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Plus:

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The Sticky Side of the Web
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Papers should be sent to the CAUSE/EFFECT editor in hard copy and electronic form. For article submission specifications, contact the editor at 303-939-0308 or send e-mail to jrudy@cause.colorado.edu. The specifications are also available on the CAUSE Web server (http://cause-www.colorado.edu/cause-effect/cause-effect.html).

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Second-class postage paid at Boulder, Colorado. POSTMASTER: Form 3570 is to be sent to CAUSE, 4840 Pearl East Circle, Suite 302E, Boulder, CO 80301-6114.

CAUSE/EFFECT (ISSN 0164-534X; USPS 458-350) is published quarterly in March, June, September, and December by CAUSE, the association for managing and using information resources in higher education. Circulation: 4,400. It is printed on Mountie Matte, which includes 10 percent post-consumer recycled paper. The journal is also available online at http://cause-www.colorado.edu/cause-effect/cause-effect.html.

Subscriptions are available to individuals at CAUSE member institutions at an annual rate of $48 ($72 outside U.S., Mexico, and Canada); to individuals at non-member institutions at an annual rate of $96 (domestic and overseas), and to campus libraries at a special annual rate of $24 ($40 outside U.S., Mexico, and Canada). Questions about subscriptions, address changes, or membership should be directed to Jeanine Reinke in the CAUSE office (reinke@cause.colorado.edu).

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CAUSE/EFFECT
A practitioner’s journal about managing and using information resources on college and university campuses

Volume 19 Number 3 Fall 1996

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Support Crisis
From the Editor

n a recent report to the CAUSE membership, Board of Directors Chair Polley McClure suggested that “most information technology staff do not adequately understand the underlying business of our institutions and ... most end users have a limited understanding of the complexity of information resource systems and their support.” As expectations rise faster than information technology budgets and support, she says, there is a critical need for high-level institutional dialog about the future of campus information resources—information, technology, and services. What is the role of central information resources organizations—as well as the role of faculty, staff, students, and departments/schools—in creating and supporting that future?

Several articles in this issue of CAUSE/EFFECT relate to different aspects of this complicated set of questions. One suggests some potential solutions for reducing the role of central technology support units, another offers a faculty perspective on technology as an enabler of a new teaching and learning model and the role of faculty in bringing about that change, and a third describes a boundary-spanning collaboration that resulted in a very effective campuswide faculty training program for use of technology in teaching and learning.

In author Michael Yohe’s optimistic view, the support crisis presents an opportunity for central information resources organizations to effect a better future—one that will emerge as a result of a careful and realistic analysis of the present challenges, along with some changes that will be necessary to address them. Within each of six directives for change, Yohe identifies specific, practical, and doable actions that can be taken to help change what he calls a “paternalistic” support model to one that fosters more self-sufficiency.

Such a model would likely have great appeal to John Chizmar and David Williams, professors at Illinois State University who have taken the initiative to create learning strategies that make use of technologies to enhance communication and access in their classes. Recognizing that their mission as faculty is not instructing but producing learning, they have systematically leveraged networking and Internet connectivity in their fine arts and economics courses, based on a matrix of time and place variables. Their article also makes a convincing argument for the potential of technology applications to reduce the cost of instruction—assuming that learning, not exposure to instruction, is the appropriate metric—and suggests that faculty training is a critical element in this equation.

When it comes to such faculty training, the University of Delaware found that collaboration was among the key success factors in developing their week-long Faculty Institute on Teaching, Learning, and Technology. Four units on campus, each with significant experiences in offering faculty development and service programs, came together to pool those experiences and leverage a number of mature training activities. The result was a new program that was designed and implemented in just eight weeks, and that was recently repeated with even more successful results.

While much of the “support crisis” discussion focuses on the people who need to be supported in their use of technology, as well as the service mechanisms for delivering that support, there is a related area that is as critical but less talked about. The infrastructure or “back-room” support crisis is arising from the increasing complexity of the multi-vendor, distributed technological infrastructure that campus technology professionals are expected to build and maintain. That structure’s reliability, manageability, serviceability, and sustainability are becoming serious concerns that also must be addressed in McClure’s proposed campus “dialog.” Author Leonard Mignerey raises some compelling questions along these lines for institutions to consider in any future administrative systems acquisition or development projects.

Once again, the Fall Task Force Meeting of the Coalition for Networked Information will be held in conjunction with the CAUSE annual conference; this year the meeting will immediately follow CAUSE96 in San Francisco. The theme of CNI’s meeting—“Enterprise-Wide Information Management Strategies”—should be of special interest to campus information systems professionals. If you are a member of the CNI Task Force planning to attend CAUSE96 (December 3-6) consider extending your stay through the weekend to attend the CNI meeting as well—and save on airfare. See Gerry Bernbom’s article (pages 4-5) for a good overview of the issues that will be explored there.

Julia A. Rudy, Editor
1996-1997 CNI Program Plan

by Richard P. West

The CNI Steering Committee endorsed the final 1996-97 program plan for CNI at the committee’s July 1996 meeting. The Committee continues to provide direction to the CNI program that serves the common interests of the broad community represented by the memberships of ARL, CAUSE, and Educom, as well as the specific interests of the members of the CNI Task Force.

Embodied in CNI’s program plan are four goals: to facilitate the transition to networked scholarly communication and publishing; to promote cross-sector perspectives, communication, and collaboration; to advance institutional readiness and professional development; and to influence the development of advanced information technologies and services.

Eight specific action initiatives are built around the program’s four goals. These initiatives provide a programmatic framework for CNI’s 1996-97 plan. They include:

- enterprise-wide information strategies
- assessment of the academic networked environment
- cost centers and measures in the networked information value chain
- networked information discovery and retrieval
- working collaborations between information technologists and librarians
- networked, collaborating learning communities
- access to and services for federal information in the networked environment, and
- subject access to networked information resources and services.

The lead action initiative is Enterprise-Wide Information Strategies. This action initiative identifies and examines the current state of implementation and best thinking in the development of networked information technologies and services at the enterprise, or campus, level. The premise of this effort is that the power of the network has to be harnessed by appropriate organizational models and tools so that a full range of networked information can be delivered to each empowered student, faculty member, and staff of a higher education institution.

The analytical framework is a familiar one. How do we create systems that easily exchange information (interoperate)? How do we organize, name, store, and define the information we have available for exchange (information management)? What are the best organizational strategies to distinguish between what is private communication and information and what is the institution’s domain? What kinds of behaviors by individuals create liabilities for organizations in a highly networked world? And, how does a highly leveraged networked information environment change hierarchies in our traditional organizations? (The relationship between the center and the departments is one example.)

In advancing Enterprise-Wide Information Strategies, CNI will focus on access to the full range of networked information venues, from administrative to community to scholarly sectors. CNI will also encourage the spectrum of professionals, specifically information technologists and librarians, to work together on CNI action initiatives.

To develop this initiative, CNI will organize approximately a dozen institutions to participate in a structured information collection and discussion process. The institutions will identify strategies and approaches that promote intellectual and institutional productivity using networked information technologies. Two multi-day workshops will then be planned to review the most successful approaches and to provide the opportunity for other institutions to discuss experiences and identify improvements. The results of these workshops will form the basis of Web page summaries as well as agenda items for CNI Task Force Meetings and regional conferences co-sponsored by CAUSE and CNI.

This Enterprise-Wide Information Strategies topic will be the theme of the Fall Task Force meeting of the Coalition on December 6-7 in San Francisco. This theme also serves as the integrating effort of the Coalition’s eight other initiatives.

Editorial space prevents examination of the other action initiatives, so I will describe the others in further detail in future editions of my CNI report to you. I will, of course, keep you abreast of our progress on the “enterprise” effort.

To remain up-to-date on this initiative or others that CNI is conducting, explore CNI’s Website at www.cni.org and subscribe to cni-announce. To subscribe to cni-announce, send the following single-line message to listproc@cni.org: subscribe cni-announce Firstname Lastname.

CNI Report is a regular CAUSE/EFFECT department that provides reports about the activities of the Coalition for Networked Information (CNI), formed by the Association of Research Libraries, CAUSE, and Educom in 1990 to promote the creation of and access to information resources in networked environments.

Richard P. West (richard_west@qmbridge.calstate.edu) is Vice Chancellor for Business and Finance for The California State University System. He has chaired the steering committee of the Coalition for Networked Information since its establishment in 1990.
The Information Professions and Enterprise-Wide Information Strategies

by Gerald Bernbom

Fundamental changes, enabled by network and computing technologies, are occurring in the professional communities of librarians, archivists, and information systems managers.

Digital representations and electronic access are enriching the library’s traditional services of physical access to analog artifacts: books, periodicals, audio and video recordings, microforms, etc. The digital libraries research agenda represents, in shorthand, this new area of professional concern.

Archives are expanding their concerns for preservation and access, institutional history, and records management to the electronic record-keeping systems that are increasingly the sole source of evidence for the official actions of organizations, agencies, and governments.

A synergistic shift is under way among information systems managers in such fields as decision support, executive information systems, electronic commerce, and work group computing. Digital documents and electronic forms are supplementing or replacing database records and file systems as paradigms by which the contents of information systems are organized, described, and used.

Convergence: technologies, professional practice, and user services

These changes represent a convergence of ideas and interests within the information professions—among librarians, archivists, and information systems managers—the full benefits of which are as yet unrealized. The potential of this convergence lies in three areas: technology, professional practice, and user service.

Networked information technologies have both enabled and stimulated changes in libraries, archives, and information systems management. These technologies include the World Wide Web, networked information search and retrieval tools, work group computing technologies, and technologies for managing documents, electronic texts, and other digital media. On its surface, technology is the area of greatest progress toward convergence, but the benefits are limited by the immaturity of the technologies themselves and the very early stage of their adoption in the various information professions. New technologies are needed that are better designed to the needs of information users. These new technologies will need to become more integrated into the professional fabric of librarians, archivists, and information systems managers in order to increase the benefits of this convergence.

Professional practice—standards, methodologies, and their intellectual foundation—is perhaps the least-developed area of convergence. Despite more than fifteen years of literature on the subject, the cross-pollination among librarians, information systems managers, archivists, and records managers remains limited. Differences in organizational roles, discipline-specific languages, and historically distinct domains of information content may account for the slow pace. Nevertheless, there are fundamental issues in the management of digital content—organization and description, search and retrieval, preservation and access—that will benefit from the collaborative attention of the various information professions, the power of such collaboration coming from the distinctive competencies and unique contributions that can be made by each of these professions.

