None. This is the root level.)	Teaches how to intrepret Gantt charts and make decisions using them.	(None at this level.)

T = link to, F = link from

This form is available from: www.designingwbt.com/html/designforms.htm.

The content of a high-level knowledge object consists primarily of lower-level objects. The organization is detailed in a separate Cluster specification. The practice and feedback described here is further elaborated in the specifications for test questions used to measure completion of the objective of this object.

This **Knowledge object** form includes slots for other items of the knowledge object, such as how consumers are to be motivated to interact with it and components that will help them locate the knowledge in the first place.

Cluster diagram

Cluster — Course cluster — Form copyright © 2000 William Horton Consulting, Inc.

ID	Project	Scope	Identification	Page	Owner
	Course: **Reading a Gantt Chart**	Entire course	RGC-Clusters-00 Version 1.2 - 2 April 2001	1 of 1	Copyright © 2000-2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

The cluster

Goal	Diagram
See Objectives form: RGC-Objectives-01	

Types of objects
Introduction
Presentation
Practice
Summary
Test

Note: The specification numbers of these topics are in the diagram next to the corresponding type of topic. All spec. numbers begin with **RGC**.

Links not shown
☒ Home, Top, Welcome
☒ Menu
☒ Help, Instructions
☒ Glossary
☐ Summary, Recap
☐ Test
☐
☐

This form is available from: www.designingwbt.com/html/designforms.htm.

To show the organization of sub-objects within a knowledge product or just within a complex knowledge object, you use a **Cluster specification**. This one

shows the whole organization of an online course. This single specification is then referred to from all the objects in the course that need to show their internal makeup. Such a diagram serves as a roadmap for the sequence in which consumers may experience the knowledge product and how they can navigate within it.

Top-level knowledge object realized

Here is the resulting knowledge object as it appears to the consumer. You are looking at the top-level, so what you see at the right is just the Welcome screen for the course. The internal content of the object is indicated by the links to sub-objects from the menu for this object.
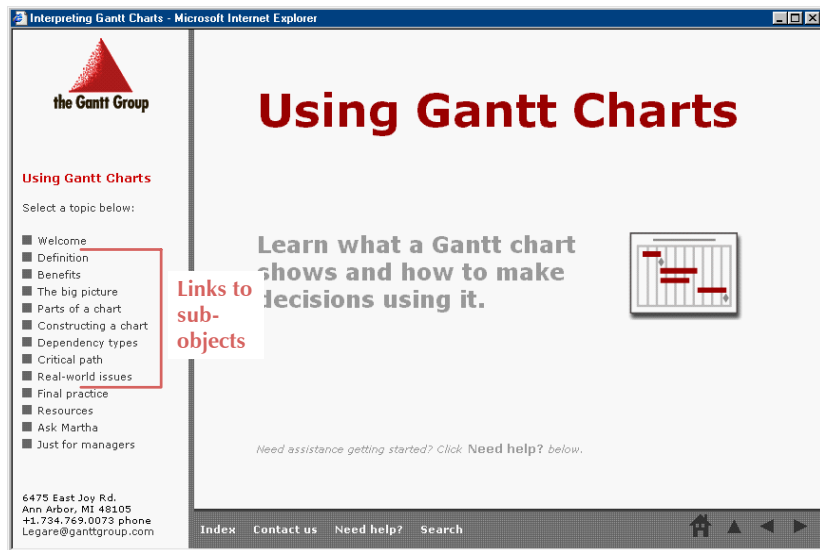
You may notice that this table of contents does not exactly duplicate that of the specification for the object. That is due to successive refinement as the object was developed through several cycles of analysis, design, building, and evaluating. Some ideas did not work as well as expected and better ones took their places. It is not unusual for the final object to change 20% or more from its initial specification. In fact, you should be suspicious of any object that does not change for the better as you cycle through the phases of development.

Mid-level knowledge object

The object for parts of a Gantt chart is a middle-level knowledge object. Its goal is that learners will recognize and correctly interpret symbols in Gantt charts. This goal is intermediate in detail between that of the course as a whole and that for recognizing the individual symbols.

The content consists of sub-modules. These modules have the goals of teaching learners to recognize the individual symbols on the chart and to see how they relate one to another.

Support components include an introduction that reminds learners that symbols in Gantt charts reveal critical business information. Motivation comes from curiosity evoked by exposure to symbols in examples shown so far. For an assessment, the object will test learners' ability to recognize and interpret common Gantt chart symbols and simple relationships among them. The summary will just list the symbols and their meanings.

Later you will look at the bottom-level knowledge object that explains dependency markers, but for now let's look at more detail about the middle-level knowledge object.

Mid-level knowledge object form

This form is available from: www.designingwbt.com/html/designforms.htm.

Here is the form for specifying this mid-level knowledge object. Note that for content, it lists subordinate objects. Since all these sub-objects are all at the

bottom level, no diagram is necessary. The numbers refer to their specification numbers, not necessarily their sequence.

Mid-level knowledge object realized

Here is the resulting mid-level knowledge object. It contains an overview animation at the top of the first display. And at the bottom of that display, it contains links to lower-level objects. These same lower-level objects can be accessed from the menu to the left.
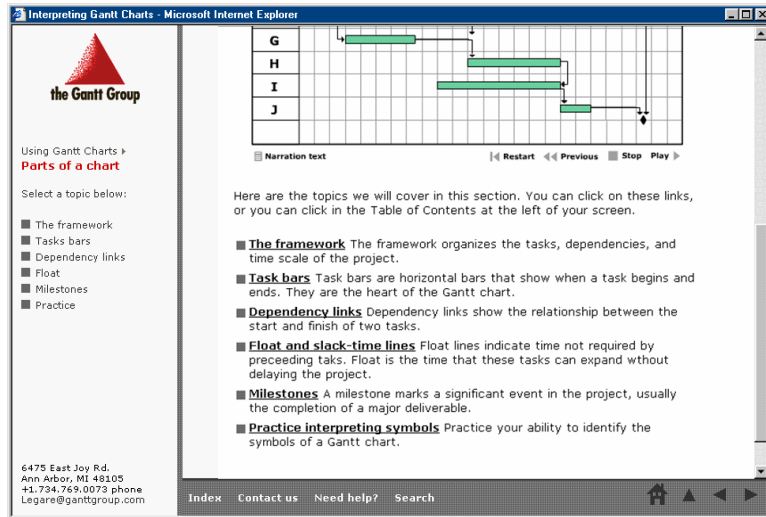
Bottom-level knowledge object

The knowledge object for dependency markers is a bottom-level object. That means it includes the content necessary to accomplish its goal without the need for sub-objects. Its goal is that learners be able to recognize and correctly interpret dependency markers.

The knowledge object's content consists of learning experiences necessary to completely accomplish the goal. These will include an animation showing task bars being connected with dependency markers. Voice-over commentary will explain the meaning of each of the dependency markers shown. Practice and

feedback will be provided by requiring learners to interpret simple dependency markers on a real Gantt chart created in Microsoft Project.

Support components will include an introduction stating what dependency markers show, motivation springing from curiosity evoked by exposure to dependency markers so far, a summary recapping the types of markers shown in this object, and a link to the knowledge object teaching the various types of dependencies.

Bottom-level knowledge object form

Here is the form for the bottom-level knowledge object. It differs from upper-level objects in that its content does not include any lower-level objects.

Its content is specified as an animation with voice-over commentary. Because this type of animation is used throughout the course, it is further specified in a generic specification or pattern. The details for the version of the animation used in this knowledge object are specified in a storyboard form.

Knowledge object		Dependency links		Form copyright © 2000 William Horton Consulting, Inc.
Project	**Scope**	**Identification**	**Page**	**Owner**
Course: Reading Gantt Charts	This knowledge object only	RGC-KO-10 Version 1.0 - 1 Feb 2000	1 of 1	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com
Goal	**Prerequisites**	**Output formats**		**Related specifications**
Learners will be able to recognize and correctly interpret dependency links.	RGC-KO-01 What is ... RGC-KO-06 Symbols	☒ Web (HTML) ☐ Slides (PPT) ☐ Paper (Word) ☐		**Parent:** RGC-KO-06 Symbols **Typography:** RGC-Typo-01 **Layout:** RGC-Layout-01 **Template:** RGCtopic.htm
Title (& subtitle)		**Content** (how you will meet the goal)		**Practice & feedback** (test or activity)
Dependency links		☐ Cluster of knowledge objects Spec: ☐ Learning activity Spec: ☒ Content modules List: Emphasize-and-talk animation pointing out dependency markers and showing how they connect tasks. Emphasize-and-talk animations are specified generically in RGC-Content-E&T-01. The exact sequence of actions and voice narration are specified in the storyboard in RGC-Story-E&T-10.		Referring ot chart in MS Project, answer questions such as which task depends a particular task, which tasks must be completed before another task can begin, and so forth. Question specification: RGC-Test-K10-T1-Q1
Introduction				
Dependency links show the relationship between the start and finish of two tasks. For example, the requirement that Task A must be completed before Task B can start. RGC-Topic-00-Welcome				
Motivation				**Summary** or reflection (Your turn)
Statement: Understanding dependencies lets you track and manage complex projects.				Dependency markers show how one task depends on the start or completion of another task. RGC-Topic-00-Summary
				Related resources
Context (location indicator)				History-KO-03 Henry Gantt-KO-04 RGC-Topic-00-Resources
(Provided by the table of contents for the course.)				
Keywords (index terms)	**Menu entry**	**Description**	**Related knowledge objects**	
dependency links	Dependency links	Shows what dependency markers look like and explains what they mean.	15 Types of dependencies (T, F) 08 Task bars (T)	
			T = link to, F = link from	

This form is available from: www.designingwbt.com/html/designforms.htm.

Like other objects, this one also includes a practice and feedback activity, consists of a test, which is specified separately.

Bottom-level knowledge object realized

Here is the resulting knowledge object. The display at the right shows the included content module. It also contains test questions.
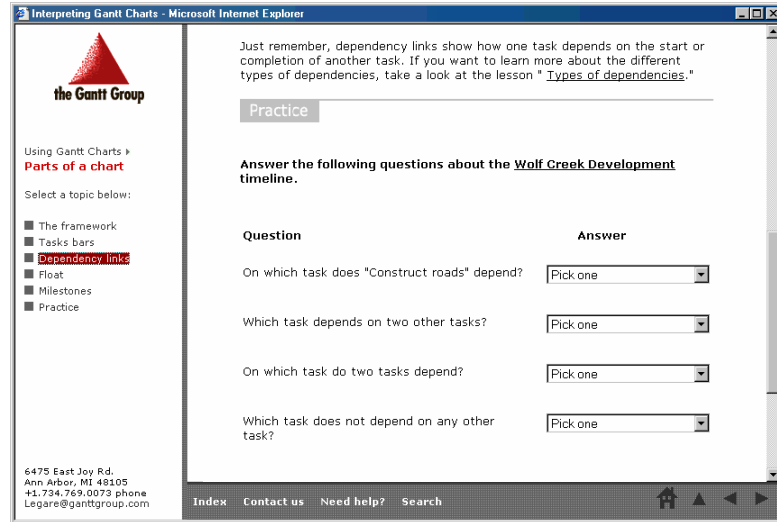
DESIGN DETAILED CONTENT

Within the bottom-level knowledge objects, you can include several kinds of content to accomplish the objectives of the knowledge object. The main forms of content are:

■ Content modules, which include blocks of text, graphics, animation sequences, video clips, and other units of media that communicate a specific idea.

■ Test questions, which let people practice applying what they have learned.

■ Learning activities in which people interact with one another or with the computer.

Let's see how we design them as part of our development methodology.

Content-module specification

Here is the specification for a content module. This example defines a pattern, that is, a specification for a type of content module that occurs several places throughout the knowledge product. Particulars for the individual instances of the pattern are provided on other forms.

This form is available from: www.designingwbt.com/html/designforms.htm.

Notice that this content module contains dynamic media, which are further described in timeline and interactivity specifications.

Here is a snapshot of the resulting animation as it appears to the consumer.
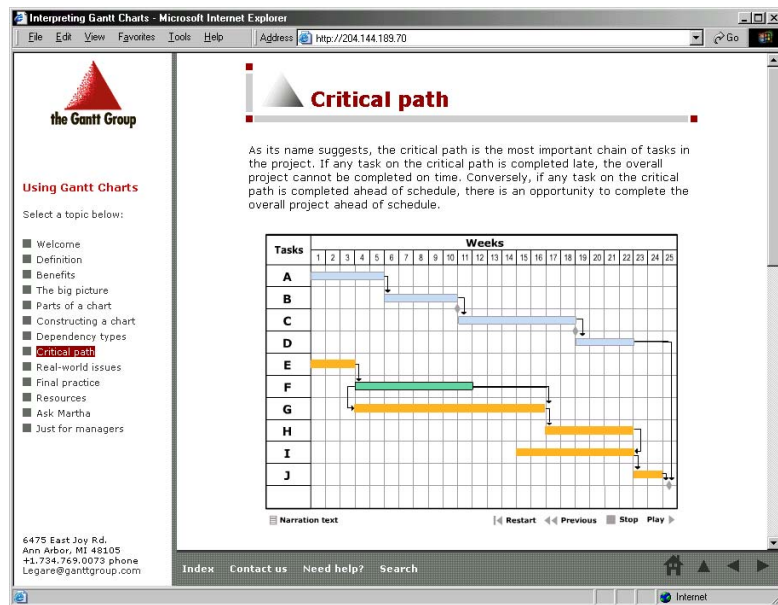
Test-question specification

Here is the specification for a test question used in a low-level knowledge object. It records everything about the test question, such as what it measures, feedback for right and wrong answers, and points awarded for such answers.

Test question — **K10-T1-Q1 Dependency markers** — Form copyright © 2000 William Horton Consulting, Inc.

ID	Project	Scope	Identification	Page	Owner
	Course: **Reading Gantt Charts**	Just this one test.	RGC-Test-K10-T1-Q1 Version 1.0 - 28-March-2000	**1 of 1**	Copyright © 2000 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Meta	Type question	Scoring	Assistance	Tracking	Related specifications
	Type: Fill in the blanks **Template:**	**Max points:** 20 **Required pts:** 20	☒ "Show answer" button ☒ "Show hints" button	☐ Name and score recorded ☐ Recorded anonymously	**RGC-KO-10**

What the it measures — Ability to recognize dependency markers and their basic function. Not to discriminate among different types of dependencies.

Question & introduction — Answer the following questions about the Wolf Creek Development Timeline.

Answers

Fill-in-the-blanks block

Question	Answer
On which task does "Construct roads" depend?	(1) _____
Which task depends on two other tasks?	(2) _____
On which task do two tasks depend?	(3) _____
Which task does not depend on any other tasks?	(4) _____

Blanks

Num	Choices	Answer	Feedback - Right	Feedback - Wrong
1	Research and planning,	Survey for utilities and lots	A dependency arrow traces back to "Survey for utilities and lots."	A dependency arrow traces back to "Survey for utilities and lots."
2	Subdivision plan approval, Environmental survey, Prepare grounds,	Market lots	Market lots is pointed to by the two preceding tasks.	Market lots is pointed to by the two preceding tasks.
3	Site approved, Survey for utilities and lots, Construct utilities,	Survey for utilities and lots	"Construct utilities" and "Construct roads" depend on "Survey utilities and lots."	"Construct utilities" and "Construct roads" depend on "Survey utilities and lots."
4	Construct roads, Market lots, Construct homes	Research and planning	"Research and planning" is the first task and hence has no dependencies.	Research and planning is the first task and hence has no dependencies.

Feedback - right answer — Good, you can clearly spot dependency markers.

Feedback - wrong answer — Not all answers were correct. Why not take a few minutes to review dependency markers.

Hint — Dependency markers are the small arrows connecting task bars and milestones.

This form is available from: www.designingwbt.com/html/designforms.htm.

This particular question is a compound one with several multiple-choice sub-questions all relating to a single Gantt chart.

And here is the actual test question as it appears to the consumer. Notice that it refers to a real-world Gantt chart which appears in a separate window.

Interpreting Gantt Charts - Microsoft Internet Explorer

the Gantt Group

Using Gantt Charts ▸
Parts of a chart

Select a topic below:

■ The framework
■ Tasks bars
■ Dependency links
■ Float
■ Milestones
■ Practice

6475 East Joy Rd.
Ann Arbor, MI 48105
+1.734.769.0073 phone
Legare@ganttgroup.com

Practice

Answer the following questions about the Wolf Creek Development timeline.

Question	Answer
On which task does "Construct roads" depend?	Pick one
Which task depends on two other tasks?	Pick one
On which task do two tasks depend?	Pick one
Which task does not depend on any other task?	Pick one

Evaluate   Show   Hint   Reset

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Learning-activities specification

Knowledge objects may employ complex learning activities to accomplish their objectives. Learning activities prescribe a sequence of learning experiences that occur as learners interact with a course, with the instructor, or with fellow learners.
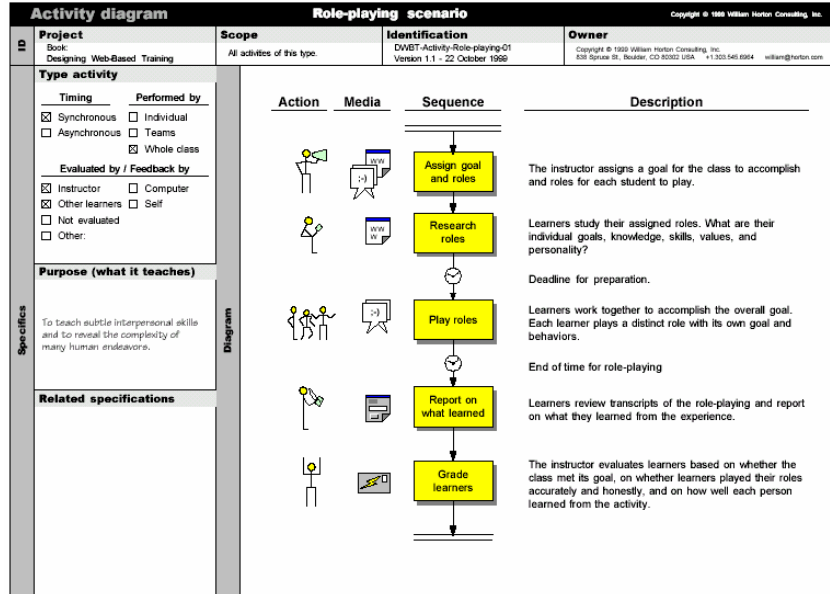
This form is available from: www.designingwbt.com/html/designforms.htm.

This example shows the flow of activities for a complex role playing activity that might be part of an online class. It shows the sequence of activities of the instructor and of learners.

Here is what a role-playing activity looks like "in the flesh." This example has a few enhancements that were not specified on the Activity form—a meeting with a consultant and a chance to vote.

SPECIFY DYNAMIC AND INTERACTIVE MEDIA

Dynamic and interactive media move, talk, and respond to the consumer. To engineer successful dynamic media we must specify the clearly enough that builders can create and integrate the required media elements.

Storyboard

The classic storyboard is good for scripting linear presentations involving changing visual displays, perhaps with accompanying voice, music, or sound effects. This particular example shows the sequence of events in a voice-over animation sequence.

Storyboard		Animation for dependency links		Form copyright © 2001 William Horton Consulting, Inc.
Project	**Scope**	**Identification**	**Page**	**Owner**
Course: Reading Gantt Charts	This specific animation only.	RGC-Story-E&T-10 Version 1.4 - 27-Apr-2001	**1 of 4**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

No.	Visuals	Other media	Interactivity
1	[Whole chart visible. Sketch of the basic chart is in BaseChart.gif]	Narration: Dependency links tie tasks together to represent real-world constraints. File: 10a.wav (When recording narration, store the sound in this file. Later import it into the animation tool and position it accordingly.)	Play this entire animation continuously unless the consumer clicks one of the control buttons.
2	[Emphasize dependency links.]	Narration: Dependency links are small vertical arrows between task bars. They show how the start or completion of one task depends on the start or completion of another. Let's look at a few examples. File: 10b.wav	
3	[Emphasize the marker between task bars A and B]	Narration: The dependency link between tasks A and B shows that ... File: 10c.wav	

Notes

De-emphasize = Change opaqueness (alpha) to 15%

Emphasize = De-emphasize everything else.

See related Timeline spec for sequencing.

Related specifications

Content module:	RGC-Content-E&T-01	**Timeline:**	RGC-Timeline-E&T-01
Layout:	RGC-Layout-Anim-01	**Other:**	RGC-Buttons-Animations-01
Interactivity:	RGC-Interactivity-Anim-01		

This form is available from: www.designingwbt.com/html/designforms.htm.

Interactivity specification

Interactivity should be consistent and predictable to consumers. An interactivity specification charts the responses to consumers' actions. This example shows how the buttons that control an animation should respond.

This form is available from: www.designingwbt.com/html/designforms.htm.
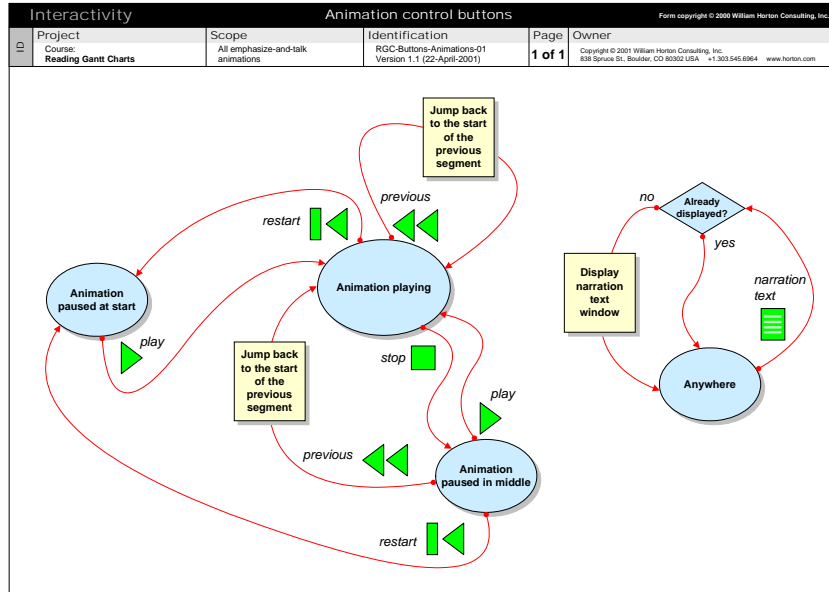
The advantage of stepping through such a complex analysis and recoding it meticulously is that you first agree on the way it should work before giving it to the programmer to implement. It also ensures that there are no misunderstandings about how the system should respond to the consumer's actions.

