Information technology not only provides new options for instruction delivery, it can also help create new instruction and learning materials. (What is the point of electronic delivery if there is nothing to deliver?) In turn, these new methods and tools can address some of the key challenges for higher education, including responding more nimbly to changes in demand and competing with new providers. As before, information technology provides not one or two, but several ways of improving the development of instruction and learning materials. Some options are relatively simple extensions of current methods, while others are novel.

EXPANDING TRADITIONAL METHODS OF PRODUCTION

To simplify slightly, the traditional pipeline for producing educational materials (and intellectual artifacts, in general) has four key components:

- Authors create documents.
- Publishers mainly manufacture and market copies of these products.
- Libraries primarily acquire, store, and distribute copies of the products to the nearby community.
- Readers consume the products.

These groups have played relatively stable roles in the publication process for decades, even centuries. However, information technol-
ogy is changing these roles; equally important, it is transforming the copyright and intellectual-property-rights laws that underpin relationships among the participants.

The simplest view of this change argues that new information technologies will reduce, perhaps even eliminate, the need for publishers and libraries. Historically, publishers and libraries have been essential intermediaries, enabling authors and audiences to reach one another. Authors rarely possessed the tools, skills, and capital necessary to typeset their books, calculate the size of production runs, or coordinate with vendors. By the same token, individual readers (especially students and researchers) rarely could afford to acquire vast libraries of literary holdings. Publishers and libraries have traditionally met these needs. However, as educational products become increasingly digital and networked, one line of argument goes, the latter two groups may prove unnecessary, at least from a technical perspective.

Today, academic research provides the most-impressive examples of how higher education is exploiting information technology to simplify the document-production pipeline. (This is hardly surprising, considering that, as we have already noted, the Internet was an active tool in scholarly research long before it played a significant role in instruction.) Members of several research communities in medicine, mathematics, and the physical sciences now publish their work, at least in “preprint” form, on the Internet. (See Figure 3.1.) The growth of such publications has been explosive: The first electronic academic journals came online in 1991; by mid-1995, more than 300 populated cyberspace;¹ in July 1996, according to the Association of Research Libraries,² there were almost 1700 electronic journals and newsletters; and estimates ballooned to over 5000 by early 1998.³ Although individual publishers have been quick to add organization and decoration, many of these works, in their simplest form, comprise a collection of homepages that can be read at a distance using

¹For an overview of electronic journals, links to many sites of and articles on electronic journals, as well as some current (as of spring 1995) statistics on their growth, see McElwain (1995).
²See http://www.arl.org/scomm/edir/ for additional information and statistics; Dewar (1998) offers further discussion of the progression from manuscripts to Internet Books.
Researchers have made the transition from print to bits in several steps—a process that is still continuing. In 1991 scientists at Los Alamos National Laboratory took the first step by setting up a service to distribute “e-prints” (electronic versions of paper preprints) over the Internet. Since then, their service has grown to handle over 40,000 requests per day (see http://xxx.lanl.gov/).

The next step is to put the whole journal review and publication process online. Researchers now submit their articles by e-mail or the Web, editors send them electronically to reviewers, and the final revised versions are published in an electronic journal. As a result, turnaround time for publication is now a few weeks, not months; subscription rates are usually a fraction of those of paper journals, and sometimes free. By 1995, McEldowney (1995) had found over 300 electronic journals.

A third step is just now being taken. Some sites that began as single journals are adding new publications and new functionality. BioMedNet (http://BioMedNet.com/BioMedNet/ biomed.htm), for example, offers researchers a library of publications, search services to help locate titles, job listings, and several other kinds of assistance for professionals.

(See also The Economist, December 16, 1995, p. 78, for information on electronic academic publication.)

Figure 3.1—Scholar As Publisher: Making Research Directly Available to Readers Across the Internet

any Web browser. Provided that you know the Internet location of an online journal, accessing the current issue (if there is one; some electronic magazines simply accumulate publications over time) is simply a matter of entering the address and reading what comes up on your screen.