User services may in time become the greatest driving force for convergence among librarians, archivists, and information systems managers. As networked information technologies begin to offer the appearance of an integrated world of information, users will expect the reality of such integration. Within any enterprise a user may need and seek information that has traditionally been in the domain of the libraries, the archives, or various management information systems. These distinctions among domains are not so meaningful from a user’s perspective, whose interest is in useful information—timely, reliable, accurate, and relevant. Truly useful inte-
gration will need to go deeper than the thin veneer of a Web-browser interface and HTML document presentation. The issues of professional practice—organization and description, search and retrieval, preservation and access—will need to be addressed with some consistency across a number of formerly distinct information domains if the resulting services are to meet user needs and expectations.

Enterprise-wide information strategies

The agenda outlined in the “Call for Statements of Interest and Experience: Enterprise-Wide Information Strategies,” developed by the Coalition for Networked Information and shared at the Spring Task Force Meeting (March 25-26, 1996), provides the basis for advancing the causes of convergence in technology and professional practice, and for improving user services. The emphasis on spanning boundaries, both organizational and technological, is a key to progress and success, and has been a strength of CNI since its inception. Equally important is the Call’s invitation to cross-disciplinary teams, which may include “academic and administrative computing units, libraries, archives, and academic and administrative units that create and use networked information.”

Many of the challenges outlined in the Call address the issues of convergence in the information professions: cross-domain information flows; interoperability; and boundaries between personal, work group, enterprise, and open communications. Two more of the challenges are of special importance to information systems managers, archivists, and record managers, and may be equally critical to such areas as library automation, reference, and the organization of library services. These are: legacy systems and resources, and center/periphery relationships.

Both the intellectual goal of this CNI initiative (“a framework of shared ideas and language... a ‘shared mental model’ for formulating, describing, and analyzing enterprise-wide information resource and service strategies”) and the tangible goals (learning-based workshops, written case studies, and useful and sharable technologies) promise a positive contribution toward realizing the benefits of convergence of the information professions in technology, professional practice, and user services.

The CNI initiative can make an important contribution by orienting the initiative around the organizational construct of “the enterprise.” The ubiquity of networked technologies has resulted in a loss of distinction between local and remote users of information, or between primary and incidental service recipients. The anonymity of the network and its users has sometimes resulted in a lack of focus on the part of information providers. This is not to say that only users who are local and known are important. Indeed many information services are intended for remote, anonymous users as the primary audience. By inviting information providers and information professionals to consider and define the scope of their “enterprise,” and by asking that information strategies be described in the context of this enterprise, this initiative introduces a useful and flexible organizational construct to the consideration of information resources management.

Final comments

Organizational collaboration among librarians, archivists, and information systems managers represents an important (and possibly inevitable) trend in the information professions. Work in this field has the potential to add value in all sectors—education, government, professional societies, and commercial industry—based on timely, accurate, and relevant information delivered where, when, and to whom it’s needed.

The organization responsible for information—whether libraries, archives, or management information systems—will not matter nearly so much to our users as will the quality of information, represented in part by its selection, organization, description, search, retrieval, preservation, and access.

The Enterprise-Wide Information Strategies initiative of the Coalition for Networked Information is a promising project to help advance the benefits of convergence among the information professions toward reaching common “enterprise” goals.
Information Technology Support Services: Crisis or Opportunity?

by J. Michael Yohe

Information technology support services are in crisis, due to dramatically increased expectations and stable or dwindling funding. This article examines the root causes and suggests actions which may help resolve the situation by reducing expectations, increasing effectiveness, and building partnerships.

In a recent issue of Change magazine, Steve Gilbert of the American Association for Higher Education discussed the very real support service crisis emerging in higher education, particularly in small colleges and universities. Rapid advances in hardware technology fuel new opportunities in applications, raise unrealistic expectations, and create unstable and unmanageable technological environments. Support services are expected to deliver everything that’s new, virtually instantly; continue support of legacy systems beyond their reasonable lifetimes; assure interoperability of disparate and sometimes incompatible applications; and do it all with resources that are rapidly dwindling in proportion to the work at hand.

But just as important as the crisis is the fact that colleges and universities across the country are finding effective ways to turn these problems into successes. In this article, we examine the causes of the crisis and explore ways in which beleaguered support services people can turn the crisis into an opportunity for a brighter future.

The vision: Utopia

We’ve done it to ourselves. For years, computer manufacturers, vendors, programmers, and support professionals promoted the “computer mystique.” The average person was systematically instructed in the magic and infallibility of computers. Even the stock “computer error” excuse for all failings of record systems was understood to be a cover-up for human fallibility.

We have convinced our customers that computers are omnipotent, omniscient, and infallible. We’ve created a sort of Buck Rogers Utopian vision of a society where all routine, tedious, time-consuming tasks are handled by automatons, leaving us free to contemplate, invent, procreate, and play.

The expectation: perfection

What, then, are the expectations of our customers?

First, they expect that all information is immediately accessible to them; that they can have whatever information they want, whenever they want it, wherever they want it, and however they want it. We measure in minutes the time from experiencing delight that the library catalog is online to anger that the full text of all listed books is not instantly available on the screen.

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Next, they expect to have at their fingertips applications that will maximize their effectiveness. If it’s available anywhere, it is expected to be available on their workstation. This implies that they will have the latest technology; that they will have connections to all other points and everything they reach will interoperate with their desktop hardware and software; that communication will be instantaneous, with integrated voice, video, and data; that the interface will be

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members to use their time more effectively.  

Third, they expect effective help in using these resources. We might postulate that this includes effective, conveniently available training and readily available, easily understood documentation. In fact, however, the real expectation is that the use of all of these resources will be intuitively obvious—with no recognition of the diversity of intuition that renders what is obvious to one person inscrutable to the next. They do not want to learn how to use these resources, only to know how.

Fourth, if support is required, they expect to make a single contact, which will result in instant, on-site response by a person who has full knowledge of all hardware and software, from the very latest to the earliest legacy systems. Each customer's needs are naturally top priority to that person; the expectation is that they will be top priority to the support staff, too. Indeed, if a single customer has multiple needs, they are all top priority.

Finally, our customers expect that there will be no problems: no network bottlenecks, no power outages, no downtime, not even any housekeeping or system maintenance time. Full service, twenty-four hours a day, every day of the year.

If this all seems too harsh, let me assure you that computer professionals are no different when they are the customers. If you catch a computer professional in a weak moment, you may even elicit an admission that “they” is “us.”

The reality: it’s not a perfect world

Against the background of these expectations, we need to view the harsh realities.

Budgets are tight. The normal fund allocations are growing slightly or remaining stable, if we are lucky. Grant funds are becoming more and more scarce as governments need tighter and tighter control over their spending. Corporate generosity is tempered, in many sectors of the business world, by declining profits. Corporate downsizing adds competition to the entrepreneurial activities that have, in the past, provided some extra revenues to colleges and universities.

The result is a tendency to keep staff sizes small relative to the task at hand, or even cut them, resulting in work overload and staff burnout and frustration, and to defer the purchase of the equipment and resources that could enable staff members to use their time more effectively.

Change is constant and rapid. Computer professionals must learn new concepts and skills continuously or risk obsolescence. Technical knowledge that is cutting-edge one day is obsolete the next. Moreover, this change does not only affect existing activities; it is the hallmark of the computer industry that new technology lowers costs, increases market penetration, and begets greater utility and greater expectations. So change also expands the responsibilities of the computer professional.

With the expansion of computing into broader and broader segments of society comes a proliferating set of problems. Antisocial activities such as hacking and the creation of viruses are on the increase. Deliberate penetration of security systems for personal gain is accelerating as the ability to connect computers together continues to outstrip our knowledge of how to defend the new connections. Complaints of unsuitable or objectionable materials, inappropriate use of resources, and violations of copyright and common standards of propriety, if not law, are exploding. Computer professionals are expected to address all of these.

The lower cost and greater market penetration begets one other problem that is so important that it deserves special mention. “Experts” buy their own hardware and software without consulting computer support staff; these purchases often do not excite the purchasing departments because the dollar value is not great enough or the description of goods does not reveal the true nature of the purchase. Once these goods are on the campus, it is too often demanded that the support staff resolve problems of networkability and interoperability.

The challenge: walk on water

These, then, appear to be the major challenges for an information technology support staff:

Providing sufficient connections (including intra- and inter-building cabling), servers, routers, and hubs. This involves the questions of network design, robustness, and redundancy.

Providing sufficient capacity, in a multitude of dimensions. As the saying goes, “you can never have too much bandwidth or too fast a processor.” Network capacity issues include backbone bandwidth, subnet bandwidth, bandwidth of the Internet connection, as well as capacities of hubs and routers. Host capacity includes processor speed, memory, disk capac-
From the service provider’s point of view, the crisis is one of unrealistic expectations. From the customer’s point of view, the service provider can’t meet even the most reasonable expectations.

The challenges

- Providing sufficient connections (including intra- and inter-building cabling), servers, routers, and hubs
- Providing sufficient capacity, in a multitude of dimensions.
- Coordinating efforts
- Integrating technology
- Keeping up with the pace of technology
- Securing funding
- Hiring and retaining qualified staff
- Attaining and maintaining peak efficiency and effectiveness

The only way to meet all of these challenges is to take on an even bigger challenge: attaining and maintaining peak efficiency and effectiveness. It is this challenge to which we now turn.

The crisis: morale

A maxim attributed to Peter Drucker holds that efficiency consists of doing things right, and effectiveness consists of doing the right things. Generally, support services groups tend to be quite efficient about what they do; most tend to be effective as well. So why the crisis? It goes back to the expectations—particularly to the expectation that an effective organization will do all the right things. It is this assumption that we must challenge. To see why, we look at the support service crisis from the two sides of the fence.

From the service provider’s point of view, the crisis is one of unrealistic expectations, or at least the perception of unrealistic expectations. There is simply more to do than we can handle in the time allotted (and perhaps even in all the time available). There is a feeling, usually accurate, that most matters can be treated only superficially and not to any reasonable standard of quality. The staff member may work more and more hours, still without satisfying the increasingly angry customers, whom the staff member perceives to have insatiable appetites. The cycle continues in a downward spiral until the staff member burns out and either leaves or gets fired.