Timeline specification

A timeline is used for showing the precise coordination of dynamic media. It is used to choreograph the appearance and disappearance of various media in a complex layered sequence. Use them to plan animations and animated slide sequences.

This form is available from: www.designingwbt.com/html/designforms.htm.
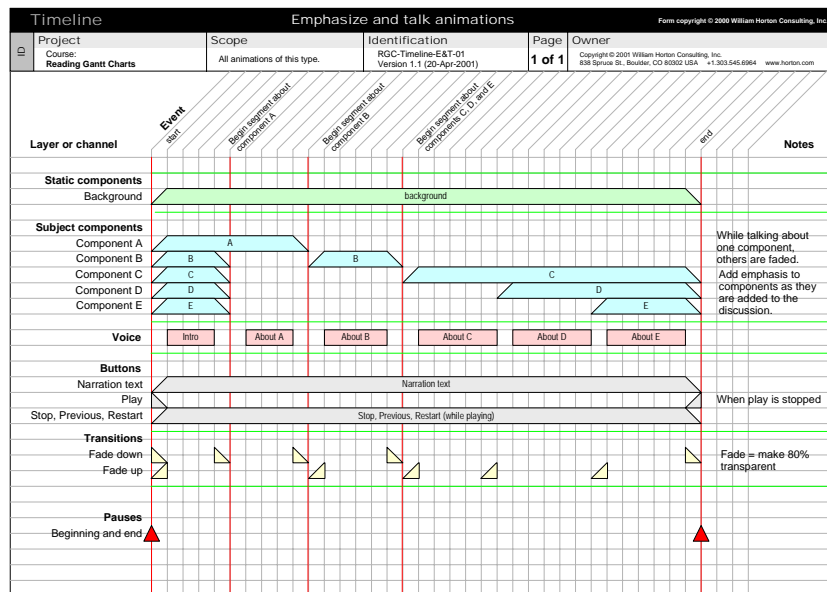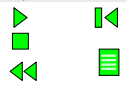
The timeline is especially useful when designing dynamic media that will be realized in tools, such a Macromedia Flash and Director that let authors assemble media on a timeline.

This example is the pattern for a particular kind of voice-over animation called an emphasize-and-talk. In this type of animation, a particular part of the scene is emphasized and then discussed. Then another part is emphasized and discussed, and so on.

Button specification

Buttons and hypertext links are usually simple enough they need no written specification. Sometimes, however, a button may have dynamic behaviors, such as pop-up text or varying states from disabled to active. In such cases, it may make sense to specify the button in complete detail. This is usually true when we want an entire class of buttons to look and behave consistently.

Button (link) — **Animation control buttons** — Form copyright © 2001 William Horton Consulting, Inc.

ID	Project	Scope	Identification	Page	Owner
	Course: **Reading Gantt Charts**	Buttons used to play all animation sequences.	RGC-Button-Animation-01 Version 1.1 - 08-April-2001	**1 of 1**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Button	Name	Purpose	Where used	Related specs
	Play, Stop, Previous, Restart, Narration Text	Control the play of canimatoins.	In framework at lower right of the frameset	RGC-Type-Basic-01

Appearance

Graphic	Text	Text format		Position
	Play Restart	**Font**	**Style**	☐ In line with text At lower right of the frameset.
	Stop	**Face:** Verdana	☐ Underline	☐ Screen position:
	Previous Narration text	**Size:** 10 pt or HTML #2	☒ **Bold**	☒ Relative to element:
		Color: Black	☐ *Italic*	☐ Relative to graphic:
			☐ Other:	

Action when clicked

Response	Sound effect	Visual effect
☐ Replace current display with:	Faint click	☐ **Wipe:** ☐ **Left** ☐ Right ☐ Up ☐ Down
☐ Add this to current display: Animation as specified in the Interactivity specification:		☐ **Zoom:** ☐ In ☐ Out
☐ Display new window containing: RCD-Interactivity-Anim-01		☐ **Fade:** ☐ In ☐ Out
☒ Play this media:		☐ **Dissolve**
☐ Run program or macro:		☐ **Fly from:** ☐ **Left** ☐ Right ☐ Top ☐ Bottom
☐ Toggle this setting:		☐ **Other:**
☐ Other:		

Additional states

Appearance and response

State	Appearance (how different from normal appearance)	Response (when entering this state)
☒ Unavailable	Button graphic is medium gray.	(none)
☒ Mouse-over	Text changes color to deep red.	Color change only.
☒ Hit	Button graphic is light blue.	Flash once.
☐ Visited		
☐ Toggled on		
☐		
☐		

This form is available from: www.designingwbt.com/html/designforms.htm.

This example form specifies the visual and dynamic appearance of a set of buttons that control playback of animation sequences.

FROM IDEAS TO SPECIFICATIONS TO PRODUCT

Let's summarize what we have talked about so far. How do you go from project objectives to a finished knowledge product? The path is long and a bit complex, but not too hard if we take it one step at a time. One of the first steps is to elaborate our project objectives into a hierarchy of ever more specific goals. Each goal leads to the specification of a corresponding knowledge object.
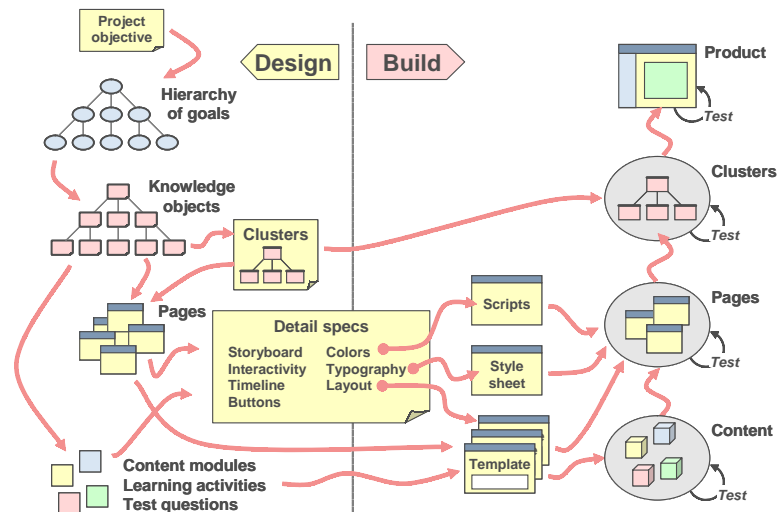
To fully specify a knowledge object, though, you may need to specify how it is organized, what pages it contains, and what lower-level content modules, learning activities, and test questions are needed to completely accomplish the objective of the knowledge object.

To ensure consistency among the many pages and other components, you may need some detailed specifications including storyboards, interactivity, timelines, buttons, colors, typography, and layout.

To save time and reduce errors in applying such specifications, you can create reusable resources for your project. From the interactivity specification, you may create libraries of scripts. From the specifications for color and typography, you may create style sheets to make applying colors and fonts simpler. And from the layout specification, you may create templates for pages and lower-level components. By copying and filling in templates as directed in the specifications, you begin to create low-level content components.

Once you have tested the individual components, you can begin integrating them into pages. In creating pages you rely heavily on the templates, style sheets, and scripts created earlier. After the pages are tested and refined, they can be integrated into clusters as prescribed in the cluster specifications. And, after testing the clusters, you can integrate them into the product framework to produce the knowledge product, which you further test and refine.

Within this process are two kinds of activities. If we draw a dividing line before the creation of scripts, style sheets, and templates, we separate the activities into

the two middle phases of product development. The earlier of these is the
design phase and the later is the **build** phase.

SPECIFY THE FRAMEWORK

Though content is the most important part of your knowledge product, it is not
all there is. Knowledge products include a framework of resources and services to
make content accessible and useful.

What is a framework

A framework is everything that is not content. It provides an environment for the
content of the knowledge product. It contains resources and services. These
include access mechanisms such as a menu, an index, and a glossary.
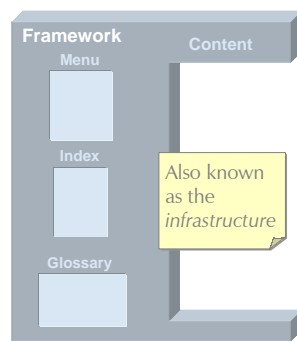
Other access mechanisms may include a map and
a search mechanism. Some frameworks include
collaboration tools like chat, discussion forums, or
internal e-mail. Frameworks for training may
include administrative tools for registering learners
and tracking their progress. A framework may
provide meta-information, that is, information
about the content. It might house a frequently
asked questions file and a statement of the legal
terms and conditions for using the knowledge
product. A framework will likely supply ways that
consumers can provide feedback to the creators of the knowledge product.
Frameworks may also include templates that developers can use to build content
for the framework.

Framework presents content

The primary function of the framework is to present content to the consumer. It
may provide a stage (a display area) on which the content of the individual
knowledge objects appear. It may also contain mechanisms to compile and
display navigational elements defined in the individual knowledge objects. For
example, the framework may display a comprehensive table of contents, index,
and glossary spanning the contributions of all the included knowledge objects.
The framework may also display final-exam questions and evaluation-feedback
questions from the individual knowledge objects.
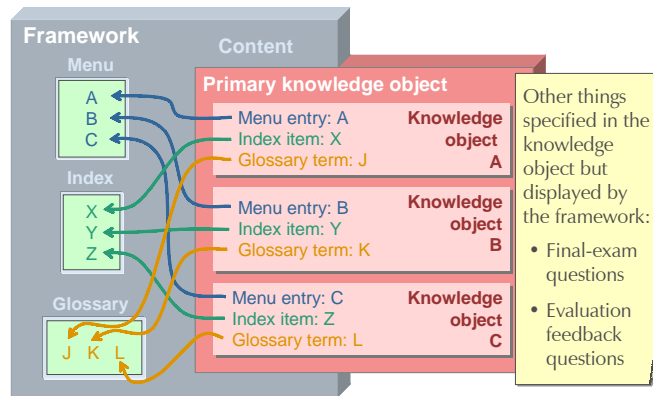
Example of an empty framework

Here is an example of an empty framework for a self-directed e-learning course. It includes display areas for access mechanisms, such as a table of contents or menu and for the primary content. It may also include slots for guidance or instructions for learners, a path for starting the knowledge product, an index, a map, a glossary, and a feedback mechanism.
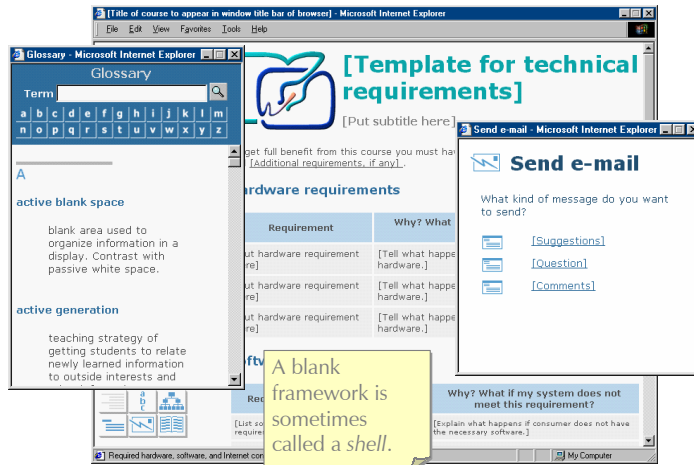
Sometimes such a framework is called a shell. Think of it as a container into which you pour your content. For e-learning, many of the components of the framework are provided by a learning management system or a virtual classroom system.

Specification of a framework

To specify a framework, use a checklist of capabilities that might be needed. The resulting specification serves as a shopping list when specifying and buying tools and technologies later. Here is an example of a form we use for this purpose.

This form is available from: www.designingwbt.com/html/designforms.htm.

LIST TECHNOLOGY REQUIREMENTS

Once you have specified the content and framework of the knowledge product, you can list the tools and technologies we will need to construct the knowledge product.

Participants and processes

To make sense of the tools and technologies needed on even a simple project, you need a framework or checklist of the major categories of technologies needed. Let's take a look at a simple way of classifying the technologies.

You start by looking at the groups of people involved and the technology they need for the activities they individually perform. One group is the **producers** of the knowledge product. And another group is the **consumers** of the knowledge product. A third group may be those who **host** the course or Website.
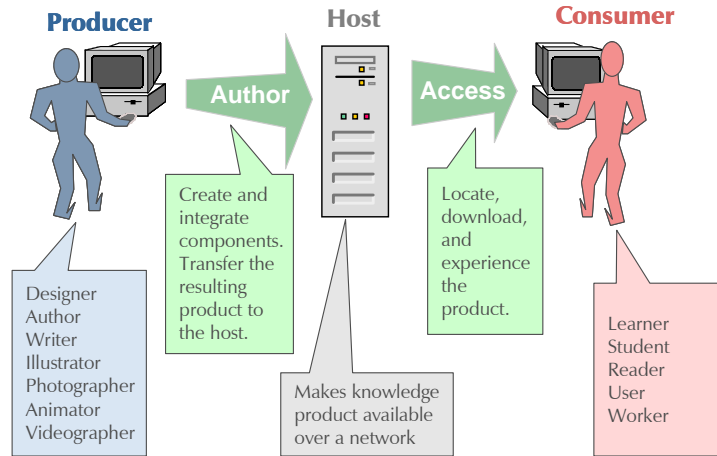
The process of creating the knowledge product is commonly referred to as **authoring**, and it is performed by the producer. The process of consuming the knowledge product is commonly referred to as **accessing** it. Let's look at each of these participants and processes in more detail.

Producers include the designers, authors, writers, illustrators, photographers, animators, videographers, and other creative souls who collectively bring knowledge products into being.

Consumers of those products go by many names. Consumers of learning products are typically called learners or students. If the knowledge product is an online document, consumers are referred to as readers. Consumers of knowledge management systems are typically called users or just workers.

The host is the organization that makes the knowledge product widely available over a network. Hosting involves making the knowledge product accessible by targeted consumers and by those who must administer and maintain it.

The process of authoring covers the activities of producers as they create and integrate components into a knowledge product and transfer that knowledge product to the host. Likewise, accessing refers to activities performed by the consumer who locates, downloads, and experiences the knowledge product.

Participants and what they need

Each of the participants—producer, host, and consumer—will require three forms of technology: hardware, network connection, and software. The consumer of the knowledge product will probably require a personal computer to access the learning product and a network connection of at least moderate speed. In addition to the basic operating system of the personal computer, the consumer will require add-ons such as a Web browser and media players.
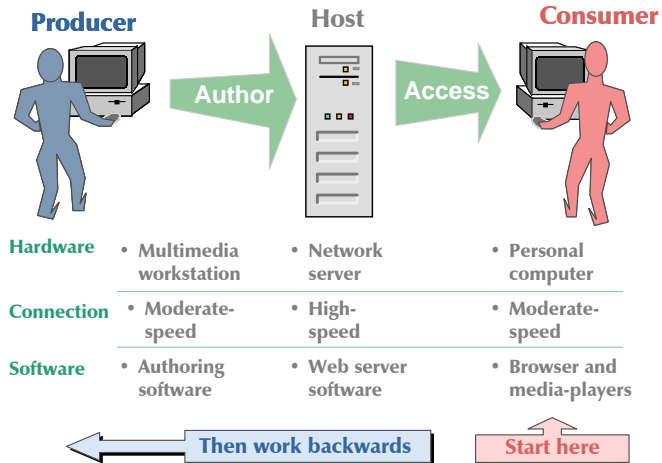
The host will require a network server. You can think of it as an ultra-powerful personal computer optimized for delivering information over a network. The host will also require a high-speed network connection so it can deliver information to many simultaneous consumers. And, the host will require Web-server software, perhaps including special collaboration tools and media servers.

The producer will require multimedia workstations for preparing the graphics, animations, icons, video clips, sounds, and other media needed. Typically, a workstation will cost twice as much as the personal computer needed to access the knowledge product. The producer will also need a moderate speed network connection. In fact, it may be best if the producer's connection is no faster than that of the consumer's so the producer experiences the knowledge product at the same speed as the consumer will. The producer will also need specialized software to create and edit the various media needed.

In putting together your technology plan, be sure to start at the right end of this diagram. Always start with the technology used by the consumer, and then work backwards. On some projects you may have no control over the consumers' choices for technology. Even if you can choose technology for consumers, keep in mind that there will be far more consumers than hosts and producers. The costs of technology for consumers may thus dominate the budget.

Specify technology in detail

Before you embark on any expensive technology project, it is always good to specify the technology requirements and constraints in detail. At William Horton Consulting, we use this one-page form to summarize the hardware, connection, and software required for authoring, hosting, and accessing knowledge products. It reminds us of the questions to ask and provides a convenient vehicle for communicating with all members of the project team.

Technology			Gantt Chart			Form copyright © 2000 William Horton Consulting, Inc.
ID	**Project** Course: **Reading a Gantt Chart**	**Scope** Entire course	**Identification** RGC-Technology-01 Version 1.0 - 13-Nov-2000	**Page** **1**	**Owner** Copyright © 2000 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com	

Hardware

Authoring	Hosting	Accessing
Processor: Pentium II 266+ MHz **Memory:** 128 MB **Display size:** 1024 x 768 **Colors:** 16-bit **Hard disk:** 30 GB **CD or DVD:** 16X speed CD-ROM **Audio:** SoundBlaster Pro **Video input:** Firewire	**Processor:** Pentium 400+ MHZ **Memory:** 512 **Hard disk:** 120 MB **CD or DVD:** (not required) **Other:**	**Processor:** Pentium II 266+ MHz **Memory:** 64 MB **Display size:** 800 x 600 pixels **Colors:** 16-bit **Hard disk:** ~1 MB free space **CD or DVD:** (not required) **Audio:** SoundBlaster Pro **Video input:** (not required)

Software

Authoring		Hosting	Accessing
File format	**Tools required**	**Op sys:** NT4 with SP3	**Op sys:** Windows 98+ and Mac
HTML	Dreamweaver	**Web server:** Internet Info. Server	
GIF and JPEG graphics	Create in Freehand, edit and optimize in Photoshop	**Security:** Standard firewall **Java VM:** (not required)	**Browser:** Internet Explorer 4.1+ and Netscape 4.3+
JavaScript 1.2	Create in Dreamweaver, debug in HomeSite	**Media server:** (not required) **LMS:** (none)	**Java VM:** Latest Sun version
Animations	Macromedia Flash	**Billing:** (none) **E-mail:** (By user's ISP)	**Add-ons:** Flash player Acrobat Reader
Adobe Acrobat PDF	PDF Writer (print driver) and Adobe Acrobat Distiller	**Conferencing:** (none) **Discussion:** (none)	QuickTime or Windows Media player
WAV sound	Sound Forge	**Search:** Index server	
Video editing	Premiere	**Other:** Access driver for security database	
Software config spec: RGC-SWConfig-01			

Network

Authoring	Hosting	Accessing
Type: ☐ Intranet ☒ Internet **Speed:** 128K bits per second **Cost:** 0 USD per _____ **Notes:**	**Type:** ☐ Intranet ☒ Internet **Speed:** 1.5 M bits per second **Cost:** _____ per _____ **Notes:**	**To:** ☐ Intranet ☒ Internet **Type:** ☐ LAN ☒ Dial-up ☐ Wireless **Speed:** 56K bits per second **Cost:** _____ per _____ **Notes:** Most have high-speed Internet access from their offices and moderate-speed from homes.

This form is available from: www.designingwbt.com/html/designforms.htm.

Tools for every level and task

You will find that you must do more than list the components needed. You will find it helpful to show how the major software components are related and how we will arrange them into an efficient workflow. Let's look at a scheme for classifying the array of software tools needed for the various levels of knowledge products and required tasks. This framework uses a rectangular grid.
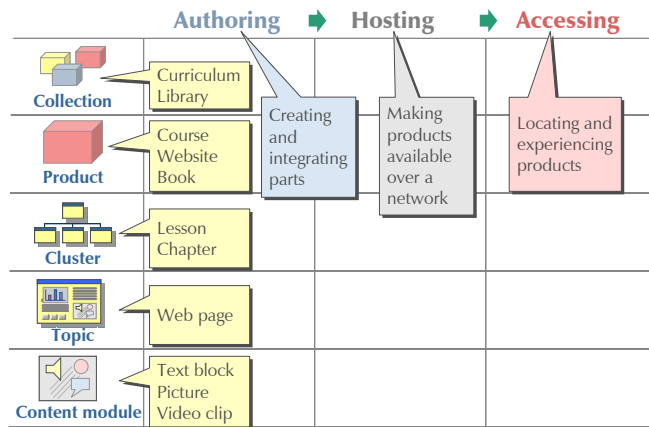
Vertically are the levels of knowledge products. At the top level is the **collection**, which might represent a curriculum of e-learning courses or a library of online documents. Below that is the level of the individual knowledge **product**, say an online course, a Website, or an online manual. The next level down is the **cluster**. A cluster might consist of a lesson in an online course or a chapter in an online book. Within the cluster you will find individual **topics**, or pages. Each topic might be a separate Web page. Within that topic may occur **content modules**, such as blocks of text, animation segments, pictures, and video clips.

The processes, arranged horizontally, are authoring, hosting and accessing. Authoring involves creating and integrating components into knowledge

products. Hosting makes them available over the network. And accessing is what consumers do as they locate and experience the knowledge products.

Tools are needed by the producer authoring the content, the host hosting it, and the consumer accessing it. Tools will be required for each level as well.