This kind of publication is gaining popularity for several reasons. Cutting out the traditional publisher intermediary not only dramatically speeds up the rate at which new ideas get into “print”; it also cuts publication costs and provides a direct link to readers, who can access the papers from anywhere on the Internet as soon as they are available. The audience, in turn, is often encouraged to be publishers in return, using e-mail to send feedback and reviews on articles directly back to authors. Finally, problems of calibrating production
runs, disposing of unsold inventory, and dealing with unsatisfied consumer demand simply do not arise with digital, networked publications. No longer do students and faculty need to wait for other scholars to return copies of popular books: They simply print their own copies on demand.

DIGITAL LIBRARIES: NEW MEDIA, NEWSERVICES, NEW INSTITUTIONS

If libraries existed only to store copies of books and other physical artifacts, and to share them with members of nearby communities, then the preceding examples might suggest that such institutions are in danger of extinction. Not surprisingly, traditional libraries are not ready to give up the ghost just yet. Along with publishers, whose traditional roles are similarly threatened, libraries are attempting to redefine their functions in ways that maintain roles for them in the delivery of information in digital, networked environments.

New digital libraries can try to go beyond being paperless versions of traditional libraries in at least three ways. First, freed of the need to store copies of (sometimes rare) documents, they can focus more on services that will help students and faculty find and organize information in vast virtual collections. Second, freed of the need to maintain collections in locations physically near their communities of readers, they can plan to aggregate virtual holdings into more encompassing, complete, and up-to-date collections. And, third, freed of the dominance of static print (audio and video can be digitized as readily as can typed text), digital libraries can grapple with the complexities of representing and cataloguing new multimedia documents.

A number of projects are engaged in the important, but painfully slow, translation of paper products into digital form. Project Gutenberg (http://gutenberg.etext.org/), for example, aims to have 10,000 texts online by the year 2001; with a growing network of volunteers, it is now downloading about eight new titles per month. The project’s mission is to provide universal access to texts. For this reason, it is digitizing only materials in the public domain, and it is using the most basic storage format: “plain vanilla ASCII.”
Already today, then, a student using almost any computer coupled to the Internet can read the complete works of Shakespeare. The National Digital Library (http://lcweb.loc.gov/homepage/new.html), part of the Library of Congress, has used its considerable resources to digitize several hundred thousand Library holdings. Not limited to simple text, these holdings range from documents of the Continental Congress, to turn-of-the-century films, to Matthew Brady’s Civil War photographs. Many students and scholars are even now making serious use of the Library’s historical collections, reference materials, and search tools.

**Tools to Find and Organize Information**

As impressive as these conversion efforts are, though, even a quick scan of the burgeoning literature on digital libraries shows that most of the action is elsewhere. Few of the universities funded through the Digital Libraries Initiative (sponsored jointly by the National Science Foundation [NSF], the Defense Advanced Research Projects Agency [DARPA], and the National Aeronautics and Space Administration [NASA]), for instance, have yet to build or acquire substantial digital holdings. Rather, they are developing tools and software agents with which digital libraries can be constructed and can be effectively searched by students, faculty, and researchers. (See Figure 3.2.)

To anyone who has browsed the WWW—which itself can be viewed as a vast and unorganized digital library—the need for these search and management tools is obvious. Most of the information available on the Internet today is of questionable quality, at best. As holdings merge, it will become more and more difficult to find high-quality products, let alone products relevant to a chosen topic. Even more problematic, traditional tools for managing this search probably will not help much in new digital libraries. Quite aside from the fact that traditional schemes barely work even today (card catalogs and huge cross-referencing tomes almost always seem to need the skills of experienced librarians), these print-indexing tools simply do not scale up well to multimedia documents that include several varieties of visual and auditory materials, as well as text. The hope is that a new generation of digital library tools and software agents will be able to
Subject matter/content:
The content will emphasize a diverse collection, focused on earth and space sciences, which can satisfy the needs of many different types of users. The content will be supplied by publishers, although the project will eventually allow all users to publish their work. A related project, the Journal Storage Project (JSTOR), will digitize and make available all issues from the first publication through 1990 of ten economics journals to the NSF-UMDL.

Testbed description:
The UMDL will consider a complex array of technical and socio-economic issues and will focus the research through the design, construction, and evaluation by real users of a testbed system. The testbed will consist of a cooperating set of three types of software agents: user interface agents, mediation agents, and collection agents.