From the customer’s point of view, the service provider can’t meet even the most reasonable expectations. If a workstation is not functional, most customers are unable to work until it gets fixed, and two or three days is an unreasonable length of time to wait. Advertising extols the virtues of the latest software, but the version the customer is using is two or three revisions old.

Securing funding. We can expect that normal allocations won’t change much; that grants and contracts will be more and more difficult to obtain; and that revenue opportunities will experience increasing competition from the business sector. Yet, the need for funding continues to accelerate.

Hiring and retaining qualified staff. Candidate pools are typically small, especially for new technologies. Even as larger corporations trim their staffs, the demand for qualified computer support people continues to increase. Some of our students graduate from our institutions and take jobs paying twice as much as we pay their mentors. Similarly skilled people on our staffs see this and begin casting about themselves, disenchanted with the myth of the “good life” in academe and tired of the sixty- to eighty-hour weeks.

The pace of change generates the requirement to keep up with new developments as well as the need to preserve the physical and intellectual effort that has gone into developing course materials or data for older systems.
Requests for service seem to fall on deaf ears. If training is offered at all, it is not at the time when the customer can conveniently take advantage of it; and, besides, the workshop is several hours long and the customer wants only a few pointers. And so on. In short, the service provider just isn’t providing service.

How can we possibly see an opportunity in this?

**The opportunity: promote self-sufficiency**

The opportunity lies in redefining the understanding of service and changing the paradigm for meeting the needs of the customer. This is not a new concept at all. In fact, we have a ubiquitous model: the telephone system.

Today, we don’t think twice about placing our own telephone calls. We simply pick up the phone and key in the number we wish to call, or perhaps even have a computer key it in for us. Yet many of us can remember when placing a long-distance telephone call involved calling the operator, who set up a connection to an operator in a neighboring area, who further set up a connection, and so on until the two parties were connected by a chain of operator-established connections. Dialing a long-distance call was simply not possible. Some may remember times or places where dialing calls was not possible at all; one picked up the phone, turned a crank to ring a bell in the central office, and the operator answered and manually patched the circuits together.

We need to heed the telephone system model. Most of the time, most people should be able to take care of their own needs for computer support. The support services staff needs to be working behind the scenes to keep the infrastructure running, and be available for direct service on the rare occasions when the customer’s needs exceed abilities.

What kinds of changes are necessary if we are to resolve the current crisis and promote increased self-sufficiency among our customers? We offer some suggestions.

**Control expectations**

If unmet expectations are at the root of the support service crisis, then an obvious first step is to ensure that the customers’ expectations are realistic and reasonable.

**Planning.** A key factor in setting realistic expectations is a campuswide planning effort with representatives of all constituencies participating. This can be a major challenge in that it requires leadership from the top and strong incentive for constituents to participate. The planning process must be tied to the budget, and include the setting of clear and consentaneous priorities. Those activities that are high enough on the priority list will be funded; those that aren’t funded cannot be expected, either. The new president of the University of Northern Iowa has begun such a process; a similar process is recommended by Steven Gilbert in an article in *Change* magazine.

Advisory committees. Regardless of whether a comprehensive planning process is undertaken, advisory committees that represent the various constituent groups can aid both in helping the service provider interpret campus expectations and in helping the campus review and adjust expectations in light of the resources available.

*Teaching, Learning, and Technology Roundtables.* One of the most exciting recent developments in working toward reasonable expectations is the Teaching, Learning, and Technology Roundtable (TLTR) program of the American Association for Higher Education (AAHE). This is a structured program for bringing together the faculty, administrative, and support service leaders on a college or university campus to develop objectives and projects leading to an appropriate and effective application of technology in the educational process.

Service level agreements. It stands to reason that a mutual understanding of the nature and extent of service provided will help forestall unreasonable expectations. Many institutions use written service level agreements to ensure this mutual understanding; such agreements, for example, are used at Fermi Labs.

**Reduce work**

One of the best ways of increasing effectiveness is to identify activities that aren’t really necessary. Clearly, time not spent in routine or unproductive activities can be devoted to projects of higher priority.

Create a single point of contact. Sometimes called a help desk or hotline, a single point of contact can aid in tracking requests for help and reducing interruptions for the technical staff. Automate problem tracking. The University of Northern Iowa has purchased a database system to aid in tracking trouble calls and their resolution. Although staff are not in a position to respond immediately to each call, the calls that get entered into the system are usually resolved in a reasonable length of time. Those that drop through the cracks are the ones that bypass the system. The technical staff can be freed from having to answer and screen the calls in the first place, and questions about progress on the service request can be referred to the help desk.

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3 Ibid.


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**One of the best ways of increasing effectiveness is to identify activities that aren’t really necessary.**
"If it’s easier to call than to use the information access tools at hand, [people] will generally call.”


rather than the technical staff. Similar systems are in use in a number of places; a paper by Tom Murray and Liz Brigman discusses a related experience at Rice University and lists a number of other places using problem tracking software.\(^5\)

Use automated phone attendant/answering machine/voice mail. As frustrating as these systems sometimes are, there are valid applications. There is no reason for a live person to spend time answering questions about when this or that lab will be open; the answers to such common questions can be recorded and calls directed (or transferred) to the recording.

Communicate via electronic mail. E-mail is a well-known time saver, both for requests and for notifying customers of the status of their requests. Setting up a special account or alias with a mnemonic name can encourage the use of this medium, as can automatically mailed response form on a World Wide Web space. Automatically posting such messages on an internal bulletin board can allow staff members to claim and respond to the messages, so no one staff member needs to screen and distribute the messages. Ohio State University is one of many institutions using this resource effectively.\(^6\)

Publish frequently asked questions (FAQs) and answers. Publishing carefully crafted answers to FAQs in accessible places (such as the World Wide Web space or on a bulletin board) can both reduce the number of live contacts and improve service by making help on the most common questions available around the clock. FAQs should be reviewed and updated regularly, and records of calls received will suggest additions to the list.

Employ conversion programs and utilities. The well-publicized availability of conversion programs and utilities can allow people to help themselves rather than asking for help from the support service staff. Better yet, staff should select and support software that has built-in conversions from a variety of competing applications of the same type.

Automate routine tasks. This seems obvious, but “who is worse shod than the shoemaker’s wife?” Opportunities abound; Catholic University, for example, automates a number of tasks connected with the operation of computer labs, and the University of New Mexico automates software installation on desktop systems.\(^7\)

Move to automated/unattended operation. In some cases, facilities, ranging from computer rooms to terminal clusters, can be left to operate themselves entirely. Most institutions leave central computers running unattended for at least a portion of each day. Some institutions leave computer labs unattended, monitoring them with closed-circuit TV or with card-key access systems. At the University of Northern Iowa, dumb terminals are placed in public places for faculty, staff, and students to use in checking e-mail, library catalog, text-based Web pages, and so on. These terminals are not particularly useful in any other venue, and the campus community values the convenience enough to guard the terminals to some extent. In any case, if one is stolen, it can be replaced from retired stock or, if necessary, for a few dollars on the open market.

Improve interface and access to information. People are like electricity in that they follow the path of least resistance. If it’s easier to call than to use the information access tools at hand, they will generally call. Making more information available via the easily used, ubiquitous World Wide Web interface or other convenient means will tend to improve service and at the same time cut down on the number of telephone calls (read “staff interruptions”). At Princeton University, online information is used as a primary means of training student staff members.\(^9\)

Standardize hardware, operating systems, application software, protocols. Standard systems tend to reduce the amount of work for the central support staff for a couple of reasons. First, there are fewer questions if everything looks the same from one workstation to the next. Second, questions can often be answered by colleagues in the same office rather than by central services.

Minimize number of supported products. The fewer different products we have to answer for, the less work we have to do in learning or remembering product information. Clearly, we must support a functional suite of software; and most of us must support one suite for Intel-based machines and another for Macs. Even at that, there are opportunities to minimize support requirements by choosing software that runs comparably on multiple platforms. There should be no requirement, in any case, to support multiple vendors’ word processors, for example, on a single platform.

✓ Get help

Strange as it may seem, we don’t always avail ourselves of the help at hand. This has always been the case; from the early days of computers, college and university computing services suffered from the so-called NIH (not invented here) syndrome. It has been a very long time since any of us could afford the luxury of traveling alone.

Students. University of California Berkeley is only one of many institutions reporting effective use of student help.\(^10\) In fact, very few of us could do what we do without student help, and it may seem like we are belaboring the obvious. How-
ever, many people tend to underestimate the abilities of students. At the University of Wisconsin–Eau Claire in the early 1980s, we had a well-run and effective help desk staffed entirely by students with the part-time supervision of a single full-time staff member; the same approach is being used at the University of Virginia. On the other hand, in other venues I have seen managers refuse to give students significant responsibility, with the predictable result that the students also failed to make significant contributions. We all have students who can shoulder large chunks of the load, if we but let them.

**Experiential learning.** At some institutions, class projects or co-op assignments are reasonable sources of help for small projects. Since these projects are of limited duration and the students' dedication to the project is not likely to survive the immediate assignment, care must be taken in the selection of these projects; however, they can be of significant benefit in some circumstances.

**Local experts.** Most institutions and communities are endowed with people who have relevant expertise and can be prevailed upon to share it with the institution. Local vendors may conduct training classes for new releases of software; local consultants may be willing to give advice on network design.

**Outside consultants.** Particularly in the case of special projects, it is worthwhile to consider hiring a qualified consultant. It may well be less expensive to hire the expert than for staff members to bring themselves up to date on specific technologies such as telephone systems. The presence of an outside expert tends to give recommendations a degree of credibility they would not otherwise have, no matter how well qualified the local staff may be. And work done by the consultant does not have to be done by local staff, thus freeing up their time for other pursuits.

**Faculty and staff.** Faculty and staff members may be willing to take part-time or summer appointments with the support service organization to teach workshops, help with installing new equipment or software, or undertake other short-term projects that would benefit from their expertise.