Self-paced e-learning course

What software components are needed for a self-paced e-learning course? Let's look at a typical case.
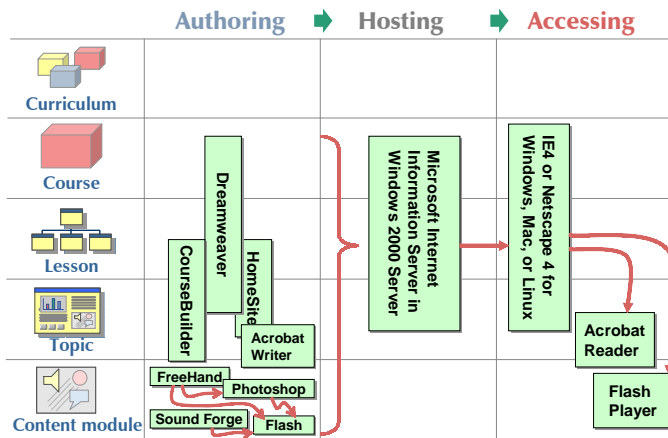
We started by asking what browser learners will have? In this case, we knew that learners had Internet Explorer 4 or Netscape 4 (or a later version of these two). They might be running these browsers on Windows, Macintosh, or Linux systems. Armed with this knowledge, we could move forward.

Our next question was what browser add-ons users might have or be able to download. The two components we felt comfortable assuming were the Acrobat Reader and the Flash Player. These were available for the targeted browsers and operating systems.

Working backwards, we determined that the client already had a Microsoft Windows 2000 Server available. This server contains the Internet Information Server, which would serve our purposes adequately.

To author Web pages, we chose Dreamweaver from Macromedia. To help in creating the assessments and other interactions, we downloaded the free CourseBuilder extension for Dreamweaver. And, because some authors were already familiar with HTML, we also included the HomeSite code editor in the toolkit. Other components included the Acrobat Writer to prepare various documents and other material referenced in the course.

Content modules that went into the HTML pages were created with a coordinated set of media editors. Drawings were done in Macromedia FreeHand. Some of these drawings were converted to paintings by putting them into Adobe Photoshop. Photoshop was also used to edit photographs shot on a digital camera. Some graphics from FreeHand were also used in Macromedia Flash to create animation sequences. These sequences also incorporated some

graphics that had been edited in Photoshop. Narration was recorded into Sound Forge and imported into Flash where it was integrated into the animations.

The animations and graphics were referenced in the HTML pages in Dreamweaver, and finally, all of these authored components were uploaded to the server to complete the project.

Specify software and file formats

You can use this **Software configuration** form to show the flow of work among software components. We like to annotate the flows with the specific file format used to move material from one tool to the next. Such a process serves as a checklist for issues of compatibility and consistency.
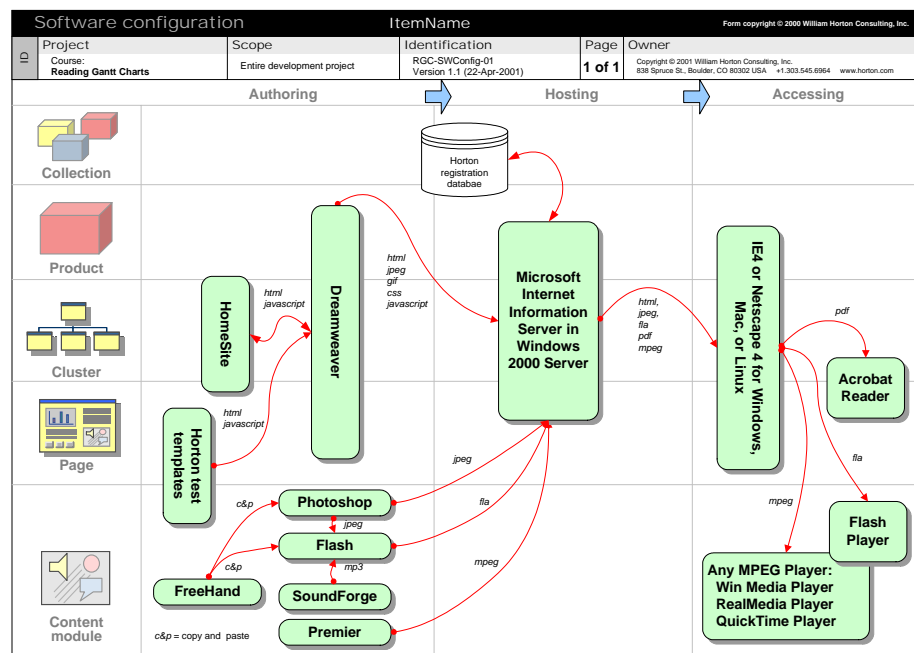
This form is available from: www.designingwbt.com/html/designforms.htm.

BUILD

Construct knowledge products quickly, efficiently, and economically

In the build phase, you make your designs for knowledge products come alive. Doing so will require much work and specialized knowledge. In building knowledge products, you must balance fidelity to the original design against the need to build quickly, efficiently, and economically. Let's see how you can do so with a minimum of compromise.

Overview of the building process

In many ways, the building process is the mirror image of the design process. On the design process, you started at the top and worked your way down, from larger concepts to smaller details. When you build, you go in the opposite direction. In building, you start with the small components. You first construct content modules, test them, and then integrate them into pages. After testing the individual pages, you integrate them into clusters, which you test and integrate into the whole.
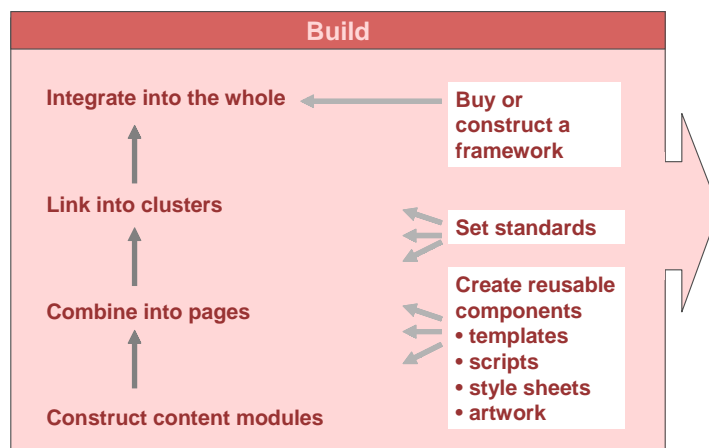
Alongside this development of content are efforts to ensure that the product is consistent and efficient. The construction of content modules and pages is aided by first creating reusable components such as templates, scripts, style sheets, and artwork.

Creative efforts at all levels benefit from standards that guide the choice of colors, typography, layouts, buttons, interactivity, and other aspects of design. (Forms are available for specifying each of these standards.)

To display the content and make it accessible, you will need a framework. In the building phase, you may choose to buy a framework or to construct one of our own. Once you have constructed or purchased a framework, you can use it in several knowledge products.

DESIGN YOUR WORKFLOW

Building knowledge products efficiently requires a well designed workflow. Such a workflow gets the right people doing the right work in the right sequence.

Production workflow

Let's look at a workflow that has evolved over several projects. It is designed to enable a small team to efficiently construct large, complex knowledge products.

First, let's meet the cast of characters. There is the **designer** who is responsible for the overall performance of the resulting product as well as its look and feel. Working closely with the designer is the product's **author**. It is the author who writes the words and prescribes other content. On a small project the designer and author may be the same person. The third member of our construction crew is a **programmer** who writes scripts and handles other highly technical tasks. The final member of the team is a **multimedia producer**. For a complex project combining many media, more than one multimedia producer may be necessary.
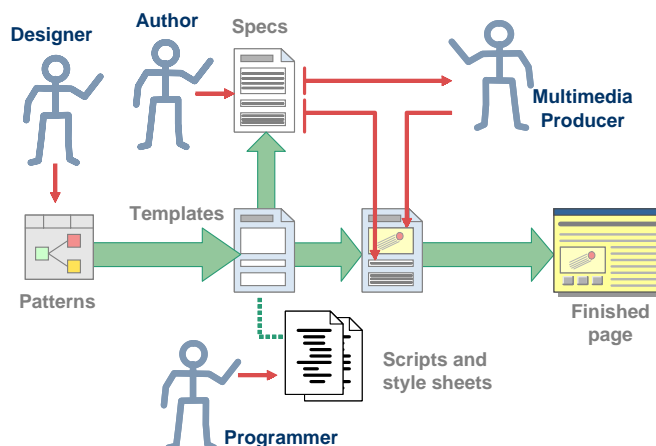
How do the team members work together to produce knowledge products? First the designer creates patterns. Patterns are specifications for general classes of things, such as all knowledge objects used to teach procedures or the use of color throughout the project. The patterns are translated into fill-in-the-blanks

templates, typically by the programmer. The programmer supplements the templates with scripts to provide interactivity and style sheets to ensure consistent use of colors and fonts. These scripts and style sheets are then linked to the templates to which they apply. The author, using either the template directly or a specification document that mirrors the template, supplies the words and describes the other necessary media. After the specification is approved, the text is placed into the template. Descriptions of additional media requirements are sent to the multimedia producer who supplies the media. Once the template is complete, the finished page or other component is added to the growing product.

Patterns (general specifications)

Patterns are general specifications for a class or category of similar components. Patterns are specified on the same forms as detailed specifications.

This example shows a pattern for a specific kind of page. It covers all topics combining a bullet list and a picture. It specifies the characteristics of all such pages we will create.

This form is available from: www.designingwbt.com/html/designforms.htm.

For example, it specifies content modules in general terms rather than precise detail. This list of content modules serves as a pattern for the author who is creating a topic of this type.

Templates

Templates are working components of the product that contain placeholders rather than subject-specific content. By providing the layout, formatting, and overall structure, templates save considerable time in creating content. Authors, rather than starting from scratch, can replace the placeholders with content for

the particular component they are creating. And the template's placeholders remind inexperienced authors of the kinds of content they may want to include.
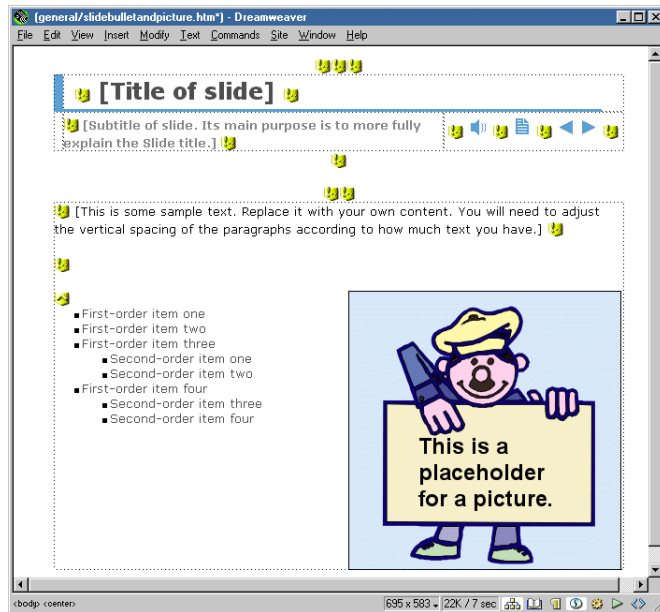
Here's a tip for you. Create overstuffed templates. That is, on the template include all the buttons, boxes, and placeholders you might ever need for this type of component. It is always easier for authors to delete something they do not need than to add something you left off.

Scripts and style sheets

Scripts and style sheets add interactivity and consistency to your knowledge product. By defining them separately from the templates or individual pages, you can reuse them freely throughout the project, thus saving considerable time and painlessly enforcing consistency.
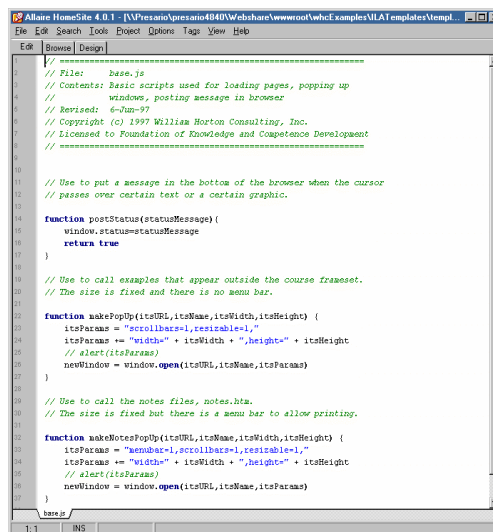
Scripts provide programming to automate functions, add interactivity, check data, and play games. The example shows a file of scripts written in JavaScript. VBScript is another language used for scripts that run on the browser. Scripts may also run on the server as well. If scripts do not provide enough flexibility or performance, you can also include components developed in other programming languages such as Java, C++, and Visual Basic. Because such scripts and components are expensive to develop, you want to design them so you can reuse them wherever appropriate.
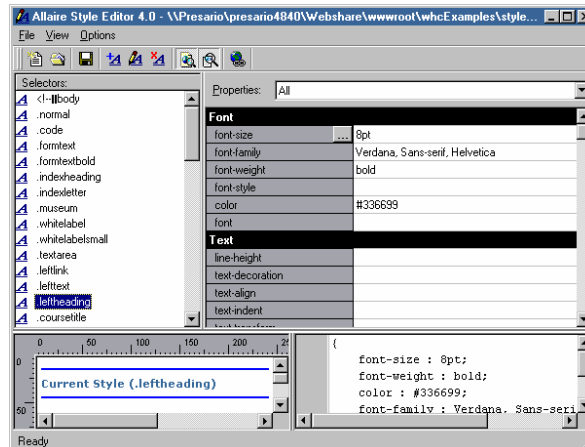
Style sheets specify the font, color, and positioning of pieces of text and other components. Supported by version 4 browsers, style sheets give great control over how information appears in your product. This example shows a style sheet being edited in a tool for that purpose. Center-right is the specifications of an individual style. A sample is shown at the lower left and the actual resulting code at the lower right.

Detail specifications

Detailed specifications specify the words and other media for actual components of content, such as individual Web pages. Specifications tell what needs to be inserted into the template to create actual content.

Detailed specifications can be created on the same forms used for patterns. Or they can be created on ad hoc forms designed to require filling only the items necessary to complete the template. Such simplified forms are typically done in a word-processing or spreadsheet format so as not to require a special program that authors may not possess.
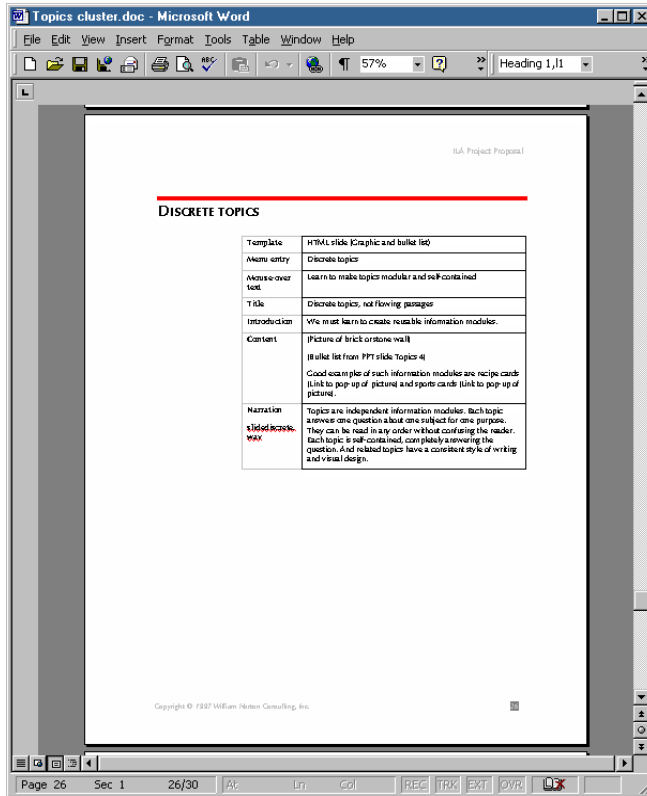
This example shows a specification in Microsoft Word. It contains slots for a title and subtitle, as well as for content. The author just types in the words and describes other media. It also contains a slot for the script the narrator reads and a slot for the name and file format of the resulting sound file. The words in the specification and the media it specifies are later added to the template to create the resulting page or other component.
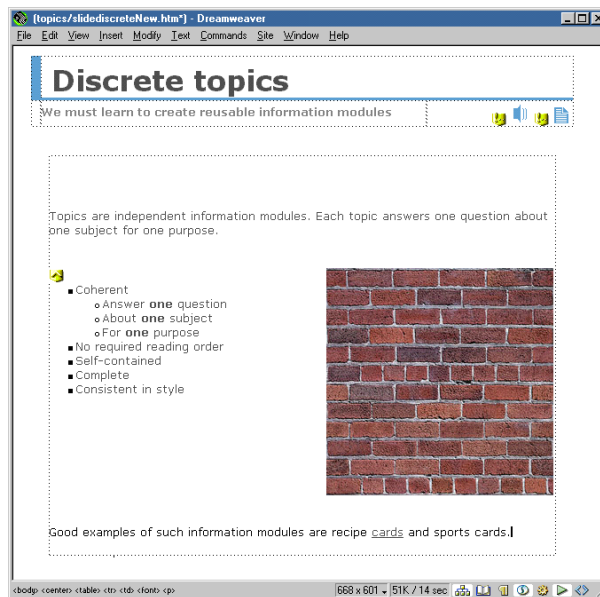
Multimedia workflow

Multimedia may require a workflow of its own depending on the complexity and type of media. Here is an example of adding narration. It starts when the multimedia developer receives the specification containing the script.
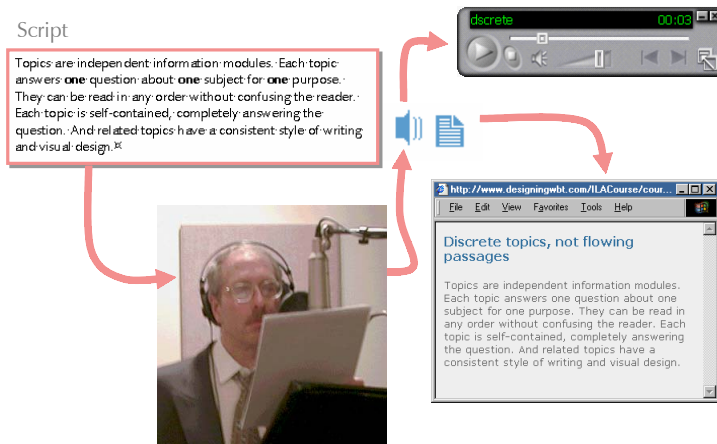
The multimedia producer may then hire voice talent and book a studio to record the narration. Once the narration is recorded, the producer must convert it to the specified format, compress it, and link it to the appropriate button in the template so that the user can play it.

In addition, the producer may need to create a pop-up window with the transcription of the narration for those with hearing difficulties or who don't want to annoy their cubicle mates. Hence, the term multimedia.

Finished page
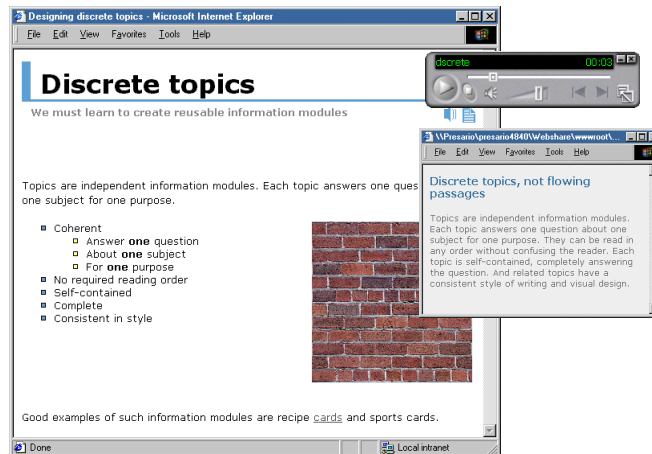
The finished page now contains the specified media and conforms to the specified look.

Design your production workflow

The production workflow we showed is a good baseline for you to develop your own workflow. Take a few minutes to sketch the ideal workflow for your project. As you do, ask yourself these questions:

1. Who are the actors (designer, author, programmer, etc.)?

2. What are the artifacts (specs, templates, prototypes, etc.)?

3. What are the processes (sketching, specifying, building, etc.)?

SET INTERNAL STANDARDS

How do you ensure consistency across hundreds of pages created by multiple authors and multimedia producers using different tools and stored in different file formats? The best solution we have found is a complete set of internal standards for colors, typography, layouts, interactivity, and dynamics.

Select theme colors

Nothing is more disjointing than nearly harmonious colors. It is like listening to a choir with three members singing off key. To ensure a consistent and pleasing use of color, prescribe a color palette.

This form is available from: www.designingwbt.com/html/designforms.htm.

In general, limit yourself to black, white, four grays, and sixteen other colors. Few consumers will be able to recognize more colors and this number is sufficient for just about anything you need to communicate.

Specify colors in red-green-blue values, in hue-lightness-saturation values, and in hexadecimal values. That way, the author designating a color in an HTML editor can match the same color being specified by a multimedia producer in Flash or PhotoShop.

When specifying colors, give guidance on where to use them. These rules will help the programmer who produces the style sheets know what colors to use in each style definition.

Select fonts

Like colors, fonts need to be used consistently. Specify the typography for your project in precise detail. That way, the text in illustrations, animations, and other content modules can match body text on the page. Such a specification forms the basis for a style sheet.

Typography					Desiging WBT Site						Copyright © 1997 William Horton Consulting, Inc.