User interface agents will conduct interviews with users to establish their needs such as what they need to know, and the breadth and depth of the information they require. The interface agent will also enable the user to specify areas of interest so that the system can notify the user of items of potential relevance.

Mediation agents will coordinate searches of many distinct but networked collections by taking orders from the interface agents. This will allow the user to search many libraries simultaneously in ways that meet time, relevancy, and economic constraints. The mediation agents will depend upon a conspectus that describes the contents of the various collections on the network.

Collection interface agents are associated with each specific collection and can handle searching within specific collections of text, images, graphics, audio and video. Information held in the collections may be owned by various entities, some of which may demand some control over dissemination of contents or compensation for access to their copyrighted material. The system design will provide mechanisms to protect information access and support remuneration operations.

The users of the digital library testbed will include expert researchers, students, and the general public. The library will include media types ranging from page images to interactive, compound documents and eventually real-time interaction with data. Critical to the exploitation of these resources will be ongoing programs of evaluation, training, user assistance, and outreach.


Figure 3.2—Providing Services to Manage Information in Digital Libraries
understand multimedia documents, and that they will be as easy to use as they are powerful. Some of these tools are little more than user-friendly search engines, which find titles through keyword searches. But others might fulfill, in electronic form, many of the roles of a personalized library assistant or online note-taker. (See Figure 3.2.)

Aggregating Single Libraries into Mega-Libraries

Another way in which libraries are trying to grow beyond their paper counterparts is simply to merge holdings. Such aggregation rarely happens in traditional libraries: One-of-a-kind documents are closely guarded and are regarded as highly limited resources that curators are naturally reluctant to part with; the cost of moving, recataloging, and repositioning artifacts usually is prohibitive; and merging libraries into a centralized location threatens to reduce access to materials by many readers in the affected communities.

Access to materials in digital libraries, by contrast, is independent of distance, so merging can only add to the resources available to communities. Moreover, merging digital holdings is comparatively trivial. Sometimes, libraries can be merged just by adding a few well-placed menu items, and smart search tools can overcome many of the resulting duplications that may arise from such mergings. (For example, duplicate finds, or “hits,” can be automatically eliminated before search results are presented to the student.) And, if mergers are planned a little more carefully at the outset (also often aided by digital merging and interface-building tools), users can be presented an interface with the look and feel of a single digital “mega-library” rather than a collection of smaller ones, each with a different interaction protocol.

Today, even the largest digital libraries are small; while the Library of Congress houses over 100 million “traditional” artifacts, its online counterpart, the National Digital Library, “houses” a few hundred thousand, at most. When digital libraries finally acquire substantial holdings, they will have promise for addressing several important goals and problems of higher education, the first being costs. Costs could drop substantially. From a technical perspective, a document need cost no more than the price of producing it on a nearby high-quality laser printer, which would easily undercut the price of com-
mon university texts, not to mention rare volumes. Of course, publishers are unlikely to tolerate such indiscriminate copying of their property, at least as copyright law now stands. However, by aggregating their acquisitions, digital college libraries are already discovering that they can use their coordinated buying power to negotiate much more effective licensing deals than publishers are willing to offer on books. (See Figure 3.3.)

Digital libraries can improve access to educational material even as they reduce access cost, thereby promising to be a key component in future distance-learning curricula. Students within a university will enjoy better access to digital materials, in part because they will be able to use them at any place and any time, not just in library study halls; and they will not have to wait for days or weeks until popular titles are returned to the shelf. More interestingly, as digital libraries merge, students can access the very best materials, regardless of their institutional affiliation.

Even if such mergers do not happen officially, students may be able to implement them informally. Today, for example, nothing prevents University of Michigan students on the Web from accessing...
digital holdings at Stanford, MIT, University of Illinois, or any of the other dozens of online libraries. For that matter, nothing prevents any Internet user—say, an unemployed worker in Detroit or a teenager in Harlem—from perusing these digital documents.