**Distribute responsibility**

A frequent complaint of the customers of a support service is that there is too much appetite to control what the customers are doing. In some ways, this is inevitable; if the network is to function smoothly, all participants must adhere to appropriate standards, and one organization must have responsibility for and knowledge of the network. At the same time, some responsibiliti-
submit jobs through a job control staff to run the reports, and the results would be picked up at the computer center. Networking and job scheduling tools make it increasingly possible for customers to submit their own jobs, with the results appearing on their own workstations or printers. Clearly, time not spent in processing routine requests can be applied to other priorities, and the customer assumes the responsibility for the correctness of the request.

**Collaborate**

A roof truss is made up of a number of small structural members, no one of which could handle the expected load alone, joined together in such a manner that the union does the job with capacity to spare. Likewise, collaborative relationships build on the strengths of all members, producing a result that can easily bear loads that would overwhelm us individually.

Related units on campus. Library professionals, educational media professionals, and computing professionals increasingly are recognizing the convergence of their disciplines. At the 1993 Small College Computing Symposium, the University of Wisconsin, Eau Claire, presented a paper on library/computing collaboration, the Third Library Services Institute, held in Chicago in 1994, focused on partnerships between libraries and computing organizations; the Fall 1994 issue of CAUSE/EFFECT focused on library/IT collaboration; and the Coalition for Networked Libraries offers a working retreat for campus librarians and information technologists to foster collaboration. It is not uncommon to find that other campus units are supporting similar activities, and that the units and the institution alike benefit from combining these efforts.

Technical coordinators. Some units may have enough equipment and resources to need a full-time or part-time coordinator. In some cases, these coordinators may be funded by and report to the support service, but often they report to the college and function independently. The University of Kentucky has found that close collaboration with these individuals results in better service to the customers and a more effective use of staff time. Since the University of Northern Iowa gave a name of its cell coordinators access to the central problem database, complaints of poor service in that college have virtually ceased.

Liaisons. The idea of identifying key people in each department to meet together to exchange information and ideas with one another and with central service staff has been around for some time; many institutions have some variation on this theme. It goes by different names in different places; at Northern Iowa the group is called Liaisons. When Liaisons call the central support service, they get preferential treatment. Others are generally referred to their department's Liaison or placed in the normal priority queue. Both Brigham Young University and Loyola University Chicago implemented such liaison-type programs early on.

Affinity groups. We know that proximity is the single most important factor in determining who we turn to for help. At Eastern Michigan University, purposeful support of these informal alliances has paid handsome dividends by capitalizing on the natural zeal for technology combined with commonality of professional interests.

Training centers. These may be formal programs, such as the one at the University of Wisconsin, Eau Claire, or informal arrangements such as a training facility shared by a number of departments. The effect, however, is to bring people together in offering training, and the proximity tends to promote better division of work and freer exchange of ideas.

Faculty. If you look around your institution, you'll likely find that faculty members are writing good documentation for their classes. There is no reason for central services to duplicate the effort; faculty members are usually quite willing to share the fruits of their labors.

Colleagues in other institutions. Often it's possible to share documentation, training modules, and expertise with colleagues in other locations. The Internet makes this kind of sharing incredibly easy. These arrangements can be diverse and suited to the particular institution and problem at hand. A handful of ACM members representing institutions on both coasts and in the nation's midsection have formed an informal Virtual Consulting Service (ViCS), through which they share expertise on knotty problems as well as personal support. Another "virtual community" shares documentation in Iowa. The Iowa Research and Education Network binds together some seventy public libraries and educational institutions at all levels; IREM members freely ask and offer advice from one another on a multitude of topics. In many states, affiliated public institutions share software, hardware, and staffs. The possibilities are limited only by the imagination of the participants.

Online information. There is a wealth of information available, free for the taking. Locally, there may be bulletin boards or mailing lists that deal with specific topics of interest. Often these can be opened for wider use by simply cajoling the organizers. Globally, there are not only many good sources of information, but, increasingly, sources such as Yahoo where searches can be
conducted; online information from vendors or other institutions may be accessible, at least to the support service staff. A support services organization can perform a valuable service for a modest investment by codifying these sources and making them known to the campus, as has been done at the University of Virginia.23

Personal networking. Never underestimate the value of personal contacts. If the budget permits, it is wise to send every staff member to one or two meetings a year. For networking purposes as well as for the professional value to be obtained from them, regional meetings such as that of the Small College Computing Symposium or focused national meetings such as the CAUSE annual conference and the Association for Computing Machinery SIGUCCS (Special Interest Group on University and College Computing Services) meeting are most valuable.

Communicate

Advertising doesn’t cost; it pays. This maxim from the business world is equally applicable to our world. Unfortunately, most technical people aren’t marketers. If you have the best resources in the world, and your customers don’t know about them, you’ve wasted your investment.

Newsletter. Newsletters can be works of art, but they don’t have to be. They simply need to get critical information in the hands of our constituents. If the articles are short and to the point, some of the newsletters may even be read before they hit the circular file. If you have a lot of time to invest in page layout and graphic arts, so much the better; but a plain old text flyer is far better than no information at all.

E-mail. The aficionados, at least, tend to notice their electronic mail. Critical information can be communicated quite effectively this way. Just be careful not to overdo it: focus the messages, send them selectively, and send only when necessary. People despise junk e-mail more intensely than junk postal mail, and almost as passionately as they hate junk phone calls.

Liaison meetings. Since these are theoretically meetings of the most interested and knowledgeable people at the institution, they should be extremely effective in communicating both directions. In practice, we’ve found that to be true, but it takes a persuasive agenda, good leadership and participation in the discussion, and a healthy dose of luck to make it work well.

User groups. Emory University has found that focused interest groups are an excellent source of suggestions as well as a natural vehicle for communicating information.24

Management teams. When specific needs are addressed by teams consisting of people “in the trenches” and people from the support service, the level of understanding is deepened quickly and dramatically. Rice University has found this approach effective.25

Conclusion

The real crisis in technology support services is that we are not recognizing the opportunities at hand. To do that, we need to revise our thinking. Technology support services have historically been paternalistic enterprises because they had to be; the technology was inscrutable to most who did not have a strong technological background. Modern technology has erased many barriers, but many of us have been afraid to change with the times. Only when we recognize that information, like love, multiplies when you give it away will we be fully prepared to abandon our crisis thinking in favor of the synergistic behavior that opens the door to the future for everyone.
Altering Time and Space through Network Technologies to Enhance Learning

by John F. Chizmar and David B. Williams

Networking technologies offer a better learning environment for students while
providing opportunities for reducing the cost of the learning process. A key outcome of
advances in networking, the Internet, telecommunications, and client/server computing
is that they are serving to alter the limitations of time and place. The authors discuss
their experiences from the perspective of teaching in economics and the arts. They have
created learning strategies that make use of these technologies for communication and
access according to a matrix showing the interaction of time and place.

In this article, we address the following questions: Will computing and networking technolo-
gies offer a better learning environment for students? Will these technologies improve our
ability to help students produce learning while reducing the cost of instruction? We believe that
the answer to these questions is a resounding “yes,” if computing and networking technologies
are used to create learning strategies that involve students as active partners in their own learning.

In the search for active learning strategies, we are guided by two principles stated by Cobb:
• The student and teacher share responsibility for the quality of a process—the process of the
  student’s learning (only indirectly and secondarily the quality of the teacher’s teaching).
• The core motivation, for both student and
teacher, should be the satisfaction that derives from improving the quality of the student's learning.2

Our goal as teachers in using computing and networking technologies is, to use a metaphor, to be a “guide on the side” instead of a “sage on the stage.” To return to Barr and Tagg’s terminology, our goal is to move from an instruction paradigm, in which a faculty member’s role is “actor” and knowledge is transferred from faculty to students, to a learning paradigm, in which a faculty member’s role is “inter-actor—a coach interacting with a team,” and students discover knowledge for themselves.3 We illustrate these contrasting paradigms in Figure 1.4

Enhancing the learning process through networking technologies

To understand how technologies can support and enhance the quality of student learning and increase active participation by students, in this article we share our experiences with implementing active learning strategies that use computing and networking. Chizmar (hereafter referred to as the economics instructor) teaches an undergraduate economics (statistics and econometrics) course in a networked computer classroom where each student works on a computer workstation connected to the campus network and the Internet. Williams (referred to as the fine arts instructor) teaches two seminars on designing computer applications in the fine arts. The first course focuses on designing multimedia applications with Powerpoint, Authorware, and HyperCard; the second course focuses on designing electronic arts exhibits on the Internet using a Web server, HTML coding, and a variety of graphics and music creative software tools. These courses take place in a traditional conference room with a computer teaching station, an overhead display, and a connection to the campus network and the Internet. Fine arts students also use a portable computer-lab-on-wheels on occasion in the classroom—a number of laptop computers are available on a cart, with wireless infrared networking—and they have access to a networked computer lab for work outside of class.

Networking and Internet connectivity is critical to our teaching strategies. To create an Internet Web presence for both courses, we set up a Web server on Macintosh computers directly connected to the Internet through a 16 MB token ring. WebStar (originally MacHTTP) was used as the Web server and FTPd was used to create file transfer and Gopher services. A key advantage to this configuration is that folder or directory access is easily administered through AppleShare, and student folders can be accessed either through the local AppleTalk networks or through file transfer over the Internet. The server for music was upgraded to UNIX and an SGI Indy computer this past year. Listservs, Usenet newsgroups, and e-mail were created through the campus Internet servers for these operations. Both of us have available personnel for technical support to assist with setting up and maintaining the servers and accounts; however, we did much of this ourselves.

The network and server facilities that we have in place provide for our students, to use Larry Smarr’s phrase, a “window into knowledge space.”5 Smarr asserts that we are experiencing today the fruits of a major transition from a world of one person, one computer, to a world of the “meta-computer,” a computer of computers. In this new world, a personal computer becomes a “window into knowledge space” and a gateway to virtual resources. But meta-computing does more than provide a looking glass through which to see the world. We believe that meta-computing also creates a looking glass that reflects back to the learner an image of him- or herself working with other learners. Meta-computing enables learning by providing diverse modes of communication and access to a creative, virtual collaborative space for students.

Here is just a sample of some of the learning activities possible in our networked, meta-computing environment at Illinois State University:

- Private news groups for each class
- E-mail collaboration: student-to-student, student-to-instructor, and instructor-to-student
- Electronic submission and critique of work
- Electronic posting of grades, class handouts, notices, schedules, etc.
- Electronic exhibit areas for class projects
- Internet-wide critique of work
- Internet-based research projects.