ID	Project	Scope	Identification	Owner
	Designing WBT site	All HTML pages. Also MSWord, PPT, and others as appropriate	DWBT-Type-01 Version 1.1 - 12-Dec-1999	Copyright © 1999 William Horton Consulting, Inc. 836 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Related specs: Color: XXX-XXXXX-01   Others: XXX-XXXXX-01

Component	Font					Paragraph						Other characteristics
	Face	Size	Style	Color	Capitals	Background	Line space	Align	Width	Space	Indents	
	Font family: Helvetica, Times Roman, Arial, etc.	points, number, or +/- size	**bold**, *italic*, underlined	name (in color spec) or RGB values	ALL CAPS, Title Caps, Sentence caps, small caps	color (name or RGB values) or image (file name)	baseline-to-baseline distance	left, center, right, justify	points, pixels	before/ after	left/ right/ first	Anything else that does not fit in any of the categories to the left.
Baseline (Use these values as a default)	Verdana, Helvetica, Sans-Serif	--	normal	#000000	Sentence caps	white	110% of font height	left	565 pixels (page width)	HTML default	0/0/0	Follow these specs for text within artwork too
Body text	(base)	10 pt	normal	#000000	Sentence	(base)	(HTML default)	(base)	(base)	(base)	(base)	This is the b... page.
Title (Headline)	(base)	20 pt	bold	#336699	(base)	(base)	24 pt	(base)	--	(base)	(base)	
Subtitle	(base)	18 pt	bold	#666666	(base)	(base)	20 pt	(base)	--	(base)	(base)	Use with titl...
Heading 1	(base)	16 pt	bold	#003366	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Use as nec...
Heading 2	(base)	14 pt	bold	#336699	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Use as nec...
Heading 3	(base)	12 pt	bold	#666666	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Use as necessary
Heading 4	Courier, monospaced	10 pt	bold	#000000	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Use as nec...
Table title	(base)	12 pt	bold	#FFFFFF	(base)	#336699	(HTML default)	(base)	--	(base)	(base)	Use if a tabl...
Table head	(base)	10 pt	bold	#000000	(base)	#CCCCCC	(HTML default)	(base)	--	(base)	(base)	Use as colu...
Table row	(base)	10 pt	normal	#000000	(base)	#EEEEEE	(HTML default)	(base)	--	(base)	(base)	Use for tabl...
Body link	(base)	10 pt	underlines	#336699	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Make sure t... underlines, t...
TOC and index link	(base)	8 pt	normal	#336699	(base)	(base)	8 pt	(base)	--	(base)	(base)	Make sure links are NOT underlined (occur in left frame)
TOC and index text	(base)	8 pt	normal	#336699	(base)	(base)	(HTML default)	(base)	--	(base)	(base)	Use for text in left frame
Bullet list 1	(base)	10 pt	normal	#000000	(base)	(base)	(HTML default)	(base)	--	(base)	(HTML default)	Use special bullet: bulletblue.gif
Bullet list 2	(base)	10 pt	normal	#000000	(base)	(base)	(HTML default)	(base)	--	(base)	(HTML default)	Use special bullet: bulletyellow.gif
Footer	(base)	8 pt	italics	#666666	(base)	(base)	(HTML default)	(base)	(base)	(base)	(base)	Placed at bottom of page

Follow these specs for text within artwork too

Implement in style sheets

This form is available from: www.designingwbt.com/html/designforms.htm.

Design layouts

Specify layouts for common types of pages and other displays. The layout should specify the window size and proportions, the subdivision into frames, the location of important buttons and controls, and any transitions as the display arrives or departs.

This form is available from: www.designingwbt.com/html/designforms.htm.
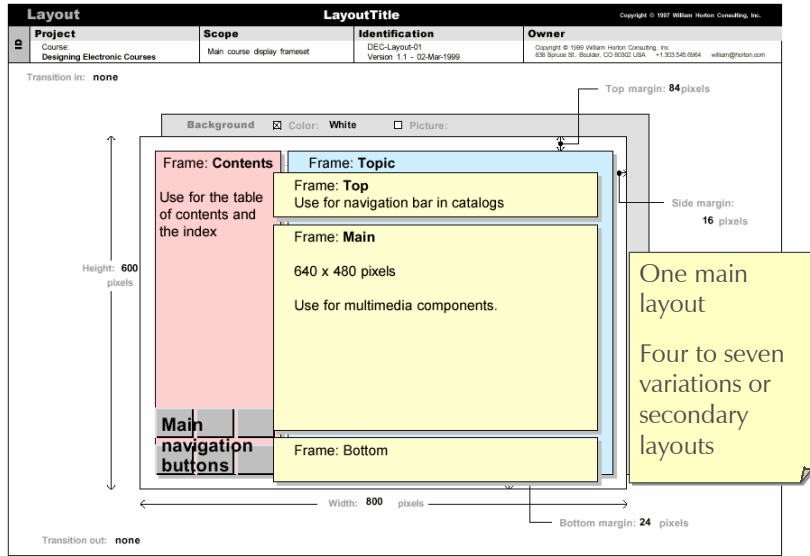
For a moderately complex project, you will need one main layout and four to seven variations or secondary layouts. Fewer than that and you will find yourself force-fitting content into the display. More than that and consumers may lose track of what the layout indicates.

What internal specs do you need?

Before you begin building your knowledge product, you need to decide what internal specifications you need. Pick the aspects of design you need to standardize. On the right are the names of forms on which you can record your standards.

Aspect of design you will specify	Forms that can help
☐ Colors	Colors
☐ Screen layouts	Layout
☐ Fonts and typography	Typography
☐ Repeated patterns of interactivity	Interactivity
☐ Overall navigation scheme	Interactivity or Cluster
☐ Repeated animation and build sequences	Storyboard or Timeline
☐ _____	
☐ _____	
☐ _____	

USE TEMPLATES

Templates are working models of pages, clusters of pages, content modules, and other items of content. They simplify and streamline producing such components, especially when producing many similar items.

Template for a page

Here is an example of a template for a Web page. It is a complete page with placeholders instead of actual content.
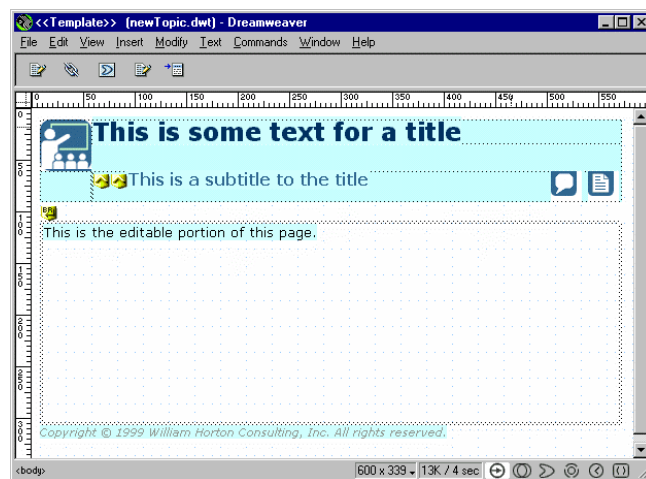
Such a template greatly reduces the amount of effort required to create a page, cutting it in half or more. Because the template has the overall page structure in place, the author does not have to start from scratch. Because the template contains formatting, either directly in the page or through attached style sheets, maintaining consistency from page to page is easy. The placeholders serve as prompts reminding authors of the kinds of content they may want to include in the template. By standardizing the things that should be the same on all pages of this type, the template lets authors focus on the content necessary to achieve the purpose of the page.

Templates are not limited to text. This example contains placeholders for emblems and other graphics. Templates can also contain placeholders for narration, commentary, links to other pages, and multimedia components. And behind the scenes, the template can contain scripts for common kinds of interactivity.
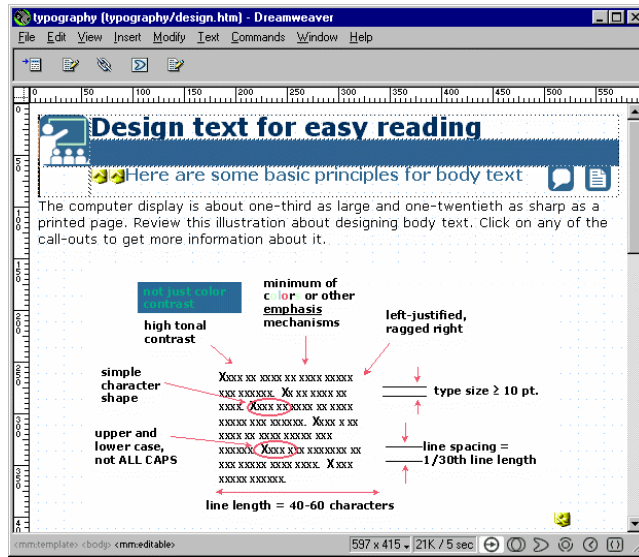
To create a new page of this type, the author just opens the template in an authoring tool, Dreamweaver for this example, and replaces the placeholders with actual content, and saves the result. Voila, a new page.

Page and element templates

In addition to templates for whole pages, you can create templates for common kinds of content modules, such as complexly formatted tables. Once you create the template, you can copy and paste it into your project.

Custom templates for components to drop onto the page
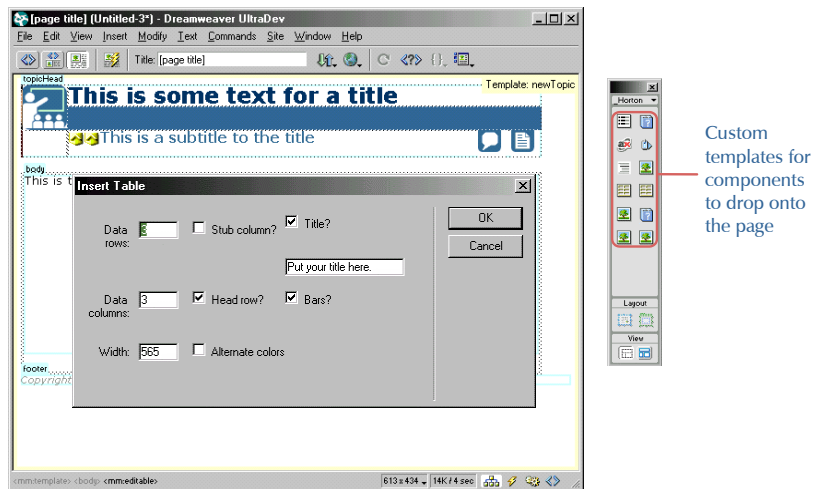
Some tools, such as Dreamweaver shown here, let you automate the process of inserting template components and filling in its placeholders. This example shows the dialog box that the user fills in after inserting the template for a richly formatted table.

What templates do you need?

For your project, you should think carefully about what components are candidates to be made into templates.

What elements of your project are good candidates to be made into templates?

Common kinds of pages: lesson introduction, objectives, summary, feedback

Course menu, index, map, glossary, instructions

Each type of test question

Here are some items that we have made into templates on projects. For training projects, we have created templates for common types of Web pages. These have included things like the lesson introduction, objectives, summary, and feedback pages.

More candidates are components of the framework that will be used in a series of related knowledge products. These can include the course menu, index, map, glossary, and instructions. Since we may be including a large number of test questions throughout the course, we will need templates for each type of test question.

What are good candidates for templates for your project?

Base pages on templates

To use templates effectively takes careful design. Rather than creating each unique page from scratch, we devised a scheme that composes unique pages by combining and completing templates.

Our scheme starts with a base template. The base template specifies the things that are the same on all pages. Such a template might include a background and fixed content that appear on all pages. It might also include some placeholders for content that varies but always appears in the same position in the same format.

| Base template | + | Type template | + | Page content | ➜ | Unique page |
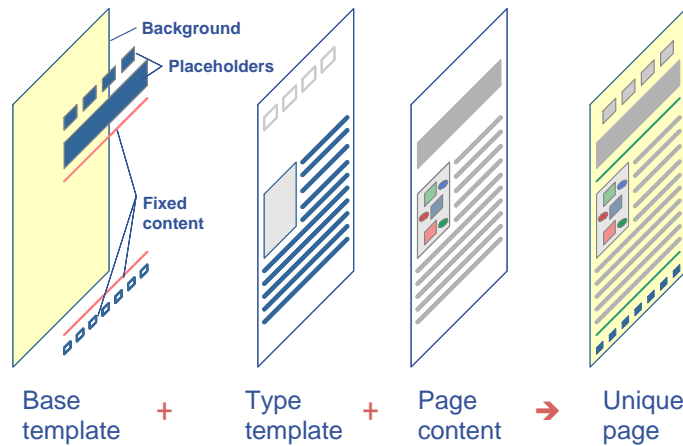
For common types of pages we may combine the base template with a type template that adds the components common to all the pages of that type. The type template contains more fixed content and placeholders. The placeholders on the base and type template are filled in by the actual content of the page.

The resulting page comes about from a combination of the base template, the type template, and the page content.

Hierarchy of templates

Let's see how this scheme can lead to the variety of pages required for a complex project.
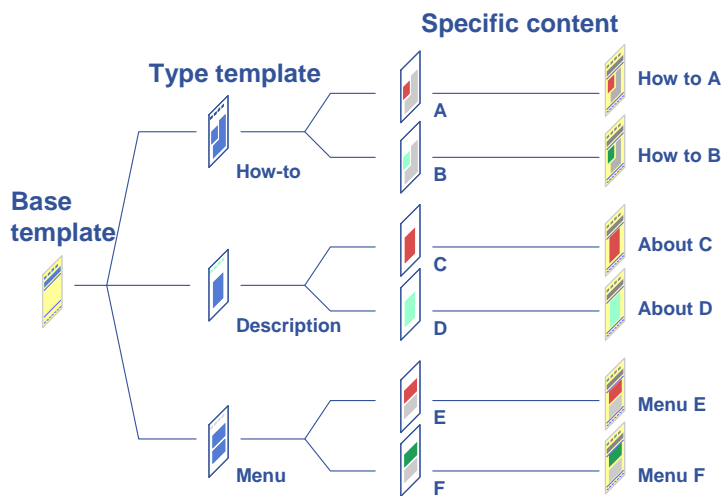
First, you start with the base template. It ensures a family similarity among all the pages based on it. Then imagine that your project will contain three types of pages: how-to, description pages, and menu pages. To create a particular page, you combine the base and how-to template with specific content yields a how-to page. If you combine the same base and type template with different content, you get another how-to page completely consistent with the first.

Having the templates available, means that each additional how-to topic requires only providing the content unique to that page.

In like fashion, you create descriptive topics by combining the base template, the description type template, and specific content. Because they share the same ancestry of templates, these descriptive topics are consistent.

Menus are created by adding menu entries to the combination of base template and menu type template.

Though setting up such a scheme takes some work, it ensures that most of the work in creating pages goes to original content. And it ensures consistency among all the pages of the project and a close similarity among pages of the same type.

Specify a template

What would you put in the base and type template for one of the types of pages you plan to include in your project?

First, specify the type of topic for which you are creating a template. Then list which of the items on the finished topic come from the base template, the type template, and the specific content.

For one type of page, what would be provided by the base template, the type template, and the specific content?

Type of topic	Lesson summary	
Base template	**Type template**	**Specific content**
ID of the course	"Summary" banner	Lesson name
Copyright notice	Placeholders for:	Bullet list of key points
Course logo	• Lesson name	Summarizing diagram or other graphic
Basic navigation buttons: Home, Menu, Next, Previous	• Intro paragraph	Links to material summarized
	• Specific content	

For example, suppose you want to create a template for lesson summaries in a course. On the base template, you would include things that would be the same on all pages, not just lesson summaries. These might include orienting information like the ID of the project, a brief copyright notice, and the course logo. The base template might also include basic navigation buttons to take the consumer to the home page, the menu, the next page in sequence, and the previous page.

To these items, the type template adds a banner identifying summary pages and placeholders for the lesson name, and introductory paragraph, and other specific content.

That specific content would include things like the lesson's name, a bullet list of key points, a diagram or other graphic to serve as a summary, and links to the material summarized.

MIGRATE LOGICALLY AND SMOOTHLY

Moving your training online benefits more from a systematic process than from a passionate riot. A systematic process must take into account of where you are now and the limitations of what you can accomplish with the time and resources available.

1. Offer proven materials

The first phase of conversion, one that most of you have already taken, is to convert the overheads to on-screen presentations—and get them legible and effective in that format. The next step is to likewise capture the other components in electronic format. You may audiotape the instructor and convert the paper documents to some digital-paper format, such as Adobe Acrobat PDF.
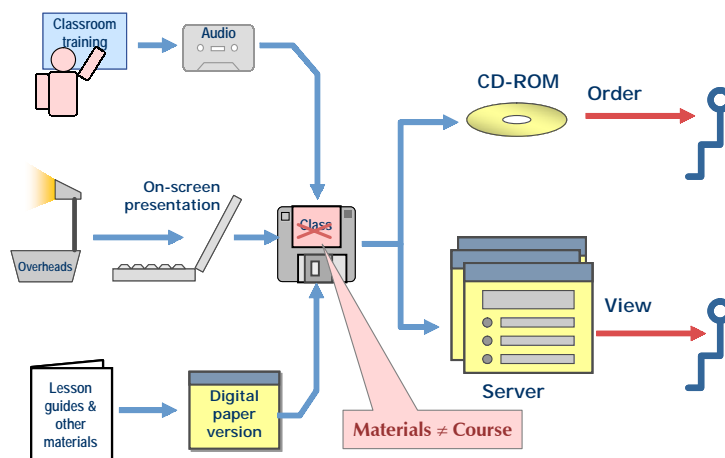
Once you have all the materials in electronic form, you can organize them into a course, which you write onto CD-ROM so that consumers can order it. And, you put it on your server in a form that consumers can view directly.

Such an offering is not a course. It is just course materials. But, that is a start; and, for many who are hungry for learning, it is a virtual feast.

2. Adapt existing materials

A Phase 2 conversion starts at the same point, but yields a more Web-savvy result. It assumes you have an effective classroom course, illustrated by overheads

or on-screen presentations, and supplemented by paper lesson guides and other materials.
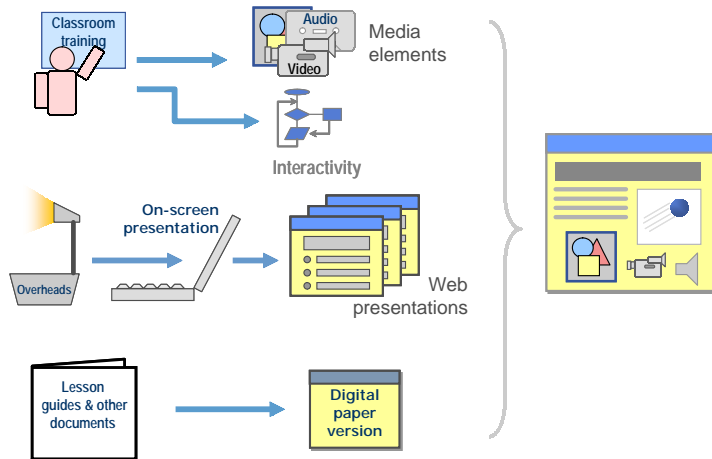
The first step is to capture the words and images used by the instructor in the classroom and put them into a format that Web browsers can display. Classroom interactivity is likewise replicated in online interactivity.

Next, the classroom presentations and activities are converted to HTML so they can play directly in a browser without a special proprietary or platform-specific plug-in. Lesson guides and other materials are also converted to HTML.

Once the materials are all in browser-friendly formats, all that remains is just to link them so that consumers can access them directly from their browser. This may require linking to sounds, animations, and other optional materials.

3. Develop new courses

Phase 1 and Phase 2 conversions merely try to replicate the classroom materials on the Web. As such, they focus on converting materials rather than experiences.

Phase 3 involves a redesign, starting with an analysis of the requirements for the course. It requires analyzing the abilities of consumers and their specific needs for knowledge and skills.
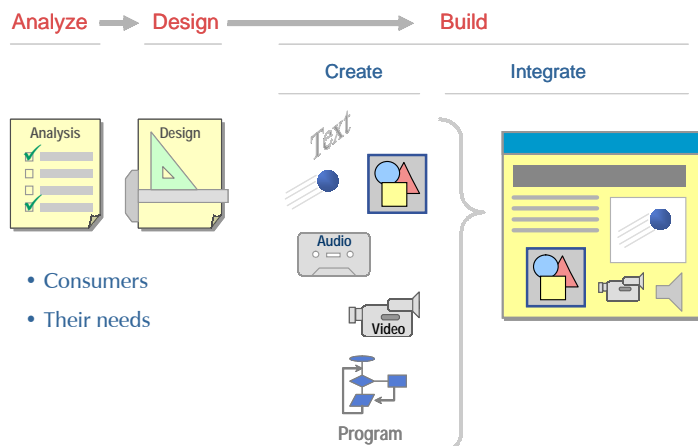
Based on this analysis, the development process continues with a design that accomplishes the course's objectives.

The final stage involves actually building the course. That will require creating the various media, such as text, pictures, animations, narration, sound, video, and any programming required for effective and frequent interactivity. Then, all the components are then seamlessly integrated into the course structure.

CREATE DOCKING MODULES

If you include materials originally designed for another purpose in your course, prepare a "docking module" to ensure that your consumers can make a smooth transition to the borrowed material.

Handling "foreign" modules

How do you display "foreign" modules, that is, materials not developed to your standards and for your purposes?

Such modules may prove confusing to consumers accustomed to the system's "native" modules. Furthermore, such modules may not seamlessly fit the system's framework. Well, you must design a "docking module" to fit between the foreign content and the learning system's framework.
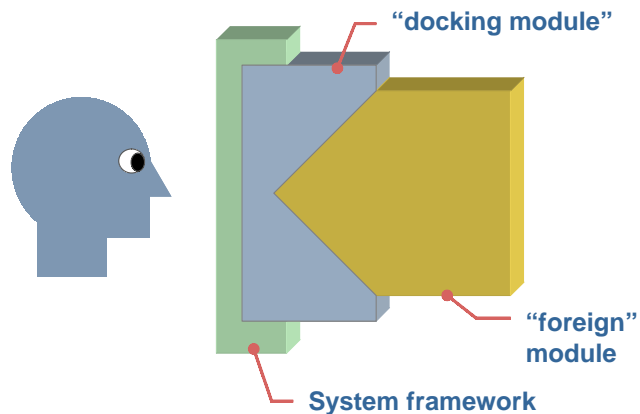
What is a "docking module"?

So what is a docking module? A docking module consists of ways to make the foreign module work well within the system. Because foreign modules will vary widely, docking modules have no single definition.