This may not be true for long, however. It is quite easy for universities to put up “firewalls,” which permit access only to their students and faculty. Technically easy, yes, but perhaps hard to justify; digital-library resources, unlike books, are simply not “consumed” when used. With well-designed library servers and ample bandwidth, the hundreds of authorized users of a digital library should not notice a thousand or more unofficial users.

All of this would suggest that the best world of all would be one with a single digital library, located at a single site (or perhaps distributed throughout cyberspace), and surrounded by a collection of smart, user-friendly, library tools and software agents to help find digital resources, piece them together into new documents, and share them among students and faculty. If bigger is better, why stop at merging just a few digital collections?

**Obstacles to Building Productive Digital Libraries**

For several reasons, this vision of the future is a long way off, even if it is a good one. To begin with, different universities and different communities may simply want to retain different digital documents; local decency laws, as well as informal cultural preferences, will continue to encourage diversity, and sometimes insularity, in digital holdings. Even discounting regional preferences, some important technical hurdles still need to be overcome.

A completely universal digital library presupposes standards for representing the different kinds of multimedia information that make up the digital documents. The de facto standards for WWW home pages (namely, HTML and HTTP) are a good first step in this direction, but they are a long way from being complete. Indeed, closure may be a receding goal, because new data formats and media types are being spawned faster than standards for existing ones are being settled. It is also important to remember that few of the artifacts now in traditional libraries (so-called legacy materials) have been digitized; they must be included in any digital library that even pretends
to supplant a paper-based one. On top of all this, digital materials, no less than paper products, are subject to decay and deterioration (Rothenberg, 1995).

Although the technical problems are substantial, perhaps the biggest obstacles to building digital libraries are legal and institutional. Higher-education institutions have a long history of independence in the way they provide services. Even if economic and social arguments point toward merging digital libraries, whether universities will enthusiastically embrace changes that might threaten their institutional identity is not clear—especially if they can convince themselves that sharing their knowledge base will lose students, and thus revenue, to competing schools.

Finally, copyright problems could kill the development of digital libraries in their infancy. Over decades, copyright law has forged a delicate balance between the interests of publishers and those of consumers, with libraries in the middle. First-sale doctrine permits libraries to lend books without requiring libraries or readers to further compensate publishers and authors. Similarly, over time, libraries have negotiated extensions of fair-use laws that allow students and faculty to (photo)copy materials without violating copyright. Current copyright law is not particularly generous to consumers, and a direct application of it to digital documents, if possible at all, would certainly not give readers the more-or-less free and unlimited copying privileges that are tacitly assumed in the scenarios we just sketched.

But even these rules would be preferable to some of the revisions of copyright now being drafted with digital materials in mind. The 1994 “Green Paper” put out by the Clinton administration’s Intellectual Property Working Group, for example, would require readers to pay by use: Each time a copyrighted digital document was copied—including (the publishers hope) copies cached on a local machine whenever a document is browsed on the Web—publishers would be compensated. If these kinds of changes are enacted, students and faculty will be required to pay each time they skim virtual shelves that hold recent issues of digital periodicals. Far from looking like progress, this future could be a big step backward in public access to knowledge: How many university libraries charge admission to their reading rooms? Cyberspace-savvy academics fear, with good reason,
that digital libraries will never thrive if copyright law is rewritten to be balanced so heavily in favor of publishers. (See Figure 3.4.)

HIGHER ED GROUPS EYE ELECTRONIC COPYRIGHT BILL

Representatives from higher education associations testified last week before a House subcommittee, urging lawmakers not to pass new electronic copyright rules before their impact on colleges and universities can be assessed. At issue is a revised definition of "fair use" of copyrighted digital materials that threatens to eliminate or severely restrict online interlibrary loans, and would also prevent professors from using such materials as part of their courses. (Chronicle of Higher Education, February 16, 1996, p. A26)


Figure 3.4—Higher Education's Fight with New Electronic Copyright Laws

DIGITAL PUBLISHERS: JUMPING INTO THE FUTURE OR HOLDING ONTO THE PAST?