In the remainder of this article, we present examples of how we implement these activities in our classes. We find it useful to view these activities in terms of a time-and-place matrix, a concept developed from writings on groupware

Figure 1: Two instructional strategies

Sage on the Stage

Guide on the Side

“Networking and Internet connectivity is critical to our teaching strategies.”


3Barr and Tagg, 24.

4These figures were digitally created by David B. Williams from an original graphic of a sage-on-the-stage-like image by an unknown artist. We have not been able to identify the source of this image.

5Larry Smarr, taken from an interview on a NOVA PBS series on supercomputing and networking. See http://141.142.3.134/Cyberia/Metacomp/Metahome.html for a good presentation on “metacomputing.”
“The advantage of the listserv in this context is that students know that their message is sent to the entire class.”

Figure 2: Instructional activities possible in a networked learning environment

Time and Place Matrix

<table>
<thead>
<tr>
<th>Time</th>
<th>Place</th>
<th>SAME</th>
<th>DIFFERENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAME</td>
<td>Traditional classrooms and meeting places</td>
<td>Virtual classrooms, distance experts, and distance tutors</td>
<td></td>
</tr>
<tr>
<td>DIFFERENT</td>
<td>Computer labs and online servers for teams</td>
<td>E-mail, news groups, Gopher and Web servers</td>
<td></td>
</tr>
</tbody>
</table>

strategies and adapted to our work. A key outcome of the advances in computer networking and the Internet is that they are serving to alter the limitations of time and space. Each cell in the matrix (see Figure 2) demonstrates this by representing unique combinations of time and place events in fully networked learning environments. We start with same-time/same-place (representing the traditional classroom) and progress clockwise through different-time/different-place.

Same-time/same-place: traditional meeting places

Same-time, same-place describes the traditional classroom, rehearsal room, conference room, or computer lab. Our definition of “place” here includes both physical space (e.g., the classroom) as well as virtual class space (e.g., a dedicated server holding students’ work and instructor’s materials much like a workroom or team room).

Most efforts at incorporating technology into instruction have been focused on this cell of the matrix. This cell includes any meta-computing learning strategy that improves the ways in which students traditionally learn within the confines of meeting for fifty minutes, three times per week (same time), in the same classroom (same place). Such strategies include collaborative or groupware applications and experiences, in-class demonstrations, practical experiences (especially with simulations), experiences with software applications, and in-class access to student and course online files. The economics course makes use of simulation and in-class electronic collaboration and feedback within the same-time/same-place cell of the time-place matrix.

The economics courses use electronic mail and a class listserv to augment an active learning strategy called “think-pair-share.” This activity takes place collaboratively during class time. To help students clarify their thinking, the instructor asks each student to write an e-mail message to the class listserv, explaining, in words their fellow students will understand, a particularly difficult concept, a p-value for example. Students then read what other students have written and discuss differences or similarities with their teammates. The advantage of the listserv in this context is that students know that their message is sent to the entire class. Version of “think-pair-share” is based on Meyers and Jones’ observation that “when we direct students to write to each other, they usually write with more clarity and precision.”

The economics courses also use network computing to provide frequent feedback on the quality of student learning through a technique...
called the “Minute Paper.”9 A typical Minute Paper asks students to respond, in the final minute or two of class, to two questions: (1) What is the most important thing you learned today, and (2) What is the muddiest point still remaining at the conclusion of today’s class?

The first question is intended to focus students on the big picture, i.e., what is being learned, and the second to provide specific statements of what students want to know more about, i.e., how well it is being learned. At the conclusion of every class, students in the economics courses answer these questions plus a set of Likert-scale questions developed by Shulman10 using a Netscape form (see Figure 3).11 The form creates a tab-delimited text file of the students’ responses, which can be easily analyzed in Excel and Minitab. Furthermore, because the form also asks students to provide their e-mail addresses, the instructor can respond immediately via e-mail to any student who seems particularly “muddy.”

Before the next class, the economics instructor analyzes students’ feedback and fashions an e-mail message back to the students that contains their verbatim responses to the Minute Paper from the previous class. Students find this practice informative because it tells them, in unabridged language, that other students are muddy about the same points as they. The instructor begins the subsequent class with a discussion of students’ responses, in essence, with feedback on student feedback.

**Fine Arts**

The fine arts courses employ a constructionist strategy of teaching with a strong emphasis on learning projects. A key strategy for the use of class time is viewing and critiquing work in progress. The guidelines for economics study with emphasis on motivation, real-world problems and projects, and the downplay of formal training, apply here in the fine arts as well.

The instructor uses the teaching workstation and its connection to the network to quickly access student work from the department server, where class and private student folders permit electronic storing of assignments and work in progress. Students have an online folder for their work to which only they and the instructor have access. Having electronic access to all student projects makes it easy to quickly show and com-

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11 The Netscape form is only the latest incarnation of the Minute Paper. Chizmar migrated from asking students to respond to the Minute Paper first using paper and pencil and then using e-mail. The primary advantage of using the form is that it substantially reduces the analysis time—from over one hour to less than 15 minutes.
pare portions of students' work and to isolate examples of problem areas in software and instructional development that need class attention. When hands-on training is needed for learning new software development tools, the portable lab-on-wheels can be rolled into the classroom.

**Same-time/different-place: lowering the walls of the classroom**

Same-time/different-place computing lets us expand beyond the classroom. Here is where we "lower the walls" and open the “window into knowledge space.” Using the power of network connectivity and advances in cable and the telephony, collaboration takes on an expanded meaning. Any group of people can be brought together for a meeting at the same “time” without regard to “place.” We can hold text-based conferences (online chat groups), audio conferences (phone conferencing), and full-audio and video conferencing right from our desktop (desktop video presentations). Tutoring can be offered remotely. Mentors or experts can be brought into the classroom from anywhere in the world. Many programs are now offering their courses and degree programs online, letting students complete some, if not all, of their work remotely.

### Fine Arts

The fine arts instructor uses the teaching station's connection to the Internet as a way to open the classroom to world-wide people resources. Active participation from the class on Usenet newsgroups provides input and assistance from people throughout the Internet for information, problem solving, and even critique of student work. The newsgroups provide informal distance experts. Prearranged e-mail (using Eudora) and chat conferences are scheduled to synchronize with class time so that distance experts can share their talents, contribute to a class discussion, or help the students solve particularly difficult problems or locate resources. Using Fetch, TurboGopher, or Netscape, a particularly rich resource of graphic images or music sound files can be queried and the files downloaded to the classroom for discussion and experimentation.

### Economics

The economics instructor uses the student station’s connection to the Internet similarly. Students, working in teams, use Netscape to access laboratory experiments designed to actively engage them in the study of economics. One experiment, entitled “An Internet Journey” and adapted from an article written by Rossman, asks students to answer a series of conjectures about life expectancy and density of people per television set in various countries. Working in teams of two, they link to an online journal, retrieve a set of the data files across the Internet, and import them into the statistical software for further analysis.

### Future applications

There are other same-time/different-place activities that we intend to implement in the future: desktop video conferencing to bring distance experts and demonstrations into class in real time, prescheduled online tutoring for students with the instructor or a graduate assistant through controlled use of Internet chat groups (IRCs), and even the possibility of permitting students to attend the class remotely through desktop video conferencing.

### Different-time/same-place: virtual shared space and computer labs

This matrix cell includes any learning activity which gives the instructor and students physical or virtual use of a dedicated workspace, any time they choose—in essence, virtual team rooms. We each provide local servers of information dedicated to class use, both for personal storage of work and for shared storage. This cell also would include dedicated physical workspaces. Our students have access to networked computer labs which they can use for “different-time” computing activities.

We both use a series of Web pages to organize online course content, where materials dedicated to our courses are stored. Students can find electronic versions of handouts and course syllabi. The well-worn plea for another copy of a lost handout is now followed by the rejoinder of “just download a new copy from the class server.” Grades are posted electronically after each assignment for those students who give the instructor permission to post grades. We make a GIF graphic image of a class spreadsheet and post it in the class server space, where only the students in the class have access for downloading.

### Fine Arts

The fine arts courses make extensive use of this cell and the virtual team room concept. Students construct off-line multimedia arts exhibits in the first semester course (Software Design in the Arts) and online multimedia exhibits in the second semester course (Internet Models for Artistic Expression). For these courses, students select a theme to develop for an exhibit which
will be used throughout the semester. They then begin to design and accumulate a variety of digital imagery for their exhibits in private folders on the class server: digital graphics, digital video clips, musical instrument digital interface (MIDI) files, digital sound samples, text documents, and so on. Learning how to prepare such imagery, suitable to the multimedia platform they are working with (e.g., slide-, icon-, card-, or document-based tools) and of high aesthetic design quality, is a key goal of the course. The students then combine these images with Powerpoint, Word, Authorware, and HyperCard for the first semester course; HTML and Web page design for the second semester course.14

The fine arts instructor provides each student with a private folder where only that student and the instructor can gain access to the materials. Special “drop folders” are created for submitting work electronically; files can be “dropped” in, but only the instructor can take them out. The instructor also creates online folders for each class project where students can share the results of their work with the class, and for the Internet Models course, with the Internet community at large. In fact, the instructor requires his students to announce their completed projects on the Internet newsgroups and invite the public to electronically critique and react to their work. (See Figure 4 for an example of student work.)

A local Usenet newsgroup is created just for the class; this serves as an electronic bulletin board for the students and the instructor. Posts for help, advice, announcements, helpful tips, and coordinating student teamwork all circulate through the class newsgroup over the semester. We believe that a listserv would provide a more controlled environment for a collective newsgroup over the Internet. Listservs are a good way to implement online critiques of work where several on-campus classes participate, or better still, where the same class on several different campuses shares work electronically.

Economics

The economics instructor has begun to experiment with out-of-class electronic team projects. While exams and projects assess student understanding equally well, projects (especially team projects) more than exams are themselves instruments of learning. Because students teach each other, team projects promote student learning and empower students to own their own learning. The benefits of team projects are substantially enhanced with the use of networking technologies. Networking technologies help to ameliorate a major complaint of student team members—that it is difficult to schedule a common time and place when everyone can meet to work on the project. Instead, telecommunication and networking technologies expand place and time by permitting students to collaborate in the same place, but at different times.