They will typically require several approaches. They may require a special browser frameset to make foreign modules fit within your framework. Or, these

modules may have to appear in a separate window. Before consumers are thrown into a foreign module, they should see an overview or preview. This may take the form of an abstract, description, or summary.

One of the most important functions of the docking module is to prepare the consumer for the foreign module. It should make consumers aware of the limitations of the foreign module. For instance, does it follow different conventions in how its navigation buttons work or how it displays information?

Because the foreign module was not prepared specifically for your framework, not all of its material may be relevant. The docking module can point out which parts are valuable and which not. Even valuable foreign modules can contain mistakes or may advocate approaches not wise for the company.

Further, if foreign modules are licensed from a non-company source, consumers must be informed about the restrictions of the license. And, if not all of the information in the foreign module is equally valuable, the docking module should provide ways to efficiently access the useful content while avoiding the rest.

The simplest approach may be a set of instructions telling consumers the best way to take the course or read the book. In some cases, docking module can include a set of bookmarks, a set of hypertext links, to the most important topics of the foreign module. In other cases, the docking module may need to provide a company-oriented index of the foreign material. If the material requires specific plug-ins, fonts, or other components, the docking module can provide buttons to download and install those components. A glossary can help the consumers understand terminology in a foreign module, especially when that terminology differs from the terminology used at the company.

Many foreign courses will not have a test or their test will not measure the knowledge and skill important to the company. The docking module may provide a special test for the company's purposes.

Provide a docking module

If you are using materials developed by others, consider providing a docking module to join that material seamlessly to your knowledge product. A docking module consists of anything that helps consumers use the foreign material to accomplish the objectives of your product.

What goes in a docking module? Here are some suggestions:

- **Prepare the consumer** for the external material. Warn the learner that they are about to encounter material from an external source and that the material may look and behave a bit differently.

- **Respect copyright**. Acknowledge ownership of the original material and ensure consumers know of any restrictions on their use of the material.

- **Focus attention**. Tell consumers what they should notice in the external material. And what they can safely ignore.

- **Evaluate understanding**. Verify that consumers acquired the intended knowledge from the foreign material. Even if the foreign material contains an assessment activity, remember that such an activity may not reflect your goals.

Here is an example of a docking module for a lesson on typography. It prepares the consumer by pointing out how this module is different from ones they are used to reading.
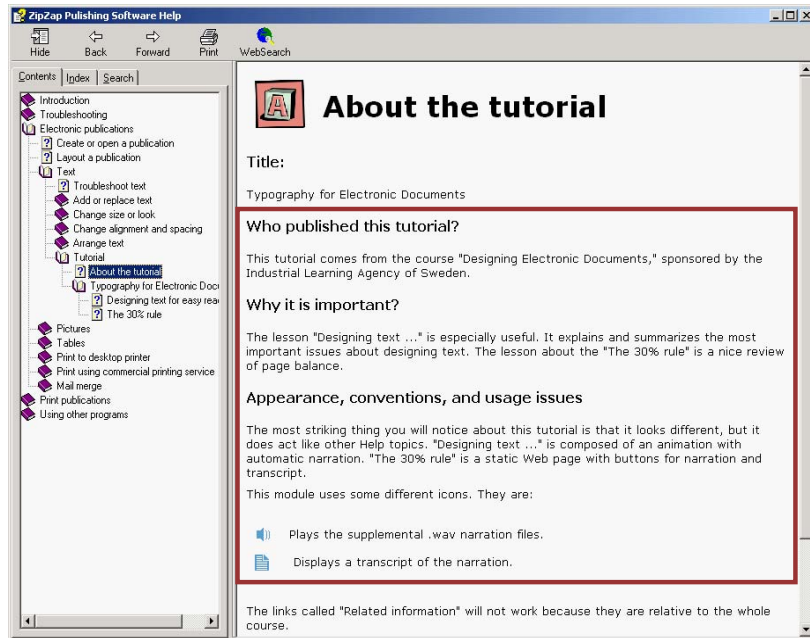
Specify a docking module

If you plan to use modules developed by third parties in your knowledge product, use this diagram to help you decide what the docking module should contain.
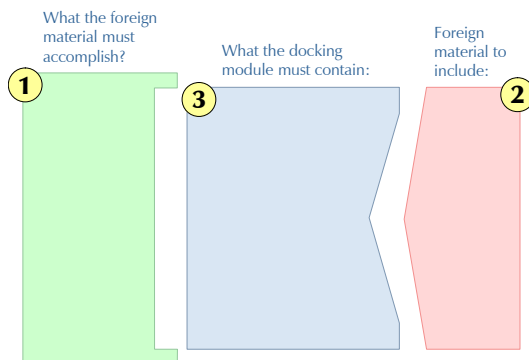
1. First, decide what the foreign material must accomplish.

2. Second, specify what foreign material to include.

3. Finally, specify the contents of the docking module.

EVALUATE

Measure the success of the project

Evaluation is the process of reckoning the value of your knowledge product. Evaluation is important because it tells you whether your efforts were worthwhile and how you can further improve your knowledge product. It is most commonly performed for e-learning knowledge products rather than informational knowledge products.

Overview of evaluation process

Evaluating a knowledge product follows a systematic flow of activities that monitors how well the product worked and suggests ways to improve it.
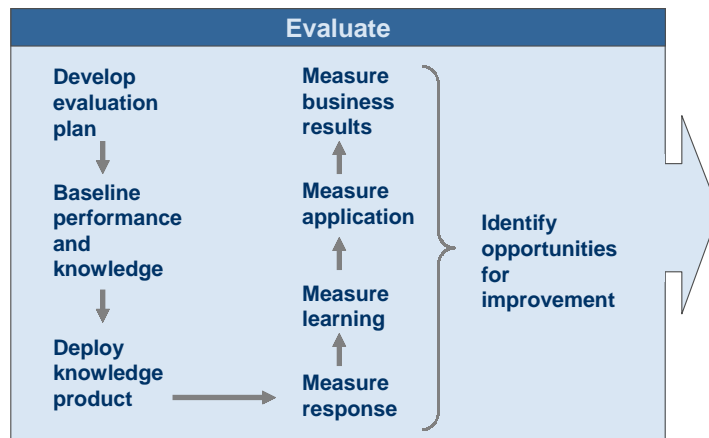
The first step is to develop your evaluation plan. Ideally you should do this right after setting objectives for your project.

Your next step should be to baseline consumers' performance. By measuring their current level of job performance, you establish a norm against which to measure improvements. Likewise, you may want to measure their current level of knowledge. For a course or tutorial, you typically conduct a pre-test just before consumers start the course.

With current levels of performance and knowledge recorded, you are ready to deploy the knowledge product among your test consumers. Usage may continue over a period of time appropriate for it to accomplish its objectives.

At the end of this period (or periodically during its usage), you may measure the response of consumers. Are they satisfied with the knowledge product? Also, at the end of the usage period, you will need to measure improvement, that is, by how much did the skills and knowledge of consumers increase?

Later, after consumers have had some time back on the job, you can measure the degree to which they are applying what they gained from the knowledge product. Are they applying what they learned? Are they using a provided job-aid or online document?

Perhaps over a longer period of time, you can measure the business results of the project. Did it cut costs, increase revenues, or open new markets?

To put all this research to work, you must not forget the final step. You must identify opportunities for improving the knowledge product from what you learned at each level of evaluation.

LEVELS OF EVALUATION

To evaluate e-learning, I like to use a structure that was invented when computers weighed tons; and, when we referred to a "network," we were talking about television. The four-level evaluation scheme developed by Donald Kirkpatrick works well for evaluating e-learning; because, we are evaluating the effects of a knowledge product, not how that knowledge product was delivered. Such a scheme rightfully reminds us that knowledge products are a means to an end. And it is the ends we must evaluate.

Recap of the levels of evaluation

Let me recap the levels and what each measures. As I said, there are four levels.

Level of evaluation		What it measures
4	Results	How well did the organization meet its business goals?
3	Application	How much is job performance improved? What can consumers apply to their jobs?
2	Learning	What skills and knowledge did consumers acquire?
1	Reaction	Did consumers like the knowledge product? Did they complete it?

Level 1 is commonly called reaction and it measures whether consumers liked the knowledge product or whether they even completed it.

Level 2, called a learning evaluation, attempts to measure the skills and knowledge that consumers acquired in the knowledge product.

Level 3, called application, goes further and measures how much job performance is improved by consumers applying what they learned in the knowledge product to their work back on the job.

Level 4, the highest level, measures business results. It asks how well the organization met the business goals that gave rise to the knowledge product in the first place.

We'll elaborate a bit on each level as we discuss how to evaluate knowledge products at each of these levels.

Tie evaluation to objectives

Evaluation should mirror the objectives set in the analysis phase. In the analysis phase, you set a cascade of goals: business goals, performance goals, project goal, and, optionally, response goals. In the evaluation phase, you monitor how well you met each of these objectives.
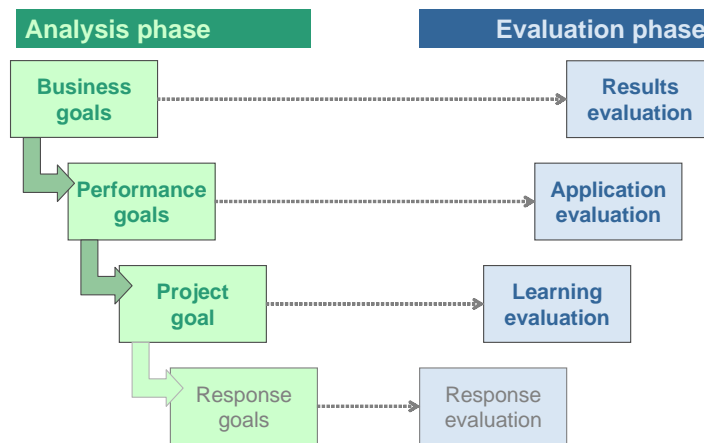
To monitor response goals, you conduct a response evaluation to determine the extent to which the intended users of your knowledge product actually used it and whether they liked using it. Response evaluations correspond to Donald Kirkpatrick's Level 1 evaluations.

The project goal leads us to conduct what is commonly called a learning (or Level 2) evaluation. This evaluation measures what consumers acquired by using your knowledge product. It measures what new skills, abilities, beliefs, attitudes, or behaviors they gained.

Performance goals lead to application evaluations. Application evaluations measure the degree to which people are applying what they gained to their jobs. Is their on-job performance substantially altered by the knowledge product? Application evaluations are commonly called Level 3 evaluations.

The highest level of evaluation is a results evaluation. It measures the business results of the knowledge product, usually in the same economic terms with which the corresponding business goal was stated. Business results are called Level 4 evaluations and often feature a return-on-investment calculation.

Level 1: Response

Level 1, or response, evaluations measure the reaction of consumers to the knowledge product. It asks whether consumers liked the knowledge product or did they even complete it.

What does Level 1 tell you?

What does a response evaluation really measure? It can tell you whether consumers feel they personally benefited from the knowledge product. It can also tell you something about their motivation. Were they sufficiently motivated to overcome the challenges posed by the knowledge product? A Level 1 evaluation can also tell you whether consumers found the learning experience emotionally satisfying.

When is such knowledge useful to you as a developer of knowledge products? Reactions are especially important in marketing something as new as e-learning. Testimonials and word-of-mouth advertising are crucial to the success in attracting consumers. Bad word of mouth will kill e-learning quicker than a server crash.

Level 1 evaluations help you quickly identify consumers who lack the motivation to benefit from e-learning. For these consumers you must either add motivation or find alternative forms of the knowledge product.

One of the best uses of level 1 evaluations is to recognize and deal with frustrations of consumers—while they are still consumers.

How to measure response

How do you measure responses for a Level 1 evaluation? Commonly, consumers fill in evaluation forms with familiar Lickert-scales. These are sometimes called "bingo cards" or "smiley sheets. "

Knowledge products, because of their use of networking and computer media, offer additional ways to monitor consumers' responses. You can monitor such things as the frequency with which consumers access the course, the number of pages or other modules they access, the rate at which they submit assignments, their degree of participation in online discussions and chat, and their rate of progress through the course. All of this raw data can be collected automatically by the Web server hosting the course or by special tracking software.

A useful technique is to let consumers vote on experimental aspects of course design, such as the inclusion of a particular lesson. By focusing the vote on a component rather than the whole course, you can obtain more specific reactions. This technique is especially helpful when coupled with a discussion thread where consumers can go to state their reasons for voting as they did.

Focus groups are another way to review consumers' responses to the knowledge product. You can conduct a focus group by bringing representative consumers together for a meeting. A discussion on the quality of the knowledge product gives consumers a place to express their opinions, hear the opinions of others,

and discuss their differences. Such discussions provide a pressure valve for frustration. The need to communicate clearly to peers may prompt consumers to make their comments complete, clear, and logical.

For distributed consumers, however, a meeting is not practical—unless you do it by conferencing software. The simplest such software is chat or instant messaging. Chat has two main advantages over audio- or videoconferencing. It is familiar to millions of younger consumers, and it leaves a written record. Another possibility is to create a discussion forum where consumers can comment on course quality at their convenience rather than having to all be online at the same time.

Invite people to comment at any point. Make it easy. Do not hide your e-mail addresses. Allow people to send a comment at any time—just by clicking a button and then filling in a short pre-addressed form.

Have a comment button that consumers can click to express their opinions at any time. One of the most important things is to listen. Get feedback frequently. Do not wait until the end of the course. Ask at the end of each module. That way you can spot problems before you have lost most of the class.

Level 2: Learning

They liked the course. They all completed it. But did consumers actually learn anything?

What does Level 2 tell you?

What does a Level 2 or learning evaluation tell you? It measures what specific facts, concepts, skills, attitudes, and beliefs consumers acquired in the knowledge product.

Such knowledge is especially useful when job performance depends on the specific content measured. If what you teach applies directly to the jobs consumers do, then testing on that content can predict the value of the course in improving job performance.

If you are teaching generic skills and knowledge that will be applied in many kinds of jobs, it may not be practical to measure performance on all these jobs. Measuring learning may be the highest practical level of evaluation you need.

Level 2 evaluations are economical, especially compared to those at higher levels. And, they are meaningfully related to the objectives of the knowledge product. If they are the best you can afford, use them unapologetically.

How to measure learning

How do you evaluate learning at Level 2? For conventional knowledge products, you can use tests, quizzes, and final examinations. You can also use a pre-course and post-course test to measure the differences in knowledge levels.

Much of the evaluation of individual consumers comes from the opinions of instructors, mentors, or discussion moderators. These same people can render expert opinions on how successful they thought the knowledge product was in accomplishing its learning objectives.

For knowledge products incorporating collaboration mechanisms, you can add additional evaluation methods based on these mechanisms. You can observe consumers' participation in discussion groups, chat sessions, and other collaborative activities. Because these collaborative activities have permanent recordings, you can, in turn, ask consumers to evaluate the participation of their peers.

Level 3: Application

Level 3 evaluations track the knowledge product back onto the job. How much better can your consumers perform their jobs as a result of the knowledge product?

What does Level 3 tell you?

What does a Level 3 evaluation measure? Application evaluations measure the degree to which consumers apply the knowledge product to their jobs and daily lives.

They are valuable for knowledge products aimed at directly improving job performance, especially where failure to apply knowledge and skills has been a problem. For example, learning evaluations may show that consumers acquired the necessary skills in the classroom, but job records show that nothing has changed back on the job.

Level 3 evaluations are also important where you set a high priority on putting theory, principles, or concepts into practice.

How to measure application

Since performance is performance, there are no special techniques for measuring job performance, though we may choose to implement some of these methods electronically.

We can evaluate job performance by consulting job records before and after using the knowledge product or by directly observing on-job performance. Such observations may require efforts by the employee's supervisor. Even without direct observations, the opinions of supervisors, peers, and subordinates of trainees may provide indicators of performance improvements.

In some companies, employees must commit to action plans or performance contracts. Tracking fulfillment of these contracts provides evidence of the effectiveness of the knowledge product.

A more scientific approach may be to compare the performance of a group that receives the knowledge product with that of an identical group that does not. For

this approach to work, you must randomly select participants for the two groups. Those not selected for the knowledge product serve as a control group. Other than the fact that one group receives the knowledge product, the two groups are identical. Then you compare the work performance of the two groups. The difference represents the improvement due to the knowledge product.

A slightly more sophisticated technique monitors trends in the performance levels of a group before and after the knowledge product. In this approach, you monitor performance of a single group before it receives the knowledge product and again over a period of time after it receives the knowledge product. It is important to monitor trends, not just levels, so you can discount the effect of other interventions on performance that may be active at the same time.

Level 4: Business results

Level 4 evaluations measure whether the knowledge product met its original business and organizational goals?

What does Level 4 tell you?

Specifically, a level four evaluation measures whether the organization is better off for having sponsored and conducted the knowledge product. It determines whether the original business and organizational goals that instigated the knowledge product were met. It also may measure the rate of return on money invested in the knowledge product.

Level 4 evaluations are helpful in deciding among different knowledge products and between knowledge products and other interventions. They can guide you to select the most cost-effective solution.

Such evaluations also help you document and demonstrate the benefits of the knowledge product to tight-fisted and skeptical executives. And, by focusing your attention on the business results of the knowledge product, Level 4 evaluations guide you in aligning knowledge projects to basic business goals.

How to measures of business results

Measures of business success range from mathematical formula to broadly expressed social goals. Probably the most often mentioned business metric is return on investment, which just measures the ratio of the net benefit of a project to the cost of completing it.

Many companies in rapidly moving and highly competitive markets worry more about reducing the time to bring a product to market than its direct financial results. Other companies make raising their market share, stock price, or earnings the primary goals. Some companies with more of a long-term perspective may stress the growth of intellectual property as measured by the number of patents, copyrights, and inventions created by their staff. Similar minded companies may measure success by their ability to recruit and retain talented workers. Still, for

other companies, social responsibility or their reputation and leadership in their field are most important.

The key to successful evaluation at the results level is to describe results in terms appreciated by the organization paying for the knowledge product.

EVALUATION PROCESS

Good intentions do not by themselves lead to successful evaluations. Accurate, detailed evaluations require a systematic process, adequate time, and sufficient budget. Let's review key elements of this evaluation process.

Evaluation timeline

The timeline of a typical evaluation process shows several distinct phases: Planning the project, measuring baseline performance, deploying the knowledge product, measuring performance again, analyzing results, and reporting findings. Let's look at each of these phases in a bit more detail.
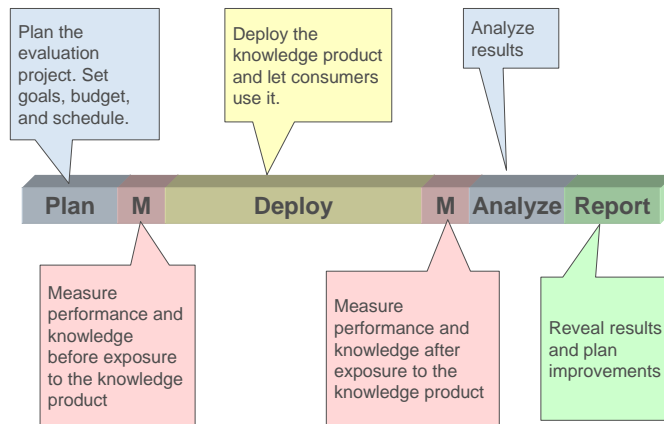
In the **planning phase**, you decide how you will conduct the evaluation. You set goals, fund the budget, and schedule the work.

The next activity is to **measure performance and knowledge** of consumers before exposure to the knowledge product. This process is called baselining because it gives us a baseline against which to measure any improvements.

Next you **deploy the knowledge product** and let it do its magic. You must allow enough time for consumers to use the knowledge product and enough time for them to find authentic opportunities to apply what they learned from using it.

After consumers have used the knowledge product, you again **measure performance and knowledge** to compare with the baseline values.

Then you **analyze the collected data** to spot trends and notice patterns. You also strive to separate true effects from happenstance and coincidence. You may also summarize results in a set of easily understood metrics.

Finally, you **report results**. You reveal your results to interested parties and plan improvements for the next round of design.

For each measurement, decide …

For each data item you plan to measure, plan how you will accurately and economically capture this data. Start by identifying the data items you will capture. Specify whether you are measuring a response, knowledge, ability, or attitude. For example, in a sales-training course, you might want to measure the ability to sell high-margin products.

Data item:	☐ Response ☐ Knowledge ☑ Ability ☐ Attitude	*To sell high-margin products*
When measured:	☑ Before ☐ At end	☑ *6 Weeks* _____ after end
How measured:	☐ Test ☐ Survey ☐ Interview ☐ Focus group ☑ Job records ☐ Observation ☐ Other: _____	
From whom:	☐ Consumer ☐ Instructor ☐ Peer ☑ Supervisor ☐ Subordinate ☐ Other: _____	
By whom:	*Manager of a parallel department*	

Next, think about when these items are measured. They can be measured before the knowledge product is deployed, at the end of the consumer's use of the product, or some time later. For our sales course, you will measure before the training and six weeks after the end of training. The six-week delay is necessary to give sales representatives time to begin applying what they learned.

Consider how you will measure results. Some methods are easy and quick while others are difficult and expensive. Some common methods of measuring results include tests, surveys, interviews, focus groups, examinations of job records, and observations of performance in the field. For our sales course, we can measure the sales records for sales representatives.

For each data item, you need to specify from whom you will gain this information. Who will provide access to the needed information? You could ask the consumer, the instructor or facilitator in training, peers and co-workers of the consumer, the supervisor of the consumer, or subordinates. For our sales training, we will obtain sales figures from the supervisor of the consumer.

A final decision is who will be responsible for gathering the data. In our case we specify that the data should be gathered by a manager of a parallel department to

the one deploying the training. This removes any conflict of interest on the part of the data-gatherer.

Analyze collected data

It is easy to overwhelm yourself and others with intricately detailed data. For data to be valuable, you must analyze it to extract its meaning and implications. First, you must remind yourself of what raw data you are collecting.