Publishers, of course, see the threat very differently. To them, the Internet calls up their ultimate nightmare: The U.S. Library of Congress buys one copy of a digital text for its collection, makes the copy available on interlibrary loan to any other library or patron (just as libraries generally do today), whereupon, since bits are so easily reproduced, every reader can manufacture his or her own copy with a few mouse clicks. In this scenario, the first sale of a digital book might well be the last. While admittedly fanciful, this extreme example holds more than a grain of truth. Copyright law can afford to be more generous when built-in barriers—the machinery needed to reproduce tapes, the time and cost of photocopy paper, for instance—provide natural disincentives to duplication. But these disincentives are largely gone with digital products. So, today, most publishers spend as much time defending themselves against the Internet as they do creating products for it. (See Figure 3.5.)
BOOK PUBLISHERS WORRY OVER THREAT OF INTERNET

Publishers may not be feeling panic, but they are clearly edgy about the prospects of new technology, which many consider as potentially significant as Gutenberg’s development of moveable type.

Their chief concern is the improvement of computer technology that will make it easier and faster to scan books.

In statements to the House Subcommittee on Courts and Intellectual Property Rights, the Association of American Publishers fretted about a new world: “although not wanting to be melodramatic, publishers do fear for their future, and the well-being of their authors, when looking at a world with low-cost, easy-to-use ubiquitous scanners, copiers and binders.”

The publishers group commissioned several studies on the issue, including one that concluded that there is no practical way to “unilaterally prevent” unauthorized distribution of books.

Instead the association is pressing for methods to detect copyright violations with a “uniform file identifier system.”

It is essentially a license plate on copyrighted work that contains the publisher’s name and the identity of the person who purchased the work. The publishing industry is backing legislation before the House and Senate to make it a criminal and civil offense to alter these cyber license plates. Even they are not quite sure what form the identifying codes will take, but they do know they want them.


Figure 3.5—Who Wins: Publishers, Readers, Both, or Neither?

Over the past few years, this fear has slowly started to transform through a variety of other emotions and actions: uncertain acceptance (Figure 3.6, panel 1), careful study (Figure 3.6, panel 2), strategic mergers (Figure 3.6, panel 3), and hasty exits (Figure 3.6, panel 4). Still, recognizing a booming educational software market whose retail sales may have climbed as much as 50 percent in 1995 (to over $500 million), traditional publishing houses, together with some fresh competitors, are beginning to sell substantial quantities of new products to higher education.
### PUBLISHERS WARILY EYE THE NET

Members of the Association of American Publishers have decided that they must become actively involved in the deployment of online information distribution systems, or get left behind in the dust. Up until now, worries over rampant unauthorized dissemination have resulted in "significant hesitation about investing" in electronic publishing, says the chairman of the AAP's Enabling Technologies Committee. Now, they've decided to try to resolve copyright issues "before copyright infringement on the network becomes very widespread and assumed to be the way the network works. It's a recognition that whereas in the past, publishing members of the AAP have been able to leave technological concerns to suppliers—such as compositors, typesetters and printers—in network publishing we cannot leave it to others."


### COLLEGE TEXTBOOKS—PAST HISTORY?

Publishing CEOs to Address the Future of College Textbooks at ConTEXT '96. With the increasing presence of distance learning programs, custom-made course packs, and multimedia tools in higher education, the future form of learning materials remains a big question. To address some of these issues, chief executives from three publishing companies will share their insights and ideas on the future direction of the textbook publishing industry during ConTEXT '96: A Conference on Textbooks and Technology.

**SOURCE:** *EDUCOM UPDATE*, January 15, 1996.

### LEARNING COMPANY PREFERS BRODERBUND TO SOFTKEY

The Learning Company has accepted a new merger offer from Broderbund, rejecting a rival offer from Softkey, the Cambridge, Mass.-based company that has little regard for the Learning Company's management. A top Broderbund executive says, "We believe that the management of the Learning Company is one of its key assets. We're looking at a merger with a successful company that is doing a lot of things right. The last thing we want to do is alter that chemistry."


### MURDOCH SELLS EDUCATIONAL PUBLISHING GROUP

Rupert Murdoch's News Corporation is selling HarperCollins Publishing to the U.K.-based media conglomerate Pearson PLC. A Smith Barney analyst says that "Educational publishing doesn't fit News Corp.'s image as a global distributor of information. Rupert has a lot of different objectives, and this is not one of them." Pearson PLC will now rank fourth in educational book publishing, behind McGraw Hill, Macmillan, and Harcourt-Brace.