Different-time/different-place:
access to the world of online information

The different-time/different-place matrix cell represents true “anywhere-anytime” computing. The freedom to participate at different times and different places lets the instructor and the students plan and control their participation and use of network resources to suit their own schedules and preferences. Through the World Wide Web and Gopher, data, software, a wide array of graphic images, sound and music files, and digital movies can be transported to the classroom for use and demonstration. There are millions of servers with full-text documents, abstracts, online library catalogs, MIDI music files, digital sound samples, graphic images and digital video clips, software, and statistical data. The list is endless. Any location on the Internet containing these resources can be accessed at any time.

Electronic mail, of course, is the most widely used different-time/different-place technology. With extensive use of e-mail for both students and faculty at Illinois State University, we have found that it has a great social-leveling or equalizing effect. Interaction with people anywhere in the world through only text frees the exchange from biases that can be caused by visual appear-

Figure 4: An example of a student arts exhibit on Brazilian music

Economics

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Student work is submitted electronically through the class drop folders, and all work is critiqued with feedback being returned electronically to the student through e-mail."

Economics

We have already discussed the electronic adaptation of the Minute Paper. The economics instructor also uses computing to augment another continuous quality improvement (CQI) teaching strategy called the Quality Circle. A circle of six to twelve student volunteers meets weekly with the instructor to provide advice and feedback on course management issues. The instructor uses e-mail to facilitate the work of the Quality Circle—devising a fishbone diagram, constructing a class survey, composing recommendations to improve the course—and a listserv to involve the remaining members of the class in the work of the Quality Circle any time, any place.

Fine Arts

This cell in the time-place matrix is another important one for fine arts classes, since students must conduct an extensive amount of research in developing their theme and materials for their multimedia projects. One of the first projects in the Internet Models course is an Internet Treasure Hunt. The dual goals of the project are to acquaint the students with the basic Internet client tools for news, Gopher, ftp, and Web, and to get them started with researching their topic. The treasure hunt asks them to locate sites for graphic images, sound files, content information, information on copyright related to multimedia and the Internet, experts that can help them with their project, and grant and funding resources should they hypothetically need to seek financial support for the project.

The instructor also uses online newsgroups and e-mail extensively in his class. Students are encouraged to use e-mail to communicate and collaborate with each other, and with the instructor. Through a combination of e-mail and newsgroups, students begin to think in terms of the learning process and the course of study being a twenty-four-hour-a-day, seven-days-a-week experience, rather than a fifty-minute-a-day, three-days-a-week experience; students, the instructor, and peers and experts worldwide are always within reach.

Student work is submitted electronically through the class drop folders, and all work is critiqued with feedback being returned electronically to the student through e-mail. Figure 5 shows a sample e-mail critique. A standard template is used for each project that emphasizes the key objectives and criteria for the project. With online course materials, electronic submission of work, and e-mail critiques, no hardcopy or paper work exchanges hands in the fine arts courses (except for the class registration list and grade submission, which still use op-scan forms)!

Reducing the cost of instruction

So far, we have addressed the question of whether using networked technologies can improve the quality of student learning and increase active participation by students. Obviously, our answer is resounding "yes." In the conclusion of this paper we address the question of whether we can show a reduced cost of learning per student as the result of the innovations we have discussed.

Notice that we state the question in terms of the cost of learning per student rather than in terms of the cost of instruction per student. In this distinction, we agree with Barr and Tagg when they say, "Under the Learning Paradigm, producing more with less becomes possible because the more that is being produced is learning and not hours of instruction. Productivity, in this sense, cannot even be measured in the Instruction Paradigm college. All that exists is a measure of exposure to instruction."16

This distinction is not the usual ploy of defining away the problem, but rather of defining the problem properly in the first place. If we take learning as the proper metric, then we have no choice but to adopt learning strategies that produce active, involved learners. The lecture-discussion, the primary means of producing instruction in American colleges and universities, does produce a lower cost of instruction than active learning strategies. But we have increasing evidence that the lecture-discussion is ineffective at producing learning. As stated by Guskin, “the primary learning environment for undergraduate students, the fairly passive lecture-discussion format where faculty talk and most students listen, is
contrary to almost every principle of optimal settings for student learning.\textsuperscript{17}

Put more positively, there is increasing evidence that the model of what constitutes good practice in higher education is changing. Already there is ample evidence that the two most important determinants of learning are time-on-task and active learning strategies.\textsuperscript{18} As a consequence, asking whether active learning strategies produce instruction at lower cost than the lecture-discussion, asks the wrong question. Rather we should be asking whether the learning produced, by whatever strategy, can be produced more efficiently. Here is where technology enters the picture.

As we have shown, networked computing—and in particular metacomputing—can be used to adapt already proven active learning strategies and produce the same or increased learning less expensively. In terms of what? Primarily in terms of faculty time.

As faculty ponder whether to adopt active learning strategies, they rationally compare costs and benefits. From a faculty member’s perspective, the cost of the technological backbone is a sunk cost. The sunk nature of the backbone is illustrated in a Doonesbury cartoon.\textsuperscript{19} Mike Doonesbury engages a colleague in the following dialogue:

Mike: Hank, what’s a Web site?
Hank: It’s an Internet presence.
Mike: What’s on it?
Hank: It doesn’t matter. Build it and they will come.
Mike: Why do we need one?
Hank: Because the technology exists. Also, everyone else has one.
Mike: What’s my motivation?
Hank: Fear. Greed. Take your pick.

Universities have built it, but will faculty come? As we have emphasized, there are two issues here: first, persuading teachers to switch from an instruction to a learning paradigm, from the sage-on-the-stage to the guide-on-the-side, and second, giving them the necessary training to gain competence with networking and Internet technologies. As to the former issue, as the new model of good practice in higher education becomes more widely held, we believe that faculty members will seek out ways of incorporating these domains into their teaching. And they will do so using technology because, as we have shown, technology can be used to produce learning at lower variable cost in terms of faculty time.

As to the latter issue, the fine arts program at Illinois State University serves as a model. Several full-time staff provide ongoing training for various computer skills, including Internet applications, for faculty and students. However, the philosophy has always been a bottom-up approach. The best exemplars are those faculty who have learned to use technology, even in small ways, and can show examples of how these technologies were used in their classroom and curriculum. The fine arts program provides many opportunities for faculty to share what they are doing with each other. The other key ingredient is providing ample rewards for the significant extra time it takes to learn new territory. The College of Fine Arts provides stipends for technology development and for taking courses related to technology skills.

Perhaps Doonesbury is correct, and the only motivation to change is “fear and greed.” But we rather hope that the motivation lies in a deeply felt understanding that the raison d’être of a college or university is not to produce instruction but rather to produce learning, and that a technology-enhanced, active, collaborative approach to learning is an answer.

\textsuperscript{17} Alan Guskin, “Reducing Student Costs and Enhancing Student Learning, Part II: Restructuring the Role of the Faculty,” Change, September/October, 1994, 6.


\textsuperscript{19} Captions are from a United Press Syndicate Doonesbury cartoon by G. B. Trudeau (28 November, 1995).
Teaming Up to Develop a Faculty Institute on Teaching, Learning and Technology

by Janet R. de Vry, Judy A. Greene, Sandra Millard, and Patricia Sine

A week-long Faculty Institute on Teaching, Learning, and Technology was developed at the University of Delaware through the collaborative effort of four different areas of the University, each with significant experiences in offering faculty instruction and service. The response from faculty was overwhelmingly positive. This article describes this collaborative experience and suggests some keys to success for other institutions that may be planning faculty technology development programs.

The University of Delaware Faculty Institute on Teaching, Learning, and Technology, offered in June 1995, January 1996, and June 1996, was planned by a collaborative team from four different areas of the University that provide educational and instructional development services to faculty—Information Technologies/User Services (IT/US), the Center for Teaching Effectiveness (CTE), the Library, and the Instructional Technology Center (ITC). (See the sidebar on page 24 for functional descriptions of each of these areas.) The Institute’s purpose was to encourage faculty to make greater use of technological resources for instruction and to help them make effective use of information technology, electronic library resources, and multimedia.

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Sandra Millard (sandra.millard@mvs.udel.edu) has been Assistant Director for Library Public Services at the University of Delaware Library for the past nine years. She is responsible for seventy staff providing library services to the one million users per year who enter the Library.

Patricia Sine (sine@udel.edu) is Manager of the University of Delaware’s Instructional Technology Center. She also serves as a Director of the Summer Institute in Educational and Assistive Technology, which trains 300 teachers each summer in current uses of technology in the K-12 curriculum.
administrative units, came together as a team and created a successful ongoing faculty development project.

Environment

The University of Delaware technological infrastructure grew rapidly during the 1990s. The campus network reached every classroom, every residence hall, the Library, and all campus offices. Technologically advanced lecture halls and classrooms were developed, and the Library expanded access to a wide variety of information resources available from all networked access points.

The University implemented a multi-year plan to be completed by 1997 to ensure that all faculty have access to computers capable of reaching the World Wide Web. University computing purchase plans made it possible for faculty and other University employees to purchase computing tools for home use with interest-free loans paid for through payroll deductions. In addition, the University committed to providing support for network access from home.

All of this activity increased faculty motivation to learn how to use the available equipment and software in the teaching and learning process. Use of technology for both teaching and research has received strong support in University planning efforts, which recognized that support and training services are necessary components of any plan to achieve a technologically advanced campus. As a result, a wide range of academic, instructional, and professional development training programs began to be created to support faculty use of technology in teaching. These programs, however, were developed by four separate units at the University, each with its own culture and focus, as opposed to being a part of a University-wide effort to provide a program for faculty to learn about and use the complex array of electronic information resources, wired facilities, networking, and instructional strategies.

Faculty use of technology for instruction

During the 1994/95 academic year, the University of Delaware faculty began to express the desire for specialized training on the new hardware and software, as well as dedicated time to explore the potential of these new tools and ways to use them to advantage in the teaching and learning process. Use of technology at the University then was similar to that reported at other institutions. Surveys of colleges and universities across the United States were finding that most faculty were comfortable using computers for word processing, and that some faculty used electronic mail to communicate with their students. The application of technology to daily teaching, however, had been slow. Technology in the classroom meant in some cases that word-processed overheads had replaced handwritten overheads, while in other cases a few faculty were developing Web pages for their classes. What could explain this phenomenon?