Data items	Calculations	How effects are isolated
Sales of high-margin products Per sales representative *Overall sales too*	☑ Totals ☑ Averages ☐ Std deviations ☐ Medians ☑ Other: *Profit per sales rep before and after training*	*Sales increase: $10 million* *X % due to training: 40%* *X Confidence 50%* *= Confident results $ 2 Million*

In the case of our sales training, these items might be figures for sales of high-margin products per sales representatives. They might also include some other items necessary for perspective, for instance overall sales figures.

Next, you need to think about what measures you will calculate from the raw data. Commonly calculated measures include totals, averages or means, standard deviations and indexes of variance, medians, and other statistical measures. For our example of sales training, you would calculate totals, averages, and the profit per sales representatives before and after training.

One final step is often omitted because it is difficult. That is the step of isolating the effects of your knowledge product from other causes of the observed changes. You must state how confident you are that the changes you report are due to your knowledge product and why you have this confidence. For our sales training, you might discount the sales increase, say $10 million, by the percentage of that increase that supervisors attributed to training (40%) and by their confidence in their answers (50%). The result of $2 million is the amount of improvement that you could confidently claim to be due to training.

Report results

Once you have analyzed the results, you need to report them. What you have learned may be of great value in bolstering support for your project and for setting realistic expectations for future projects.

Results	To whom	How communicated
Increase IN knowledge of features and benefits *Sales increase due to training*	*Director of training* *VP of Human Resources* *Sales managers* *Sales reps who participated*	☑ **Paper report** ☐ **Online report** ☑ **Presentation** ☐ **Other:** **Format:** *10-15 pages summarizing results* *45-minute slide show*

Decide what data and measures you will report, to whom you will share results, and what form your report will take. It is important to make these decisions before collecting data. They will help you answer questions about privacy and access.

For our sales training example, you might decide to report the increase in knowledge of features and benefits of high-margin products and the sales increase due to training. You might then prepare our report for the director of training, the vice-president of human resources, regional sales managers, and the sales representatives who participated in the study. Finally, you might plan to offer your report both as a 10-15 page paper document summarizing results and a 45-minute live presentation.

Plan the evaluation process

Commit your evaluation plan to writing and have it approved by those funding the project. Make clear how you will conduct the evaluation so that everyone agrees that the evaluation will be fair and complete. We use the **Evaluation plan** form for this purpose.

Evaluation plan			High-margin sales training				Form copyright © 2001 William Horton Consulting, Inc.

ID

Project	Scope	Identification	Page	Owner
Program: High-margin sales training	Evaluation of the first version of the training only.	HMST-Evaluation Plan-01 Version 1.1 – 12 Nov 2000	1 of 1	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 www.horton.com

Goal

Purpose	Levels	Objectives to measure
To guage the effectiveness of the training program in meeting its business objectives.	☐ 1 Response ☒ 3 Performance ☒ 2 Learning ☐ 4 Results	As stated in the program charter: To increase sales of high-margin products by ensuring that sales representatives can translate product features into benefits that customers can understand and appreciate.

Process

Schedule / **Budget**

Step	Date	Who	Step	Date	Who	Step	Date	Who	Budget
Specify detailed eval plan.	12 Dec 00	Trng mgr	Analyze data	25 Feb 01	Analysis team				$12,000 USD in salary-time of participants
Conduct training	1-10 Jan 01	Facilitator	Report results	5 Mar 01	Trng mgr				
Gather data	1-8 Feb 01	Trng dept staff							

Data collection

Data item	When?	How collected?	From whom?	By whom?
Knowledge of high-margin features	At start and end of training	Online tests of knowledge of features	Trainees	Built into training course
Ability to translate to customer-benefits				
Sales rate of high-margin products	30 days after trng	Sales figures for products by trained reps	Sales managers	Training manager
Are customers buying because sales reps are better informed	30 days after trng	Interviews and focus groups	Customers and sales managers	Training manager

Analysis

Target measures	Methods of calculation	How controlled for other factors	Who performs analysis
Knowledge levels of features and benefits of high-margin products before and after training Sales increase due to the training program	For knowledge: average and std deviation of increase. For sales, multiply percent of increase thought due to traning by confidence in this estimate to yield a confident lower estimate of effect of training.	Trained group will receive no other sources of knowledge. Sales managers and customers will be asked to estimate what percentage of the sales increase resulted from better informed sales representatives as apart from other factors.	Manager of a parallel training department--one with no stake in the results of this evaluation.

Report

What results reported?	To whom?	How communicated
Increases in knowledge of features and benefits Sales increase due to training	Director of training and VP of HR Sales managers involved All training department managers Sales reps who participated	**Form** / **Format** ☒ Paper report 10-15 pages summarizing main findings ☐ Online report ☒ Presentation 45-60 minutes with graphs sumarizing findings

This form is available from: www.designingwbt.com/html/designforms.htm.

IDENTIFY OPPORTUNITIES FOR IMPROVEMENT

The final step of evaluation is often the most valuable. In analyzing, designing, building, and evaluating the knowledge product, you have learned a lot about the knowledge product and your head is probably buzzing with ways it could be made better or how you could do your next project more efficiently. Take some time to commit those ideas to writing before they vanish.

Recommend improvements

Here is a form for systematically identifying and recommending improvements. For each problem you want to eliminate or each incident where results were not up to your standards, record four kinds of information.

First, describe each significant incident in the test or evaluation that indicated a problem with the knowledge product or a need for knowledge by the consumer.

This form is available from: www.designingwbt.com/html/designforms.htm.

Second, rate its severity. We use a scale ranging from 10 indicating danger to human life to 1 indicating something that was just not the way the consumer might have preferred.

Third, identify what knowledge (or other change in the product) could have prevented the problem or made resolving it so simple that the consumers could have solved the problem without outside help.

Finally, identify ways the problem can be prevented. What changes are necessary to ensure that consumers have the knowledge necessary to avoid this problem?

APPENDICES

ANALYSIS TECHNIQUES

Several techniques are helpful in our task of analyzing consumers and the knowledge they need and stating those requirements precisely. Let's look at these techniques.

Knowledge ecology

Crafting complex knowledge solutions is seldom simple. This is especially true when the solution must span the knowledge needed and shared by many people within several different organizations.

One form of analysis can help us pinpoint the performance changes necessary to accomplish a business goal. This analysis method is called knowledge ecology and it analyzes the flow of knowledge within an organization or a population.

Knowledge ecology can, for example, analyze both direct and indirect flows of information among different departments or between an organization and various groups of its customers.

Examine the knowledge ecology

Let's look at a simplified example of the knowledge ecology. It concerns how potential buyers of a product get the knowledge they need to buy and use the product.
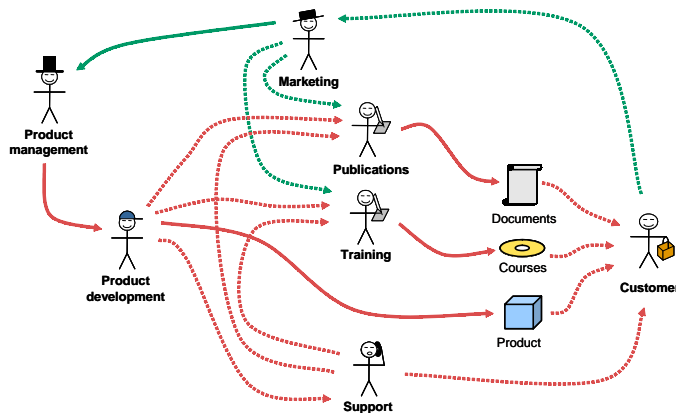
You start with the training department, which was the initial focus of the study. The training department produces courses. The solid line from training to courses indicates that the training department creates or "pushes" the knowledge

The customer, or user, consumes the courses to learn about the product. The dotted line indicates that the customer chooses whether to consume the information. That is, the customer "pulls" knowledge from the course.

This training perspective, however, does not tell you very much. Let's take a broader perspective and look at where the knowledge in the courses comes from and what other sources of knowledge inform the customer. To do that, you have to go back and look at how the product came to be in the first place. The first step was probably intelligence gathered by marketing about the needs of the customer.

That knowledge about the customer was passed along to product management, which decided whether the company should develop a new product or modify an existing one. The assignment of developing a product to suit the needs of the customer was passed to the product development group. After a lot of work, a new product or version emerged. The customer bought the product and learned about it.

Now, let's look at some other flows of information behind the scenes. Where did the training department get the information for its courses? Well, from marketing they learned the needs and characteristics of the customer. From product development, training learned about the technical details of the product. The customer also had other sources of knowledge. One of them was telephone support. Another source was the documents shipped with the product.

So, where did the documents come from? In this case, the company had a separate publications department. Like the training department, the publications department drew on marketing and product development for knowledge. Both training and publications also depended on the support group to learn what knowledge was missing from training courses and documents. Support did not exist in a vacuum. It relied primarily on product development for knowledge about the detailed workings of the product.

Whew! That was a lot of work. And this was the simplified version.

Problems in "knowledgeland"

Let's see what you can observe in this diagram. What problems do you notice right off the bat? The first problem is the gossip-game loop. This refers to the long, circular path from the customer through marketing, product management, product development, and back to the customer. Remember the party game where you whisper something to the person next to you, who in turn whispers it to the next person in the loop? By the time it gets back to you, it bears no resemblance to what you originally said. Often that is what happens when too many intermediaries sequentially try to interpret the needs or desires of the customer.
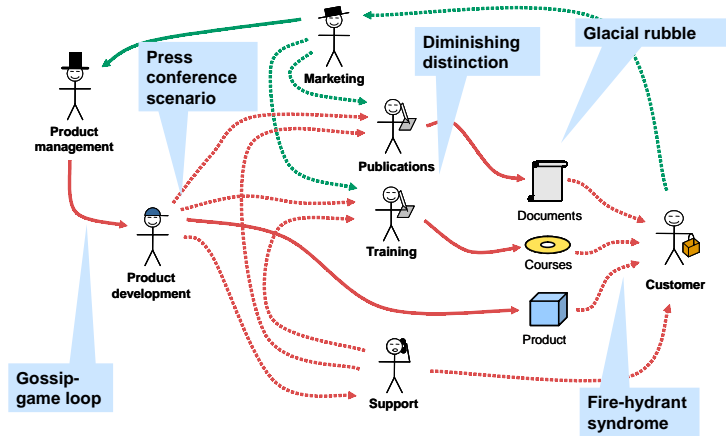
Another problem is the press conference scenario. The product development department must answer questions, often the same questions, from publications, training, and support groups. Unfortunately, it is not as efficient as a press conference where everybody asks their questions at the same time and everybody hears all the questions and answers.

As documents and courses become digital, there is a diminishing distinction between the functions of the training and publications departments. The customer does not remember or care which department was responsible for which Web page or CD-ROM.

As the glaciers of the Ice Age inched their way forward they bulldozed huge mounds of rocky debris in front of the advancing ice. This glacial rubble resembles the piles of unread documents and untaken courses produced by some organizations.

A final problem is indicated by the informational lines converging on the customer. This is called the fire-hydrant syndrome, and it is the mirror image of the press-conference scenario. The fire-hydrant syndrome refers to the poor customer who is inundated with information. That is, getting information about the product is like trying to take a sip from a fire hydrant.

Reengineer knowledge flow

The first step in dealing with some of these problems is to reengineer knowledge flows.

Merge parallel flows

One obvious organizational solution is to merge parallel flows. By consolidating the efforts of training and publications, you can reduce duplication of effort. Customers will see less overlap, fewer gaps, and more consistency.
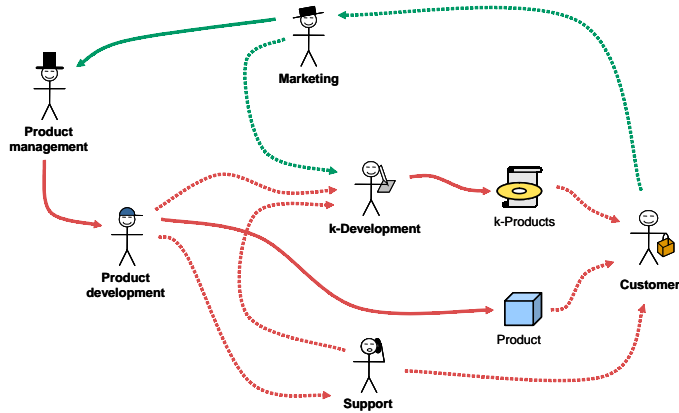
Support is not consolidated because it provides knowledge primarily by telephone, not by Web-based materials.

Establish e-communities

The next advance is to use Web-collaboration mechanisms to establish an electronic community allowing direct communications among all the participants in product development, marketing, and support. The electronic community also allows the company's employees and customers to exchange messages.
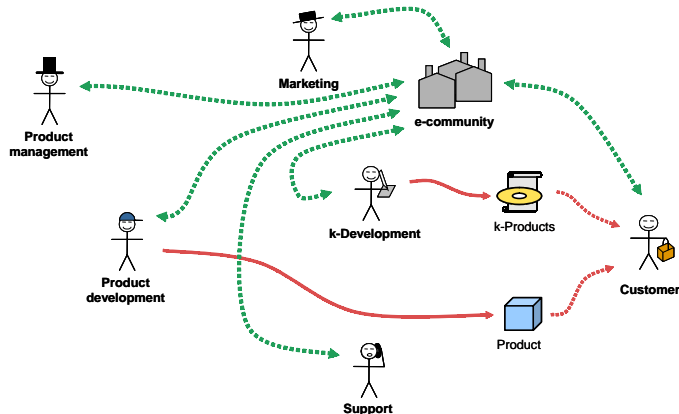
An e-community may be as simple as a discussion board or as sophisticated as videoconferencing links. The important thing is that everyone can "talk" with everyone else without long delays or a long chain of intermediaries.

Steps to analyze a knowledge ecology

The process of analyzing a knowledge ecology is really quite simple.

First, identify the people whose actions matter to the business goal you are trying to accomplish or to the problem you are trying to solve. Many people may be involved, but determine those whose decisions and responses have a large overall effect.

Second, identify what role each of these people play. Do not be content with listing their job positions. Learn what they add to the organization's ability to accomplish its objectives. What is the range of their responsibilities?

Third, ask what prompts them to act and where do they get the information necessary to guide their decisions.

Fourth, chart the ways that information is transmitted among these key individuals. Does it flow along paper trails or zip along networks?

Fifth, identify who initiates each transfer of information. Is it pushed from one person to another? Or, is it pulled from someone who has the information to someone who wants it?

Finally, once you are sure you understand how knowledge flows today, sketch out how it should flow in the future. Identify opportunities to streamline the flow of knowledge, to reduce long chains and unnecessary loops, and to involve the right people in each critical decision.

Analyze your knowledge ecology

Now, take a few minutes to sketch the knowledge ecology behind one of your tough business problems. To do so, you may want to use a copy of the **Knowledge ecology** form.
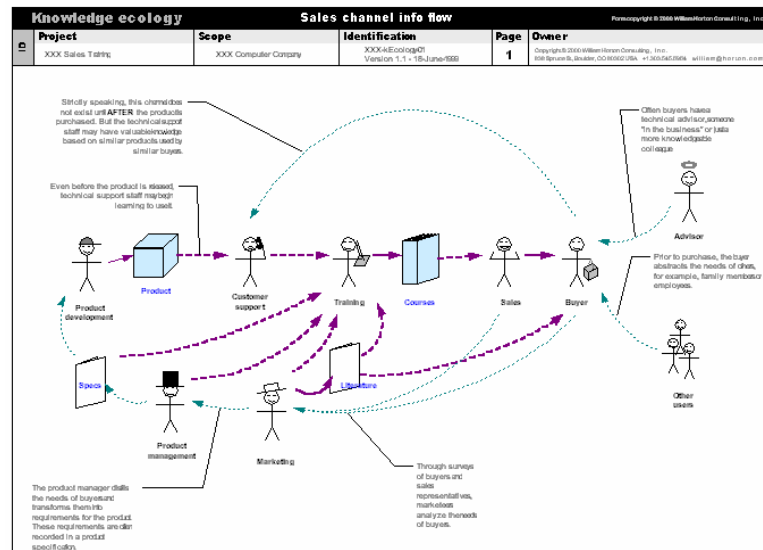
This form is available from: www.designingwbt.com/html/designforms.htm.

Analyze work

To understand what people need to know to do their jobs, you must understand those jobs. By analyzing the way work is structured, you can deduce what kinds of knowledge are required.

Analyze the work consumers do

To analyze work, we need to think about how it is structured. A complex piece of work usually springs from a goal. The goal is the general purpose of work. The goal may point to a specific product or results, such as building a bridge or constructing a house. Or, the goal may concern an ongoing process, such as maintaining the highest level of quality in our industry.
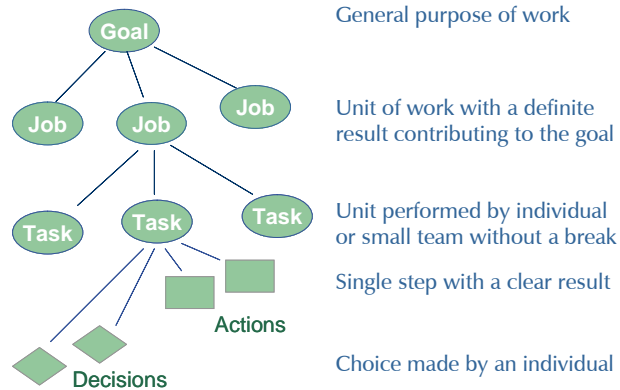
Accomplishing the goal of work may require several jobs. A job is a unit of work with a definite result contributing to the goal. A job typically represents a body of work done by several individuals or teams over a significant period of time.

Goals can be divided into tasks, which are units of works performed by an individual or small team without a break.

Tasks are composed of sequences of actions and decisions. An action is a single step with a clear result, and a decision is a choice made by an individual.

Knowledge needed for work

Understanding the structure of work, we can see that three kinds of knowledge are required: strategic, procedural, and conceptual.
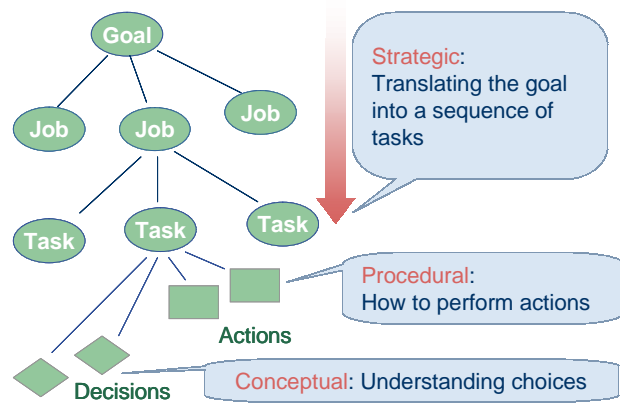
Strategic knowledge is necessary to translate the goal into a sequence of tasks. It involves deciding what jobs must be performed to meet the goal and what tasks

are necessary to complete each of these jobs. Strategic knowledge involves seeing the big picture and how all of the parts interrelate.

At the task and action level, workers need procedural knowledge to be able to perform the steps of required tasks.

And to make the necessary decisions as to what actions to take, workers need conceptual knowledge to understand the choices they must make.

What knowledge is needed?

For each area of work, can you identify strategic, procedural, and conceptual knowledge needed by those who perform the work? For example, suppose that the user of a photograph-editing program want to convert color slides of a vacation resort into a photo-montage for inclusion on their company's Web page. They must first divide that general goal or job down into its constituent tasks. Dividing the general goal into specific tasks requires strategic knowledge.

List a few examples of each type of knowledge needed by your consumers

Strategic	Procedural	Conceptual
What is the procedure for turning color slides of a vacation resort into a photo montage suitable for the Web home page of the resort.	*How to scan in slides* *How to adjust colors* *How to crop and resize* *How to combine graphics* *How to save graphics in a Web format*	*File formats for Web graphics* *Compression algorithms* *Color palettes for Web graphics*

Procedural knowledge will be required to perform the various actions of the task, such as scanning slides, adjusting colors, cropping and resizing the pictures, combining them into a montage, and saving them in a format suitable for use on the Web.

These tasks are not rote, step-by-step procedures. They require conceptual knowledge to make choices in the procedure. For example, workers must understand what file formats work for graphics on the Web, how compression algorithms affect the size and visual quality of the result, and how color palettes can limit the use of colors in Web graphics.

By repeatedly analyzing the needs for strategic, procedural, and conceptual knowledge, we compile a complete inventory of the knowledge our product must contain.

Gather information about work

To analyze work and the knowledge it requires, we must learn how that work is really performed. To that end, we may want to ask the opinions of people who should know. Or, we may just want to observe them at work.

Who should know what knowledge is needed? You may want to start with expert workers who can already do the work at high levels of quality and efficiency. You may also want to consult novice workers. Novices can tell you what they already know and what they find hard about learning the job. And, you may want to investigate some typical workers to find out what they find easy and hard about their jobs.

Other good sources include those who teach workers. They can tell you what trainees already know and what they find difficult to learn. From the managers, supervisors and executives you may learn how well the work is performed now and what improvements in work performance are needed. For completeness, be sure to seek out others that workers turn to for knowledge. These may be co-workers, professional associates, or mentors. And do not pass up the opportunity to perform the work yourself to see what is involved in getting started and advancing in the field.

Techniques for gathering information include standard methods of data gathering: questionnaires, phone surveys, in-person interviews, site visits, and focus groups. With collaborative technologies, such as e-mail and chat, you can gather much of the information you need without leaving your office.

Questions to ask about work

To gather the information you need, you must ask lots of questions. Here are some especially important questions to ask:

- **What are the goal, jobs, tasks, actions, and decisions of work**? Start with the general goal and trace your way down through the individual actions and decisions.

- **What do experts know that novices do not**? What knowledge, skills, attitudes, and behaviors distinguish those accomplished in the job from those just getting started?

- **What is hard for novices to understand**? What aspects of the subject make it hard for novices to get started? What makes their learning curve deep?

- **How do experts become experts**? How have experts acquired their knowledge and skills? Did they learn from formal training, trial and error, on-job training, mentors, or other techniques? Was the way experts learned efficient?

- **What are common performance problems**? For example, is efficiency too low or is work continually late? What factors limit the quality, timeliness, or quantity of results?