---

*Figure 3.6—Traditional Publishers and the Digital Enemy: Fight or Flight?*
Conservatism, however, still seems the order of the day, in at least two senses. First, the initial reaction of many large publishers has been to simply follow the lead of the pioneering academics, who are abandoning paper journals in favor of just-in-time electronic versions (Figure 3.7), following the “if you can’t beat them, buy them” strategy: Some small and informal online publishing sites are being acquired by professional publishers. BioMedNet (Figure 3.1), for example, initially the brain-child of a few researchers, was taken over by Current Science, a small but fast-moving new publishing firm that specializes in value-added electronic products. Second, while publishers certainly will develop more and better digital products for higher education—BioMedNet has grown from a single digital journal to a rich, online community, for example—the processes by which new titles are created in the future probably will not be much different from what they are now.

To find places where information technology is changing the ways in which learning materials are created in a big way, we must look at a much smaller scale: the individual publisher.

---

**MCGRAW-HILL PLANS ELECTRONIC ACADEMIC PUBLISHING**

McGraw-Hill, the publishing and information services company, is considering the development of electronic academic journals that could be published more quickly and economically than traditional academic journals. An enthusiast about information technology, McGraw-Hill chairman Joseph Dionne says: "If you take this technology, you have someone submit his research, have it reviewed by knowledgeable people, the process could be done in a week or two weeks." He says he has approached such groups as the Society of Physics and the Society of Chemistry, and "there is a very real possibility that it is going to happen over the next five years." *(Financial Times, October 16, 1995, p. 19)*

*Figure 3.7—Paper Publishing Elephants Following Digital Mice?*
INTERNET IMPACT: INNOVATIVE WAYS TO CREATE NEW INSTRUCTION AND LEARNING MATERIALS

Consider again the World Lecture Hall, a virtual repository of online course materials. We discussed in Chapter Two how specific courses here might be part of a new generation of distance-learning class materials. But we look now at the Hall itself, rather than at its constituent products (Figure 3.8), to see how new instruction and learning materials are created.

The most prominent feature of the Hall is a large table that organizes specific courseware by subject matter. It is much like a standard university course catalog, except that the offerings are full sets of course materials, rather than brief course descriptions. The Hall also provides tools that allow new courses to be easily searched and added, and a “What’s New” link to identify the latest entries (a very valuable resource for frequent browsers, since hundreds of courses already reside at the Hall).

The World Lecture Hall demonstrates two very powerful benefits of information technology for education—one already widely touted, the other less so. Relatively familiar is the idea that new technologies encourage individual, home-grown production. In higher education, we have seen such production in electronic journals that bypass traditional publication bottlenecks, as well as in online courses constructed by individual faculty almost from scratch, using digital materials. Outside education, the examples are often even more compelling. Today, for example, audio and video desktop publishing puts at one’s fingertips the facilities that just a few years ago were available only to large, well-funded professional studios. Using these tools, small grassroots print-journalists, moviemakers, and record producers are already making significant inroads into markets traditionally dominated by big players. There is no reason to believe that, at least on technical grounds, educational publication and the creation of instructional materials will be immune to these sea changes.

The second feature has more to do with the World Lecture Hall itself, and the cooperative curriculum development it can encourage, than with the nature and origins of its constituent online courses. The Hall attempts to provide a location and supporting tools that will encourage faculty not only to create new online course materials, but to
The World Lecture Hall is a Web site managed out of the University of Texas. Its main feature is a large table that organizes several hundred courses, alphabetically, by subject name. Users select a subject link, which then leads to a page listing all specific courses of that type. These course links, in turn, can be followed down to their component pieces: lecture notes, tests, and so on.

The World Lecture Hall encourages new course submissions, which may be completely original or modifications of courses already resident. However, as of 4/97, it provides relatively few tools for users or developers beyond a “What's New” link that lists recent additions, a simple search facility, and the table of course offerings itself. The Hall’s developers apparently do not review courses offered by developers, follow other policies for quality control, or provide tools to help consumers find and compare products.