One explanation put forth by William Geoghegan applies the theories proposed by Rogers and uses the bell curve to understand faculty behavior with regard to adoption of innovations such as new technologies. “Innovators” and “early adopters,” says Geoghegan, constitute the first 15 percent, traditional faculty are the majority or “mainstream” faculty constituting the central 70 percent, and the “nonadopters,” who will never adopt these technologies into their classrooms, form the last 15 percent. He emphasizes that the majority need assistance in “crossing the chasm” from the “mainstream” to technology “adoption.”

Using this model of adoption-of-innovation behavior, the goal at the University of Delaware became focused on providing the requisite assistance for “mainstream” faculty to adapt technology to teaching. In the winter of 1995, the University provost initiated a meeting chaired by the vice provost for academic affairs that included faculty, the registrar, the director of libraries, the director of the Center for Teaching Effectiveness, the vice president of information technologies, and managers of units that had been developing faculty training programs for using technology to teach. The committee included faculty who represented both novice and advanced users of technology. This group held two meetings to discuss how best to provide faculty with assistance in using technology in the classroom. The first outcome of those meetings was a decision to survey faculty to determine their needs, and the second outcome was the formation of a specific team made up of representatives from each of the four cooperating units and charged with planning and implementing a cohesive program.

Results of survey of faculty use of technology

The first step in the planning process was to survey the faculty on the uses of technology in the spring of 1995. The survey was designed and conducted by the Center for Teaching Effectiveness, with input from the CTE Faculty Advisory Board and the other three cooperating units (IT/US, IT/CA, and the Library). The survey was mailed to 950 faculty in April of 1995, and resulted in a 33 percent response rate when 315 were returned. Survey responses revealed much about faculty learning needs—they essentially served

“The first outcome of those meetings was a decision to survey faculty to determine their needs…”
CAUSE/EFFECT
Fall 1996

Areas Represented on the Team

**Information Technologies** (IT) provides and manages the University of Delaware campus information infrastructure composed of the campus network, data, voice, and video technologies. IT’s User Services department (IT/US) provides a variety of services to support those who use that infrastructure, and places a strong emphasis on consulting, online information, and training. Commitment to broadband, high-quality training hails from the University’s first faculty microcomputer purchase program in the mid-’80s, when word-processing and spreadsheet software were the two predominant productivity tools. Today, User Services offers over forty different seminars, orientations, and custom-designed training to a yearly audience of more than 6,000—including students, staff, and faculty. User Services extends its educational outreach by providing videotaped classes, live satellite broadcasts, Web-based tutorials and reference material, and one-on-one consultations with faculty on applying technology to their classes. As technology has become an integral part of the entire University, User Services has sought out collaborative partnerships with other departments across campus to facilitate computing education.

**The University of Delaware Library** consists of the Morris Library, the main library, and four branch libraries: Agriculture, Chemistry, Physics, and Marine Studies. Over one million users enter the Morris Library each year. Faculty, staff, and students use DELCAT, the online catalog, to access the 2.2 million volumes of books and journals, as well as a vast array of electronic resources, including subscriptions to over thirty-five full-text and bibliographic networked databases available to University faculty, staff and students. Over 8,000 users are reached each year by the library’s instructional program, which includes group orientations, electronic library workshops, lectures to classes at the request of faculty, an electronic freshman English course unit on using the Library, and a credit course on Electronic Library Resources. The Library also offers individual one-on-one instruction to faculty on using electronic library resources in their office or in the Library. The Library is committed to service and works closely with faculty to develop library collections and new services. It is a member of the Association of Research Libraries, the Center for Research Libraries, and PALINET, a state network through which it is connected to OCLC (Online Computer Library Center).

**The Instructional Technology Center** (ITC), located in the College of Education, directs its teaching and development efforts toward helping on-campus and off-campus constituencies explore innovative solutions to difficult problems through the use of instructional technologies. For over twenty years, ITC researchers and developers have worked with University faculty to create hundreds of computer software, interactive videodisk, and multimedia programs that address curricular, instructional, and informational needs across a wide range of subjects. Many of these programs are used in schools, colleges, universities, and companies around the world. Several have won national and international awards for excellence. Within the College of Education, the ITC works with faculty and staff to integrate technology into teacher preparation at both the undergraduate and graduate levels. The Center helps faculty use technology effectively in their own teaching as a model for aspiring educators and supports the college’s efforts to identify new ways technology can be used to improve schooling, teacher preparation, and faculty effectiveness. For in-service teacher training, the ITC has worked closely with Education faculty since 1977 to coordinate the Summer Institute in Educational and Assistive Technology.

**The Center for Teaching Effectiveness** (CTE) was established under the auspices of the Vice Provost for Academic Affairs to promote excellence in teaching at the University of Delaware. The CTE staff provide instructional consultations and develop and facilitate workshops covering areas related to more effective teaching and learning to approximately 300 different faculty members and 200 graduate teaching assistants each year. CTE supports the instructional improvement efforts of faculty, graduate teaching assistants, and other teaching personnel. This is accomplished through sponsorship of a series of faculty colloquia, roundtable discussions, workshops, and seminars on best practices in teaching and learning. In addition to campuswide group programs, CTE staff offer private, confidential consultations for faculty and teaching assistants; publish two newsletters and a handbook for teaching assistants; run a program of instructional improvement grants, and assist faculty to identify external funding sources for innovative instructional projects, such as the National Science Foundation-funded project in Problem Based Learning in the Undergraduate Sciences.
to dispel several myths about what faculty already knew or wanted to learn, and pinpointed areas where the four cooperating units could concentrate their efforts.

Most faculty who responded to the survey
• used computers both in the office and at home
• described themselves as “intermediate” or “advanced” computer users

Almost two-thirds of the faculty respondents wanted to learn more about how to
• use the Internet to retrieve information
• prepare text and graphics to send on the Internet
• use electronic library resources, including networked databases and full text
• use video, CD, and audio technologies

Over half of the faculty who responded wanted to see how other faculty
• use technology in their teaching
• use a networked environment

Approximately half of the respondents wanted to learn to
• use e-mail creatively in instruction
• communicate with and distribute materials to students
• search and utilize electronic library resources in instruction
• use computing applications to conduct research
• design and conduct courses using TV and video

One-sixth of the faculty described themselves as “technological novices” or “non-users,” and this group provided some of the most valuable information about the specific needs of faculty who had not yet acquired the necessary skills to apply technology to instruction. Although a few faculty wanted basic instruction in software such as word processing and operating systems, one-third wanted to learn presentation software, and how to use the network and cable TV connections available in the classrooms. Approximately one-half of the respondents said that for their own learning, they preferred hands-on, step-by-step instruction conducted in small groups, which allowed for practice time and individual assistance. After taking a training class, most faculty wanted individual consultation on a single item, and 20 percent wanted consultation on how to apply what they learned to their own particular instructional projects. One-fourth requested online or paper tip sheets and other written reference materials as part of the instruction.

When asked what they most needed at present in order to use technology in their teaching, faculty responses were varied. Forty percent said they wanted to learn intermediate and advanced features of some applications. Thirty percent wanted help using the skills they already possessed to design classroom applications, and to learn how to get funding for software, equipment, and development time. This was not surprising given that the majority of respondents were intermediate or advanced users of technology. The novices asked for basic instruction on how to begin to use their computers, the instructional TV classrooms, video and/or satellite facilities, and for basic instructional design skills.

Typical survey comments from faculty identifying themselves as “novices” included:
• “I need to see what others are doing, so I know what is possible, and then have time to think about what, if anything, I might want to do.”
• “What’s available and how do I use it?”
• “What are my choices?”
• “Where do I go and who do I contact to find out what is available and how to gain access to equipment, software, and classrooms?”

Thirty-eight faculty said “yes” when asked if they would be willing to teach other faculty how to use technology, and included topics they would be willing to teach, which ranged from how to use software such as WordPerfect and Windows to multimedia applications. This level of volunteering was consistent with the experience of the CTE staff, who have a long tradition of having faculty teams teach other faculty about teaching.

It was clear from the survey that some faculty and administrators were already actively using the existing technology and electronic resource infrastructure of the campus in their classrooms. The challenge was to get other faculty, the “mainstream” majority, to begin to use the available resources: to develop faculty interest, then their skills, so that they could and would use technology in their teaching as well as their research.

The survey itself was a form of intervention and education, and it was necessary to quickly capitalize on the momentum and interest it generated. The next step—a formal planning process for the development of a cross-area coordinated program of instruction for faculty on using technology—was surprisingly brief.

Planning process
How did the University assist faculty in applying the tools of technology to their classrooms, where they have the ability to transform education? The dominant feature of the planning
was its simplicity, which allowed the implementation to take place eight weeks after the team first met. The collaborative team process is offered as a potential model for adoption by other institutions planning faculty technology instructional development programs.

The four members of the team were from four different areas of the University, each with considerable experience in providing educational services and development assistance to faculty. They collaborated by pooling their expertise and resources to design a plan that would increase faculty integration of the tools of information technology into their teaching.

The first time the team met as a group was to attend a symposium on teaching and technology at the University of Maryland. The two-hour travel time was used to discuss the faculty survey results, to brainstorm, and to decide on program design.

In one day, the team created a framework for the overall instructional design, set a tentative date, and decided on methods of communication and publicity. It was possible to accomplish so much in a short time because all team members had a shared frame of reference and similar goals. After this initial meeting, each team member then met with appropriate training staff in her division, and subsequent communication was primarily by telephone and e-mail. Only one formal planning meeting was held by the team after the trip to Maryland.

One factor that enabled the first faculty institute to occur only eight weeks later was the decision to use many of the already well-developed current technology workshops as a core curriculum.

**Title:** The program would be called the Teaching, Learning, and Technology Faculty Institute

**Focus:** Technology and information resource utilization for teaching would be aimed at both novice and intermediate level faculty technology users.

**Participants:** Attendance would be limited to University of Delaware teaching staff to encourage participation and allow sufficient resources and staff support for all interested faculty.

**Time:** The Institute would extend over a one-week period in June 1995 during the first week of the summer session. This decision was based on faculty preference from the survey for either summer or winter training sessions.