- **What errors are common**? Are certain mistakes especially common or costly? Do certain processes require high rates of rework? Are quality defects too high in some areas?

- **What are the ideal worker's skills, knowledge, and attitudes**? Ask supervisors, managers, executives, and customers to describe the perfect worker. What is common to all their descriptions?

- **Are there gaps in the existing education and documents**? Have recent advances rendered training obsolete? Are their errors or omissions in documents and other reference materials?

- **How do experts get answers to their questions**? Experts seldom know all the answers, but they almost always know how to find the answers. Where do experts look for answers? Whom do they ask?

How will you gather information?

To proceed in gathering information, you must identify the people you will contact and which techniques you will use. Why not take a few minutes to plan how you will gather information.

Who will you contact?	By what techniques?
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Inventory the knowledge needed

As you gather information about the nature of the work, compile an inventory of the knowledge needed to perform it. Use the **Work analysis** form to record your observations about each major task.

This form is available from: www.designingwbt.com/html/designforms.htm.

List prerequisites

Once you have identified the core knowledge and skills required to perform work, you may then have to identify additional knowledge needed to understand and apply this core knowledge. This additional knowledge can be identified through a simple process of prerequisite analysis.

Prerequisite analysis

In prerequisite analysis, you ask three simple questions: For each idea the consumer must understand, what other ideas must the consumer understand? These are the prerequisite ideas.
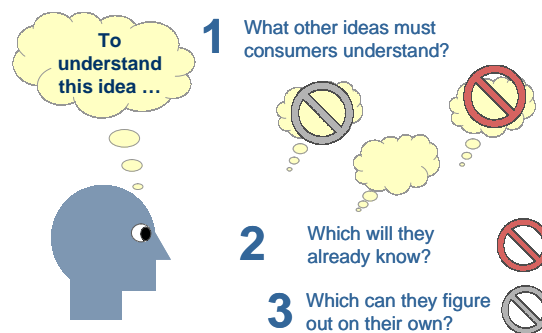
Next, which of these prerequisite ideas does the consumer already know? These you do not need to include in our knowledge product.

Finally, which prerequisite ideas can consumers figure out on their own? These you may want to omit as well. Or, you may want to provide guidance in figuring them out.

Repeat prerequisite analysis on each idea uncovered until you have identified all the necessary ideas.

Analyze prerequisites

To analyze prerequisites, you pick an important idea you must communicate and then identify its prerequisites … and their prerequisites, and so on. For the example of a course teaching how to read Gantt charts, an important idea is the fact that the critical path identifies tasks that must be completed on time in order for the project to meet its original completion date.

Pick an important idea you must communicate in your project. Then, identify its prerequisites and their prerequisites.

Important idea	Its prerequisites	Their prerequisites
The critical path identifies tasks that must be completed on time	The critical path has no float lines.	What is a critical path? What are float lines? Floats vs. lags
	Task bars show duration	What are tasks? What are task bars?
	Dependency markers define a path	How to recognize markers Types of dependencies

To understand this idea, we believe that learners must understand how to recognize the critical path by its absence of float lines, see how task bars indicate the duration of tasks, and know that dependency markers define a path.

Each of these prerequisites has prerequisites of its own. The first one depends on knowing the definition of a critical path, being able to recognize float lines, and understanding the difference between floats and lags. The second prerequisite requires an understanding of the meaning of tasks and the ability to recognize and interpret task bars. The third prerequisite requires recognizing markers for dependencies and understanding of the most common types of dependencies.

Take a few minutes to analyze the prerequisites for an important idea in a project you are working on.

How to handle prerequisites

Let's look at another example of prerequisite analysis to see how you might identify and handle prerequisite information.

Designing cellular telephones

Digital electronics

Basic electronics

Radio electronics

Telephone technology

Batteries and power supplies

Basic electricity

include

summarize

link to

exclude
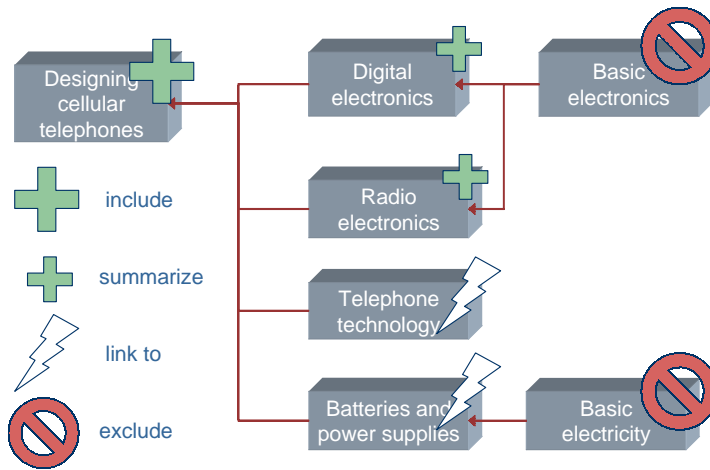
Let's say you are developing a course on designing cellular telephones. That is a vast subject and might require knowledge of digital electronics, radio electronics, telephone technology, and batteries and power supplies. Both digital electronics and radio electronics would in turn require knowledge of basic electronics. To understand batteries and power supplies would require knowledge of basic electricity.

If you include all these prerequisites, your course will be too expensive to develop and too long to take. You have to make some decisions. First, you will want to include some of the material in full. That will probably be the part specific to designing cellular telephones.

Then, you will want to summarize other components. Because your target learners are experienced electrical engineers, you may decide just to summarize digital electronics and radio electronics.

Next, you may link to other components on the Web. That way learners who need the information can find it; but, it does not clutter your course. So, you choose to link to information on telephone technology and on batteries and power supplies.

Finally, you may choose to exclude some other information. Since your course is for electrical engineers, you can safely choose to omit material on basic electronics and basic electricity.

To recap, performing a prerequisite analysis requires taking each main idea and identifying its prerequisite ideas, their prerequisites, and so on. Then for each idea we identified you must decide whether to include it, summarize it, link to material on it, or just omit it altogether.

Simulate work

One way to determine exactly what knowledge learners need to do work is to conduct experiments simulating actual work tasks and observing what knowledge workers require to complete the tasks.

Observe simulated work

The technique for simulating work is quite simple. In software design it is called usability testing and has been used successfully for decades to improve user interfaces, training, documentation, and online support.

Though many variations are possible, the core of the technique is quite simple. It starts with a realistic work setting. Into this setting you place a typical worker. This person represents the typical consumer of our knowledge product. You give this "consumer" authentic work tasks to perform. Then you record what knowledge the consumer requires to perform the tasks.
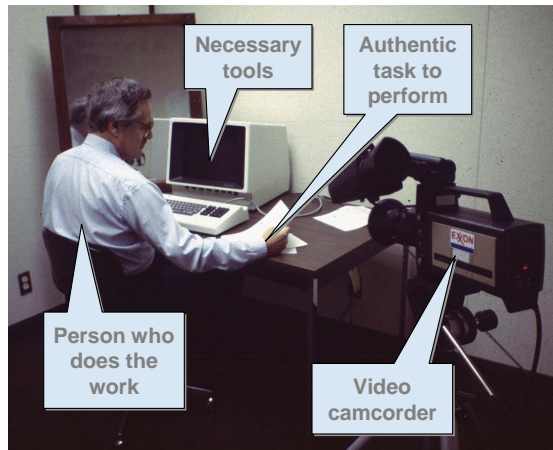
If you were to look in on such a test you would notice a person in the work environment. They would be performing authentic work tasks. They would have access to the necessary tools, such as computer systems, reference documents, written work orders, and so forth. And, you might see a video camera or two to record their progress and to capture incidents where they needed knowledge to proceed.

To reveal what knowledge the consumer requires, you typically pair the consumer with an expert. The expert does not lead or in any way direct the activities of the consumer. The expert is there to answer questions the consumer may ask. Here's how the procedure works.

The consumer works along until he encounters a problem. If the problem requires knowledge the consumer does not possess, the consumer may try to look it up in a paper or online document, may just experiment to find solutions, or may ask the expert.

If the consumer does ask the expert, the expert answers the immediate question of the consumer but does not elaborate on the answer or volunteer information that goes beyond the scope of the question. The consumer can always ask a follow-up question.

There are no restrictions on the types of questions the consumer can ask. The consumer can ask yes-no questions or completely open-ended questions. The consumer can just ask the expert to confirm an opinion.

After the expert answers the question, the consumer paraphrases the answer. This lets you verify that the consumer understood the answer and reveals the vocabulary and concepts common to consumers. Understanding how consumers think about things and how they refer to them will prove useful in developing knowledge products for them.

Hawthorne effect

So, what could go wrong? One problem with usability testing was observed before usability testing was even a term. This problem goes by the name of the *Hawthorne effect* after a series of experiments that were conducted from 1927 to 1932 by Harvard Business School Professor Elton Mayo at the Western Electric Hawthorne factory in Chicago. The experiments measured changes in the rate of production of telephone relay switches by a team of workers as a result of changes in the work method or environment.

Workers were shifted to piece work, … and production rose. Workers were given more rest breaks, … and production rose. The rest breaks were lengthened, … and production rose. A hot meal was supplied, … and production rose. The work day was shortened, … and production rose. Then all the changes were reversed to return to the original conditions, … and production rose. Huh?

What Dr. Mayo discovered had little to do with worker fatigue and nutrition but had a whole lot to do with worker psychology. Observing human behavior tends to modify that behavior. It is a psychological analog to the Heisenberg principle of particle physics, which states that you cannot measure the position and momentum of a subatomic particle because observing one modifies the other.
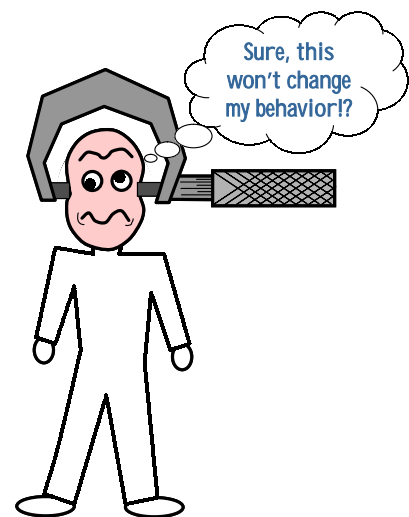
Lab-coat effect

Another experiment, this time conducted by Yale University, also undercuts the basic premise of usability testing. In this test subjects were tested in pairs. One subject was strapped into a chair with electrodes attached to his body. The other test subject was located in front of a control panel with a dial indicating electrical voltage and a button to deliver a shock to the first test subject each time he missed the answer to a test question posed by the test-conductor wearing a stereotypical white lab coat. After each mistake, the second test subject, the one administering the shocks, was instructed by the test-conductor to increase the voltage.

The real purpose of the test, unknown to the shock-delivering test subject, was to see how far he or she would go in causing pain to the first test subject. Not to worry, the first test subject was just an actor and was not receiving shocks.

The frightening result was that many of the test subjects kept raising the voltage and delivering shocks as instructed by the test-conductor—even after the first test subject was screaming in pain or even appeared to be unconscious.

What this experiment showed is that in laboratory tests, the person conducting the test has enormous authority over the test subject. It further shows that test subjects will do things in the laboratory that they would never do in ordinary life.

In usability tests we whisk test subjects up the elevator to an interior room with no outside windows but with a mirror along one entire wall. We point four video cameras at them and tell them to "act normal." Yeah, right.

In usability tests, subjects do not act normally. They follow only approved procedures and follow instructions literally.
They hide their doubts, fearing they may appear ignorant or look foolish. They work mightily to please the tester.

Guess what usability test subjects do in the lab that users in the real world do not? Yeah, use the documentation.
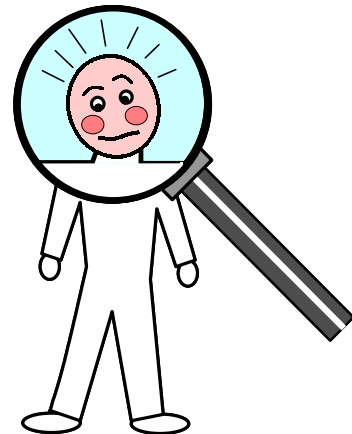
Tip: Test a twosome

One of the simplest and most effective ways to overcome the difficulties posed by the Hawthorne and Lab-coat effects is to test with pairs of consumers.

Having a buddy along side greatly reduces self-consciousness. Within a few seconds the consumers have forgotten about the video camera and one-way mirror and are engrossed in the task. When they are puzzled, they do not grow silent. They ask questions of one another. They offer hypotheses. They suggest solutions to problems. They talk, talk, talk. And from that talk, you can form a clearer understanding of what they know and what they need to know.

Notice questions consumers ask

Let's recap the technique. You give two consumers an authentic work task to perform and observe the questions they ask. When stumped, they ask a question of an available expert.
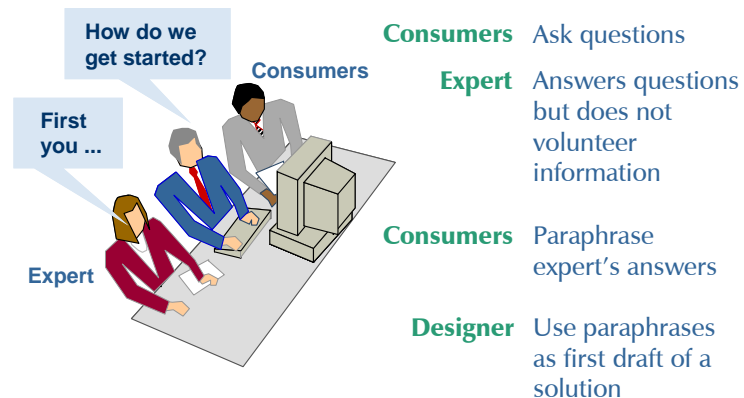
So, when consumers ask questions, the expert answers the questions but does not volunteer information. The consumers then paraphrase the expert's answers to ensure understanding. And you, the designer, use the paraphrases as a first draft of a solution.

Pay attention to emotions
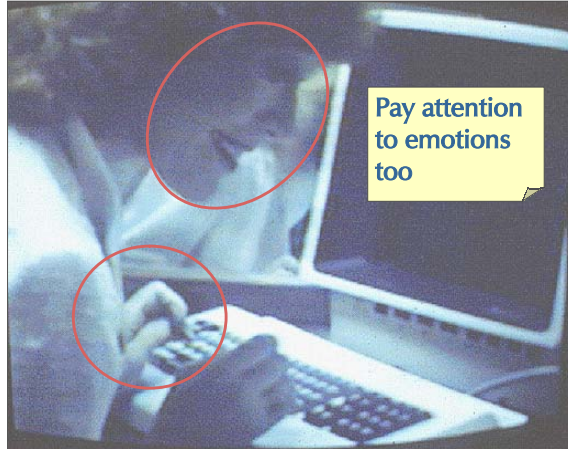
Here's a tip. When testing, pay attention to emotions too. Look at the facial expressions, body language, gestures, and tone of voice of the consumers. A written transcript of what the consumer said may not be sufficient. When the consumer says "Everything is just fine!" through clenched teeth, we know that exactly the opposite is true.

Look for signs of anxiety, enthusiasm, uncertainty, discovery, anger, relief, and embarrassment. Then track down the sources of these emotional reactions.

How would you test?

How would you use work simulations to help you determine the content for your knowledge product? What test subjects would you employ and what task would you assign them to perform?

Test subjects	Task assigned
Experienced graphic designers who have used the PhotoBlop program before but who have never scanned in slides, created a photomontage, or prepared graphics for use on the Web.	*Create a Web-ready photo montage. Given:* • *Photographic slides* • *Computer* • *Slide scanner, installed and working* • *PhotoGlop program, installed and working* • *Online documents automatically installed with PhotoGlop*

Let's say you are developing a knowledge product to teach users of the computer program PhotoBlop. For test subjects, you might select experience graphic designers who have used PhotoBlop. You need to make sure, however, that they have not performed the test task or its component steps before.
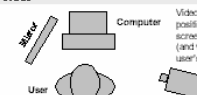
The test task might require the test subjects to perform a complex piece of work that requires applying several individual skills. For example, you might have them create a photo-montage for use on the Web.

You would also have to ensure that they have access to the source materials, computer hardware and software, and reference materials that will be available in the real-world situation.

Plan work simulations carefully

Work simulations are complex and can be expensive to conduct. You want them to run smoothly and yield meaningful insights. The best way to ensure this outcome is to plan the simulation carefully.

Here is an example of the plan for a work simulation. It is written on our **Work simulation plan** form.

This form is available from: www.designingwbt.com/html/designforms.htm.

Analyze and act on results

Merely observing the need for knowledge is of little value unless you act on your observations. To help, we use the **Work simulation results** form to record the incidents showing a need for knowledge and our recommendations for meeting these needs.

Improvement plan		KM Search			Form copyright © 2001 William Horton Consulting, Inc.
Project Screen designs: **Knack knowledge management sys.**	**Scope** KNACK Keyword Search facility work simulation testing	**Identification** KNACK-Search-Keyword -Test Results	**Page** 1 of 1	**Owner** Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St., Boulder, CO 80302 USA +1.303.545.6964 www.horton.com	
Consumers (subjects)	**Date and time**	**Place**		**Test or evaluation plan**	**Conducted by**
Alexander Lindbloom (A) Juanita Castro-Nevez (J)	18 April 2000 10:00 - 13:00	Room 234, Slidel Building Mountain View campus		KNACK-Search-Keyword-01	Chin Wo and Ami Vauhhn

Incident or problem Difficulty encountered or question asked by the consumer	**Severity** How bad is it?	**Knowledge needed** What knowledge could have prevented or resolved the problem?	**Solution** What specific changes do you recommend to meet this need for knowledge?
A & J could not find the tab for conducting keyword searches. They clicked on each tab in turn but did not recogize the page for conducting keyword searches when they saw it.	4	Behind which tab lurks the page for conducting keyword searches.	Change the label (test alternatives) Add ALT text to pop up an explanation of what the page does.
A confused full-text search with keyword search, thinking keyword search would match words from the text of the database entries. Several searches instigated by A failed for this reason.	3	Keyword searches match only the indexing terms assigned by the author of each entry or their synonyms assigned by the editor.	On the page explain this limitation and link to full-text search as an alternative and to Help for more. Point out this difference on the guided tour.
J did not realize that the system matched synonyms automatically. J entered several synonyms for each search term herself.	2	Keyword searching uses built-in synonyms so it is unnecessary for the user to enter more than one or two terms for a concept to match.	Change "to match keywords assiged to each entry" to "to match keywords or synonyms assigned to each entry."
J & A discussed their search strategy for so long that their session variables had timed out by the time they entered their search. They were confused by why the system had kicked them out.	4	After 10 minutes of inactivity, KNACK essentially logs you out. Such timeouts are necessary for performance and security.	Critical: Eliminating timeouts would cost $50K USD! Try explaining the problem and test further to determine severity of this problem. What fraction of users will be timed out in actual use?
J & A commented that the bright red and stark black, though exciting at first, got tiring, especially as they were trying to concentrate on defining a search strategy.	2	The use of more sedate colors might have provided a calmer environment.	Use the marketing colors (red and black) on the opening splash screen only.

This form is available from: www.designingwbt.com/html/designforms.htm.

Identify the competence gap

Once you know what human performance your knowledge product is to engender and who the consumers are who must exhibit this performance, you are ready to identify the competence gap that your knowledge product must bridge. The competence gap is the difference between what people know and what they need to know. It indicates the gap between their present levels of understanding, skills, beliefs, and attitudes and the levels necessary to accomplish the performance goals you have set.

What is the competence gap?

What do we mean by a competence gap? The competence gap is the distance between the desired level of performance and the current level of performance.

$$\text{Target level of performance} - \text{Current level of performance} = \text{Competence gap}$$

Identifying the competence gap requires combining two kinds of information. The first is the goal of your knowledge product that is the target level of performance by consumers. From this we subtract the second item, which is the current level of performance. The resulting difference between these two makes up the competence gap.

The competence gap is essential because it defines the scope of your project. Your goal is to help consumers bridge this gap. You must start at the current level of performance and end at the targeted level of performance.

What is missing?

To ascertain the competence gap, you must first identify what consumers know already. How much of the desired knowledge, skills, attitudes, and beliefs do learners possess already? For each specific goal, what is their current level of achievement against that goal?

How much of the desired knowledge, skills, attitudes, and beliefs do learners possess already?

Goal	Current level	Need (the gap)
Recognize Gantt charts	20% can distinguish from other forms of a timeline	Recognize general form and note defining features
Interpret basic symbols	Most recognize task bars and grid only	Recognize and see implications of main symbols
Recognize relationships	Few recognize other than finish-start relationships	Recognize F-S, S-S, F-F relationships
Draw inferences	Almost none can infer critical path or predict results of changes	Spot critical path and predict CP and non-CP changes

For our sample project, one main goal was that managers recognize Gantt charts. For this goal, we felt that 20% could distinguish a Gantt chart from other forms of a timeline. This gap leads us to the need that learners come to recognize the general form of Gantt charts regardless of it particular appearance; and, that they can spot the defining features that make it a Gantt chart and not some other form of timeline.

For the goal of interpreting basic symbols, we believed that most learners could already recognize task bars and the background grid but not many other symbols. The gap is the ability to recognize and see the implications of all main symbols.

For the goal of recognizing relationships among tasks and other symbols, we felt that few could recognize any relationships other than the most common finish-start type. To close the gap we must teach recognition of finish-start, start-start, and finish-finish relationships.

For the goal of being able to draw inferences from a Gantt chart, we believed that almost none of the potential learners could already infer the critical path or predict the results of changes to assumptions expressed in the chart. Here the need was the ability to spot the critical path in a Gantt chart and to predict the effect of changes to tasks on the critical path and to tasks not on the critical path.

Chart the competence gap

It is sometimes handy to express the levels of knowledge numerically and to chart them graphically as is done here. The spreadsheet on the left lists the skills required of technical supervisors. These include recruiting, budgeting, scheduling, and so forth. For each of these skills, three numbers are supplied.