Figure 3.8—The World Lecture Hall: Homepage Image

share those materials with others. Because the Hall is implemented as a Web homepage, all materials from a course can be downloaded (a trivial process) from the Hall site (which happens to be in Texas) to the browser’s home machine. Using simple but very powerful digital cut-and-paste tools, this copy can be edited into a new course—possibly for a slightly different topic and audience, and, perhaps also a
Challenges to Building Productive Individual Publishing Communities in Higher Education

How likely is this rosy future? On the one hand, early indications seem promising. It was quite possible that when the World Lecture Hall was established (in 1994), no one would have come to the site. At its inception, the Hall contained very few online courses, and so had little value to browsers. But, by late 1996, the Hall contained several hundred courses; according to its managers, dozens of offerings flow in each month, and the pace is increasing. In short, at least this communal repository of digital instructional material demonstrates what economists refer to as positive “network externalities”: the more users adopt the product, the more valuable (but not more scarce) the product becomes for other users.

On the other hand, most home-grown products—whether in the form of videotapes, audio recordings, or Web homepages—suffer from a common problem: Although their creators view them as priceless, few others may. Just as once we were bored to tears by our neighbors’ vacation slide shows, today most Web surfers are frustrated by the thousands (now probably millions) of homepages that serve only to hide the few gems they seek. In the case of virtual collections such as the World Lecture Hall, it is likely that if potential consumers (who may also be producers) cannot find quality digital course materials, they will cease browsing this site (and adding to it). If so, the number of new entries will decrease, and, with fewer shoulders to stand on, the overall quality of offerings is unlikely to improve quickly, if at all. In this future, the World Lecture Hall, far from flourishing, would probably disappear within a few semesters.

Whether or not such sites foster a productive community of grassroots publishing in higher education will depend on a number of factors. Luck and good timing may play a role. If, for example, home-
grown sites develop strong early products, they may attract the attention and new contributors needed to sustain them through their formative period. Also, even if quality products exist, they must be easy to find. Internet search engines and smart agents already help consumers locate useful sites and ignore irrelevant ones. Providers also have several means at their disposal to simplify search and improve product quality. Passive tools, such as the World Lecture Hall’s table organization and “What’s New” option, help make navigation easier for consumers.

Other providers (although not the World Lecture Hall) take more active steps, preferring to control the quality of products they include in their collections, rather than just relying on consumers to cut through irrelevant materials with search tools. One ingenious, simple idea that virtual Yellow Pages (BigBook, for example, at http://www.bigbook.com/) are trying is to rely on consumer popularity to organize products and shape the market by letting users rate any business in their database and permit new buyers to see these reviews. Although this strategy has not been applied to educational courseware databases, the implementation would probably be very simple; however, the long-term consequences of using such a quality-management scheme would certainly be far from easy to predict.

Taking a more traditional approach, electronic journals such as BioMedNet have instituted formal peer-review procedures. Similarly, many of the electronic discussion groups on Usenet (the newsgroup side of the Internet) are moderated, rather than uncontrolled. Moderators can play a wide range of roles: reorganizing and packaging submitted materials, editing copy, adding commentary, and even censoring contributions outright. All this sounds very much like the value-added functions of traditional publishers. It hardly comes as a surprise, therefore, that publishing firms, seeking to re-define their roles in the digital age, are now seeking partnerships with developers of home-grown online course materials for higher education. In addition to ensuring quality and packaging of new products, many publishers are planning also to market the courseware, secure copyright agreements, and arrange licensing. (See Figure 3.9.)
UNIVERSITY ONLINE

University Online, a small Internet publisher that licenses 200 ready-made high school and college courses, is working with George Washington and George Mason Universities to create tutorials and more online courses at the higher education level, and is seeking more universities for similar alliances. The company’s president is working with textbook publishers to obtain the electronic rights to their materials, and will then pay the publishers’ royalties and split the tuition with the universities that license its products. (The Wall Street Journal, February 24, 1996, p. B5D)

Figure 3.9—Grassroots Developers and Traditional Publishers: A Marriage?

Individual publishing on the Internet is so new that it is difficult to determine how significantly it will contribute to the creation of new instruction and learning materials. If it flourishes, however, this innovative approach could speak to several important goals and problems of higher education, such as the need for just-in-time and on-demand learning.

Home-grown publishing is now technically feasible because information technologies greatly simplify constructing, editing, and sharing of documents, which may invite the creation of many low-quality products. But, suitably channeled, high-volume and high-speed production also has its good side. Obviously, the easier it is for individual faculty members to create courseware (or to tailor existing materials into new packages), the more they will be able to offer diverse materials to an expanding and increasingly divergent student population. Responding to a nearly overwhelming need for remedial instruction, for example, faculty from the California State University system might be able to put together a fresh physics curriculum in short order by combining some of the simpler digital simulations, assignments, and exams from any of the more than 25 physics courses now online in the World Lecture Hall.

This same flexibility could permit institutions to build new courseware and learning products that respond to the rapidly changing demands of industry—not, assuming popular predictions are right, a
one-time effort. Former Labor Secretary Robert Reich, among others, claims that workers will need to retool for up to five job changes per career. If so, rapid changes in instructional materials will be the rule for the foreseeable future; and the versatility that new information technologies bring to educational production will be critical for meeting these demands.

In short, just as information technology already helps manufacturing and services industries to dramatically shorten production cycles and to help solve the challenge of just-in-time academic publishing, it could enable higher education to meet the demand for just-in-time or on-demand learning.

**REFLECTION: MANY INTERESTING OPTIONS, MANY HARD CHOICES—A REPRISE**

Viewed broadly, information technologies might change the ways instruction and learning materials are created much as they could alter the ways instruction and learning are delivered: by providing many different kinds of applications, not just one or a few. The applications could speak to a variety of goals and problems in higher education, helping to reduce costs, enrich and diversify course offerings, expand access, and increase responsiveness to industry demands and social needs; and some of the most valuable uses of information technology will not simply improve educational productivity, but will require institutions to consider moderate or extensive structural transformations.

For example, by digitizing library holdings, universities can expect to save space, reduce acquisition costs, seamlessly combine multimedia documents with traditional text, and provide students and faculty with a new generation of tools for finding information and organizing it into intellectual products. However, although a single university can benefit from digitization, cross-institutional cooperation may be critical if digital libraries are to make the best-quality materials available to students and to reach the broadest audience. As we have noted, copyright problems will challenge this kind of library merging, as will barriers between higher-education institutions.

By the same token, smaller, grassroots publishers on the Web, rather than larger, traditional publishing firms, look to be nimbler providers
of new digital courseware that will meet changing industry needs. But, at least today, the individual publication process is chaotic, to say the least. In the World Lecture Hall, for instance, faculty often cut and paste new curricula from previous offerings, with little concern for copyright or institutional origin. This kind of highly informal cross-institutional collaboration has been common in academic research. Nevertheless, in the past, most higher-education institutions have been much more reluctant to share their course offerings, informally or otherwise. So, as with digital libraries, individual academic publishing may stress or even transform existing institutional structures, rather than simply enabling them to operate more productively without fundamental change.4

A slightly different way to view all this is that the Internet is beginning to foster new academic and learning communities across the Web, most of which are organizing along functional lines: developing courseware, conducting research, sharing curricula, for instance. Common interests and expertise are much more important in defining these communities than is distance, an impediment that cheap, high-bandwidth connectivity largely erases. For similar reasons, most cyberspace communities tend to ignore institutional boundaries when those boundaries interfere with emerging functional interests. These forces are beginning to give rise to new communities of practice that, at the very least, crisscross previous structures and may even erode old higher-education structures while building new ones. We discuss such communities in the next chapter.

4Or not. Perhaps the individual publishers will be transformed by existing institutional standards rather than change them. How freely authors will actually share their online curricula with others, for instance, remains an open question. Historically, the academic community, compared to for-profit publishers, has followed a very open policy. This may be changing. For example, increasingly, faculty are copyrighting their World Lecture Hall products; if enforced, these copyrights may have a chilling effect on cooperative courseware development. This and other intellectual property rights issues are discussed above in the section called Obstacles to Building Productive Digital Libraries.