The first column states the required level of the skill on a 10-point scale. The second column rates the current level of that skill. And the third column, which is just the difference between the numbers in the first two columns, indicates the gap. Notice that the category Technical skill actually has a negative gap. This means that consumers already have higher levels of technical skills than required in this area.

Compentence gap			
Technical supervisors	**Level of expertise**		
Area of expertise	Needed	Current	Gap
Recruiting	5	4	1
Budgeting	7	5	2
Scheduling	8	3	5
Motivating	5	3	2
Conflict resolution	6	5	1
Technical skill	5	8	-3
Supervising	7	5	2
Teamwork	10	8	2
Legal knowledge	4	2	2
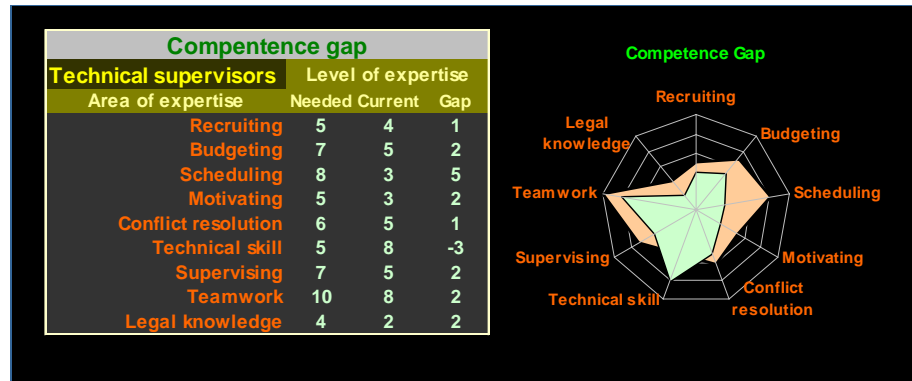
The radar diagram on the right plots the numbers to illustrate the gap graphically. The competence gap is the area between the inner shape and the outer one.

Knowing the competence gap, we can set precise goals for our project. It must enable consumers who have the initial levels of knowledge to obtain or function at the target levels. It must bridge the gap.

Kipling analysis

To identify performance goals and analyze performance problems, I often use a technique I call Kipling analysis. It is a simple technique to identify and correct bottlenecks, logjams, lapses, and other problems in the flow of information within a complex organization.

I took the term Kipling analysis from the poem "Elephant's Child" by Rudyard Kipling. The technique consists of using Kipling's "honest serving men" to repeatedly ask what why, when, how, where, and who.

> **I KEEP six honest serving-men**
> **(They taught me all I knew);**
> **Their names are What and Why and When**
> **And How and Where and Who.**
>
> **Rudyard Kipling,**
> **"Elephant's Child"**

Questions to ask

I ask the questions this way. For the organization to succeed …

- Who must do what?
- When and where must they act?
- How should they act?
- Why should they act?

There are many ways to ask these questions. The exact wording is not as important as the intent—and the persistent probing to get to answers.

Who must act?

Who must act? We must know a lot about the people who must take actions or change their behavior.

Must the actions be taken by members of a team acting in concert? By all members equally? Or by an individual who works alone? Is the person a professional, a technician, or an artist? What are the person's culture, language, and background?

What must they do?

What exactly must they do? Must they perform an act, be able to perform an act, feel a certain way on an issue, believe a specific claim, or understand a concept? Must they apply a formula, a procedure, a principle, an algorithm, a heuristic, or just know a fact? Or, is it a complex skill they must apply? Or, is it more of an attitude or belief than specific knowledge or skill?

When must they act?

When must people act? Is the required performance linked to a point in a process or a specific prerequisite event?

Is the behavior something they perform at the beginning of their career or entry into a profession? Or at the start of a new project? Is it performed at specific points within the course of life or a business career? Is the action triggered by certain predictable events? Is it needed to perform certain activities? Or is it done during a particular phase of work or life?

Where are they?

Where are people when they must act? By where, I mean the whole context in which they must apply knowledge. Context includes their location and physical environment. It can also include the mode of work and what other resources they can draw on for help.

Be sure to ask questions such as these:

- Do they apply the knowledge in a private office?

- Or, must they apply knowledge while traveling?

- Do they work in an environment that restricts which media they can use to acquire knowledge?

- Or, alone in a cramped, private workspace?

- Do they work outdoors where temperatures, darkness, bright sunlight, wind, or environmental hazards restrict their options?

- Or, do they work on a busy or noisy factory floor?

How must they act?

Once you have answered who, what, when, and where—only then should you consider answering the question of how they should act. What is the best way for them to achieve the overall objectives? And, how will they get and share the required knowledge? Must they conduct research? Must they seek training or communicate with others? Must they use electronic tools and networks?

Why should they act?

The final question asks you to justify your decision. Why should they act? What motivates them now? And what can motivate them to act differently?

Are they motivated by the opportunity to make more money or otherwise improve their economic status? Do they want to save time or streamline operations? Or, are they seeking to broaden their experiences or open new markets? Does it cost the least or return the most money? Does it save the most time or let you complete the project by a crucial deadline? Is it the most universal solution, the one that the largest number of people can use?

Record the who, when, how & why

Use the **Objective** form to capture the finding of your Kipling analysis. Use it to chronicle the *who*, *what*, *when*, *where*, *how*, and *why* for your project.

Objectives		Gantt Chart			Form copyright © 2000 William Horton Consulting, Inc.
Project	**Scope**	**Identification**		**Page**	**Owner**
Course: **Reading a Gantt Chart**	Entire course	RGC-Objectives-01 Version 1.0 - 13-Nov-2000		**1 of 1**	Copyright © 2001 William Horton Consulting, Inc. 838 Spruce St, Boulder, CO 80302 USA +1.303.545.6964 william@horton.com

Goal

This group of people	Will accomplish this business objective	To this degree
The Gantt Group principals ...	Will increase their revenues from training by...	50% over the previous year.

Objectives

Who? Group of people	**What?** Action or change required		**When?** Time or event	**Where?** Environment	**How?** Method or technique	**Why?** Motivation
Business managers with the ability to hire consultants ...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Hire the Gantt Group to train their team leaders in Project Management.	After reviewing the course and reading the Manager's Only section.	In their office.	By accessing the schedule and booking information located at the end of the course.	Because they are impressed with the quality of the course and the sound advice presented by Martha in the Managers Only section
Business managers who need to use Gantt charts as part of their project management duties ...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Hire the Gantt Group to train their team leaders in Project Management.	After taking the course.	In their their work environment.	By clicking the more information link at the end of the course and receiving a follow-up evaluation form.	Because they are impressed with the quality of instruction.
Project team members who are given Gantt charts to read...	☒ do: ☐ be able to: ☐ believe: ☐ feel: ☐ understand:	Find that this course meets their needs and recommends more training to managers.	In the course of their work.	In their office.	By finding the course and taking it.	Because they enjoyed the learning experience and the approach to training.
Business managers who need to use Gantt charts as part of their project management duties ...	☐ do: ☐ be able to: ☒ believe: ☐ feel: ☐ understand:	That there is more to project management than reading Gantt charts and they need more training.	While taking the course.	In their office or at home.	By learning that the Gantt chart is the result of much preliminary research and looking at links to other training.	To better understand the processes of project management.
Individuals who wish to advance to management.	☐ do: ☒ be able to: ☐ believe: ☐ feel: ☐ understand:	Read a conventional Gantt chart, noting crucial features and reacting to their significance.	In the course of their training time.	In their office or at home.	By looking at the symbols on the chart.	To increase competency and get a higher paying job.

This form is available from: www.designingwbt.com/html/designforms.htm.

FORMS AND DESIGN AIDS

At William Horton Consulting, we have created a suite of design forms to guide the development process and record and share design decisions. These forms, which are available at www.designingwbt.com/html/designforms.htm, are keyed to specific units of knowledge products and specific points in the development process.

Before you begin looking at forms, it is important to understand the role of forms in the development method. Forms are not a magic bullet and filling in forms does not ensure good design. But filling in forms can lead us to ask better questions, to communicate more fully, and to learn from our successes and mistakes.

The purpose of these forms is to record design decisions. By doing so, we produce a tangible design that we can build on. Successes can be proliferated to other projects. Mistakes can be corrected and the correction specified for all to use.

Design forms are extremely valuable to communicate design decisions to those who carry them out, especially to direct the work of subcontractors or employees. For subcontractors, design forms can become an integral and definite part of the work assignment, thus reducing later disputes about what was called for. They can ensure consistency among the work of different groups, especially those working independently, using different tools, and producing different parts of the knowledge product.
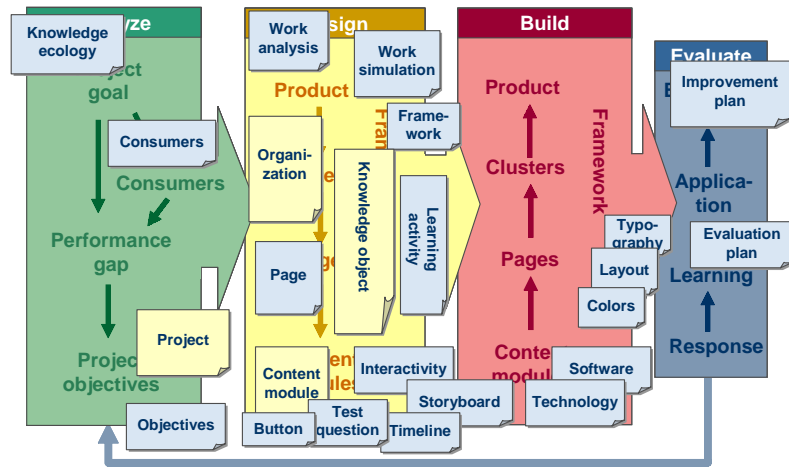
The most important role of design forms is that they remind us to ask critical question. The blank box on the form nags and whines until we satisfy it. It makes sure that we at least think about critical issues in time to act on them.

When to record decisions

When do you use the various forms to record your design decisions? Let's start with the main forms.

The first form you use will be the **Project** form at the end of the Analysis process. It serves as the charter and keystone for the project.

In the design process, you will repeatedly use the **Knowledge object** form to design first the whole knowledge product, then its clusters, and smaller units. To show how clusters are organized, you may use the **Organization form**. The **Content module** form enables you to specify multimedia components that go within a page or knowledge object.

These four forms: Project, Knowledge object, Organization, and Content module form are the ones you will use most often. They form the core of the design process. But let's look at some of the other forms and where they fit in.

As part of the analysis process, you may perform a **Knowledge ecology** analysis to determine the need for knowledge project within an organization or population. As a result of this or other analyses, you may use the **Objectives** form to specify clear performance objectives. Doing so will probably cause you to identify consumers for your knowledge product, which you describe fully in a **Consumers** form.

As part of your design effort, you may need to determine the knowledge needed by consumers to do their work. You may record your findings on a **Work analysis** form. Or you may chose to simulate work activities and record results on the **Work simulation plan** form.

If you are creating a Web-based learning project, you may find the **Framework** form handy to specify the infrastructure you will require to support effective learning and the **Learning activity** form to chart out complex learning experiences. To specify some of the components of the knowledge object, you may use the **Page** form to prescribe an individual Web page, for instance.

In addition to the Content module form, you may use several other forms to specify particular kinds of content or dynamic aspects of content. You may use the **Timeline** or **Storyboard** forms to specify a sequence of displays or interactions. To specify complex interactions between computer and user, the **Interactivity** form is the one to use. The **Button** and **Test question** forms are tailored to these specific kinds of content.

The building effort will require deciding on what technology to use. To this end, the **Technology** form records the hardware, software, and network connections of users, developers, and hosts. The **Software configuration** form specifies the interrelationships among tools and file formats over the span of the project.

To ensure a consistent look across the project, you may want to use the **Colors**, **Layout**, and **Typography** forms to standardize these aspects of the visual display.

To ensure that the project works well and that you can prove so (or else fix what is wrong) you may need the **Evaluation plan** form to spell out how to test the resulting knowledge product and an **Improvement plan** to outline how improvements are to be integrated back into the project.

Which forms for each level?

Another way to pick a form is to consider what unit of the knowledge product you are designing.
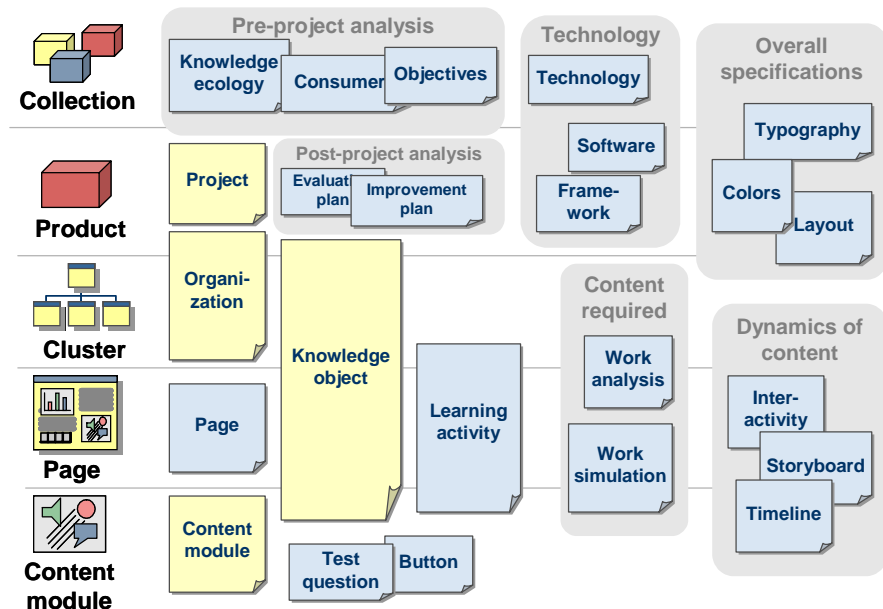
At the product level, the **Project** form anchors the entire development process. The other core forms, **Knowledge object**, **Organization Page**, and **Content module** are used to design successively more detailed parts of the product.

To fully understand the context of the design of your product, you may need to do a pre-project analysis. You may need to analyze the needs of your organization and your potential consumers. Three forms help in such pre-project analysis: the **Knowledge ecology**, **Consumers,** and **Objectives** forms.

To determine the technology required for a complex project, you may want to use the **Technology**, **Software configuration**, and **Framework** forms.

For ensuring consistency within an individual product or among a family of products, consider using the **Typography**, **Colors**, and **Layout** forms.

Also at the level of the product, you may need to plan for post-project analysis. You may need the **Evaluation plan** form to plan how to measure the success of the product. And, you may need the **Improvement plan** to outline how improvements are to be integrated back into the project.

To design clusters and pages, you may need to determine what content is required to support work. The **Work analysis** form and the **Work simulation** form can help. If you are creating a Web-based learning project, you may need the **Learning activity** form to chart out complex learning experiences. To specify some of the components of the knowledge object, you may use the **Page** form to prescribe an individual Web page, for instance.

Content at the Lesson, Topic, and Content module levels can be dynamic and interactive. For linear dynamic content, the **Storyboard** or **Timeline** forms may prove useful. For scripting complex interactivity, the **Interactivity** form is the one to use.

At the bottom level of detail, you may find two special purpose forms helpful: the **Test question** form and the **Button form**.

Relationships among forms

Forms are seldom used alone, especially on a large, complex project. Let's look at some of the relationships among the forms.
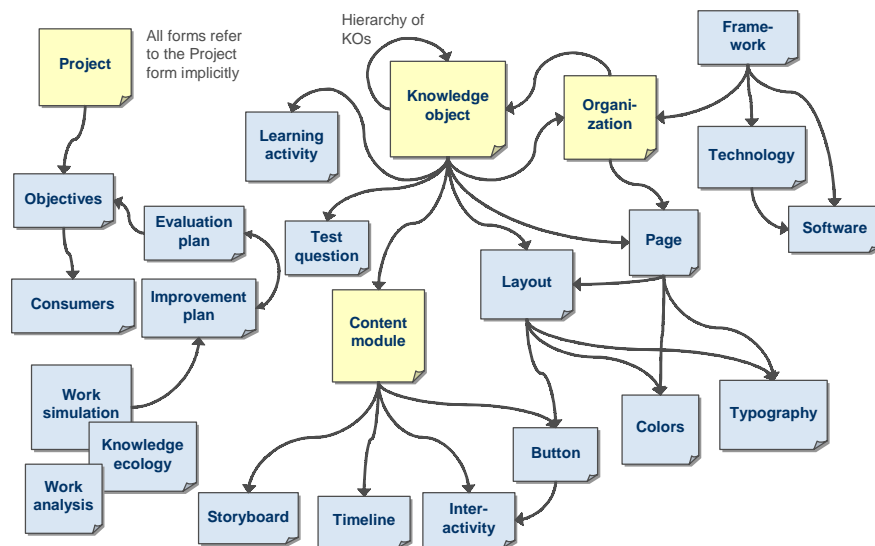
The **Project** form is the parent form for the whole effort. All forms refer to the Project form implicitly. Even more explicit relationships are common. The project goal on the Project form is often elaborated on an **Objectives** form, and the consumers mentioned in these objectives are described more explicitly on the **Consumers** form. The **Evaluation** form may refer back to the Objectives form to state which objectives are being measured. It may be referred to in the improvement plan, which outlines how problems identified through evaluation will be solved.

Another cluster of relationships centers upon the **Knowledge object** form. The Knowledge object form can refer to forms describing items used to fulfill the goal of the object. These items are described on the **Content module**, **Test question**, **Learning activity**, and **Page** forms. If the knowledge object is a compound object, its form will refer to an **Organization** form to show the relationship among its lower-level objects. Thus the Organization form thus refers to the Knowledge object forms for those lower-level objects. In a hierarchical organization of objects, the Knowledge object form for each object will refer to the Knowledge object form of its parent and children objects. The Organization form is also used to show the relationships among individual Page forms.

The appearance and behavior of the components of a content module may be shown by **Storyboard**, **Timeline**, **Interactivity**, and **Button** forms. The behavior of interactive buttons is shown by an Interactivity form. All of these forms cover low-level details and are usually reserved for multimedia developers.

Both the knowledge object and the page describe their visual appearance on a **Layout** form. This form further specifies appearance to the Button form and to **Colors** and **Typography** forms. These last two forms generally apply throughout an entire project and may be referred to directly from the Page form.

Relationships also exist among the forms prescribing technical infrastructure. The **Framework** form refers to the **Technology** form and to the **Software** configuration form. The Framework form may also refer to the Organization form to show how the components of the framework are to be organized. Because the Technology form overlaps the Software configuration form somewhat, it may also refer to that form.

The remaining forms are used in analyzing the organization and how work gets done within the organization. They include the **Work analysis** form, the **Knowledge ecology** form, and the **Work simulation** form. Although these forms affect the information entered on other forms, these forms are not explicitly related to other forms, except the Work simulation form that may require an Improvement plan to document how issues identified in the simulation will be resolved.

Which forms for which projects

Form	Where used				
	E-learning	**Web sites**	**Online documents**	**Knowledge management**	**Multi-media**
Button		✓			✓
Colors	✓	✓	✓		✓
Consumers	✓	✓	✓	✓	
Content module	✓	✓	✓		✓
Evaluation	✓				

Form	Where used				
	E-learning	Web sites	Online documents	Knowledge management	Multi-media
plan					
Framework	✓	✓			
Improvement plan	✓	✓	✓	✓	
Interactivity		✓			✓
Knowledge ecology				✓	
Knowledge object	✓				
Layout	✓	✓	✓		✓
Learning activity	✓			✓	
Objectives	✓	✓	✓	✓	
Organization	✓	✓	✓	✓	
Page	✓	✓	✓		
Project	✓	✓	✓	✓	
Software configuration	✓	✓	✓		
Storyboard					✓
Technology	✓	✓	✓	✓	
Test question	✓				
Timeline					✓
Typography	✓	✓	✓		✓
Work analysis	✓	✓	✓	✓	
Work simulation plan	✓	✓	✓	✓	

ABOUT WILLIAM HORTON AND WILLIAM HORTON CONSULTING

William Horton

William Horton has been designing technology-based training since 1971 when, as an undergraduate, he designed a network-based course for the Massachusetts Institute of Technology's Center for Advanced Engineering Study.

William Horton is an internationally sought-after speaker. He recently delivered the keynote addresses for the Human Resources Association National Congress in São Paulo, the Information Technology Training Association conference in Barcelona, and the Knowledge Management Seminarium in Stockholm.

William Horton is a registered Professional Engineer, an MIT graduate, and Fellow of the Society for Technical Communication. He currently serves as a member of ASTD's commission on e-learning certification.

William Horton is a prolific author. His books include *Designing Web-Based Training*, *Designing and Writing Online Documentation*, and *Secrets of User-Seductive Documents*. He is co-author of *Getting Started in Online Learning* and *The Web Page Design Cookbook*. He is also the author of three books to be published in ASTD's series on e-learning: *Leading E-learning, Evaluating E-learning, and Using E-learning*.

William and his wife Kit, the other half of William Horton Consulting, live in downtown Boulder, Colorado, just five blocks east of the Rocky Mountains, in a hundred-year old house they are lovingly restoring. The kitchen, which he and Kit redesigned themselves, was featured in the April 1999 and September 2000 issues of *Better Homes and Gardens*.

About William Horton Consulting, Inc.

For the past 12 years, the two-person team of William and Katherine Horton has helped organizations plan, design, justify, and perfect e-learning initiatives.

William Horton Consulting, Inc., develops prototypes, critiques designs, leads Problem-Bashing® sessions, and conducts training in the design and management of e-learning.

William Horton Consulting's client list contains both established and emerging companies throughout North America and Europe, including Allen Communications, Apple Computer, Arthur Andersen, AT&T, Compaq Computer, Cray Research, DataChannel, El Paso Independent School District, Enlightened Leadership International, Ericsson, Exxon, Hewlett Packard, IBM, Intel, International Speakers Bureau, Lotus, Lucent, Macromedia, Microsoft,

Mindlever.com, Northwestern Mutual Life, Nokia, Novell, SAP AG, SAS Institute, Sun, ThinkCAD Bleu, U. S. Army, and Wilson e-Learning.

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