**Content:** The workshops offered would consist of ones that had already been developed and presented in the previous year and that matched faculty survey responses. Workshop length would be one to three hours, in accord with faculty preferences. Demonstrations of newly wired electronic classrooms and specialized sites would be included as “open houses” and would feature presentations on using new equipment.

**Location:** Most workshops would be held in electronic classrooms. The Library, IT/US, and ITC each has its own instructional classroom equipped with twelve to twenty-five individual networked computer workstations for faculty to use.

**Faculty involvement:** Faculty who were currently using technology successfully would be invited to participate by presenting their experiences during the Institute.

**Fees:** All workshops would be free—standard practice at the University.

**Registration:** Each of the four cooperating areas would handle registration for its own workshops, rather than centralizing the process. This way questions could be answered by those staff most familiar with the workshops. The areas would try to minimize time conflicts, but as in any conference, several sessions might be occurring simultaneously. Faculty would be free to register for as many sessions as their own schedule would permit.

Faculty from the original provost-sponsored committee reviewed the team’s plan and gave it strong endorsement.

The CTE compiled the schedule based on team input, and produced a brochure with workshop descriptions and times, and registration procedures. The first print brochure was a simple, inexpensive, 11" X 17" yellow sheet. This was mailed to all faculty and professional staff using campus mail. The brochure was also made available on the University World Wide Web site, and the Institute was advertised in the campus news-
open house for the Technology Solutions Center (a pre-purchase consulting center) became a demonstration on selecting computers for the classroom.

The second Institute, held in June 1996, included two keynote speakers. One focused on the new research questions that must be investigated if educators are to establish clearly the contribution of technology to the learning process. The other keynote outlined the possibilities for learning that are being opened up by Web use. With these two speakers providing a context within which to view the changes in educational technology, eighteen faculty members gave demonstrations of their own use of technology in the classroom. Presentation topics ranged from using video to reach distance learners to using Java scripts to manipulate financial models. Workshops included Current Contents database searching and electronic business information resources.

The twenty-four hands-on workshops encompassed a broad range of topics, which can be summarized under three overarching areas: using electronic communication and electronic information resources to extend the classroom, learning and using presentation software, and creating and modifying Web pages. The four site-related demonstrations focused on specific services offered by specialized sites. For example, one demonstration provided illustrations on obtaining and analyzing survey data using the Research Data Management Services. A complete listing of the 1996 offerings is available at http://www.udel.edu/dcannon/Usered/faculty.html.

Attendance and participation
The total attendance for all sessions at the 1996 Institute (488, not including the prerequisite classes) was almost double the attendance at the 1995 Institute (247). Many participants attended multiple sessions. By eliminating duplicate names and names of those who do not have formal teaching responsibilities, we were able to ascertain that the number of individual faculty members attending also almost doubled between 1995 and 1996. Approximately 70 different faculty attended in 1995, while 120 faculty attended in 1996. It also appears that the majority of participants in the 1996 general sessions were newcomers and not from the same group of faculty that had attended the year before.

We have more complete records from the 1996 Institute and are able to make several more observations from them. The 1996 participants represented forty different departments from all ten colleges at the University, including those at
Campus Profile

University of Phoenix

The University of Phoenix (UOP) was founded twenty years ago in Phoenix, Arizona, as a private, for-profit higher education institution whose mission is to provide high quality adult education (students must be 23 years of age or older and employed to qualify for admission). Accredited in 1978 by the North Central Association of Colleges and Schools, UOP currently enrolls 31,000 students and employs approximately 4,000 faculty. The University offers undergraduate degrees in business, management, information systems, nursing, and accounting, and graduate programs in business, management, nursing, education, counseling, and computer information systems.

Through innovative methods, including distance education technologies, the University offers educational access to working adults regardless of their geographical location. Programs are offered at physical campuses and learning centers in Arizona, California, Colorado, Florida, Hawaii, Louisiana, Michigan, Nevada, New Mexico, Utah, and the Commonwealth of Puerto Rico. Degrees are also offered through distance education programs to more than 3,100 students in all fifty U.S. states and abroad, using the directed study and teleconferencing options of UOP’s Center for Distance Education or enrolling through the Online Campus.

UOP is one of three major subsidiaries owned and operated by Apollo Group, Inc., a for-profit higher education corporation also headquartered in Phoenix. The other two are the recently acquired Western International University and the Institute for Professional Development (IPD).

Technology—a strategic resource

The University of Phoenix is unique in its focus on delivering higher education to working adults, using a highly interactive and experience-based educational model (see sidebar, facing page). To the extent that technology supports that focus and educational model, it is viewed as a valuable strategic resource in which UOP is willing to make major investments. All technology acquisitions and applications are directed at solving a business problem or enabling a better way of doing business, as well as supporting the teaching and learning model. Thus, proposed technology investments are accompanied by cost/benefit analyses, a significant component of the planning and budgeting process.

Planning at the University is very much driven by the goal of growth within the framework of continuing to offer quality adult education. Technology is seen as making a major contribution to both of these ends; according to UOP President William Gibbs, “If we want to keep growing and improving our programs, technology must continue to be a significant resource for the University.”

Debra Kelin, vice president of the University’s Mountain Region, describes technology as a “tool to help us achieve three areas of importance to the University: quality, knowledge, and innovation.” At the Colorado Campus, an Information Systems Advisory Committee has been charged with envisioning the campus’s future in the Information Age and proposing appropriate technology investments to enable that future.

According to Todd Nelson, UOP’s executive vice president, while many functions of the University are decentralized to the campuses, there are nonetheless a number of key functions that are highly centralized, and for which effective information systems are critical. “Every problem we have, we try to address

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1 IPD is a consulting company that contracts with four-year colleges and universities to market and/or run adult education programs on their behalf. Currently IPD has eighteen such contractual agreements, serving more than sixty sites in eighteen U.S. states.
“Education that Goes to Work”

In a time of stabilization for many higher education institutions, why is the University of Phoenix experiencing significant growth, both in terms of new campuses and numbers of students? John G. Sperling, founder and president of Apollo Group, Inc., the corporation that owns the University of Phoenix, attributes much of their success to focus, and to the application of a teaching and learning model that is very attractive to working adults. “We specialize in delivering higher education to working adults. For twenty years, we have known our mission and not varied from it. We also saw the demographic and social trends—an increasingly older, more mature population in need of professional and continuing education—and took aim at them. And from the beginning we treated our students as customers. The most precious thing working adults have is time, so we deliver education in a way that recognizes that, and also recognizes and complements their maturity, experience, and personal and professional responsibilities.”

Phrases such as student-centered learning, facilitated learning, lifelong learning, and learning outcomes and assessments have been part of the vocabulary of the University of Phoenix from its inception. These concepts reflect the philosophy on which it was founded, a philosophy responsible for the use of a teaching system in which lectures are minimized, and simulations, seminars, group discussions, and student work-related projects constitute the primary methods of learning.

Because the learning model also recognizes the importance of integrating theory and practice, the curriculum for each UOP degree program is designed by a task force of both faculty and industry professionals, and all courses are taught by working professionals with advanced degrees and current experience in the subject areas of their courses. The carefully planned curriculum identifies specific learning outcomes for each course, stated in terms of skills, competencies, and other performance-based measures, and a system is in place that enables consistent evaluation of both students and faculty.

As we look at the critical mass in the major population areas, while at the same time having a mission to provide access wherever students have needs, emerging network and communications technologies make a lot of sense for us to help maintain the University’s growth.”

Planning for information services

While a formal, written strategic plan for information technology is not a critical activity, an ongoing strategic planning effort is. This effort is being led by the central Information Services organization, in conjunction with the enterprises it supports—Apollo Group corporate offices, IPD, Western International University, and the University of Phoenix central offices as well as all of the UOP campuses.

An Information Services Steering Committee at the corporate level serves as an advisory board to Information Services, capturing input from the president of Apollo Group, presidents of the three subsidiaries, Apollo Group’s chief financial officer, heads of the IS departments, directors of major corporate departments, and several UOP regional vice presidents. The committee focuses on a different topic at each meeting, so in addition to the standing membership, additional areas are represented, depending on the topic under discussion.

According to Jan Baltzer, Apollo Group’s new vice president for Information Services (IS), until last year the IS organization had been reactive, rather than proactive, in terms of meeting technology needs. But the creation last fall of her chief information officer position with a direct reporting relationship to Apollo Group’s president enabled a total reorganization of Information Services and initiation of the strategic planning effort. With a more strategic and unified view, Baltzer says, “IS can focus on being ‘out in front’ of needs. We are much better positioned now to work with campuses in determining their technology needs and, in the process, help campuses plan for and budget for these investments.” Nina Omelchenko, vice president for University Services at UOP, believes the creation of the CIO position and the consequent reorganization and refocusing of Information Services was a key decision: “It has made technology not just a tool, but a part of the strategic direction of the organization.”

As part of the strategic planning process, Information Services staff created a mission statement and identified eight major goals and a series of tasks related to those goals within Apollo Group:

• to establish networking as the cornerstone technology;
• to promote and support the use of information technology to improve all aspects of communication;
• to increase the technology literacy level of all employees;
• to provide information technology support for delivery and support of instruction;
• to provide high quality customer service;
• to establish and maintain high quality data management applications and processes;
• to assume a leadership role in process improvement; and
• to establish Apollo as a leader in the use of information technology in higher education.

Managing information services

While all of these strategic goals are important, Baltzer says the highest priorities are establishing networking technologies as fundamental to the support of both administration and instruction, and promoting the use of technology to improve communications and business processes. Addressing these goals has been facilitated by reorganizing IS, which is now much more “customer-centric.”

The new Information Services organization has seven units: consulting services, customer services, administrative services, software engineering, telecommunications services, network services, and computer operations. Director of Administrative Services John Lewis has worked closely with Apollo Group’s human resources department in rewriting every job description and revising the organization’s performance management system.

The new consulting services unit, in particular, will facilitate the goal of aligning technology with business needs. A major function of this unit is to consult with administrators at UOP campuses, Western International University, and IPD sites to help them determine how technology can be applied to solve their business challenges, as well as prepare them for technology that will be rolled out at the corporate level. Betty Maisel, director of this new unit, explains the importance of creating service level agreements: “In the past, IS has had conflicts with the campuses because of different levels of expectations; we haven’t communicated very well. So managing expectations is a large part of what consulting services will be doing.”

As part of this effort, a research and development function has also been created in IS. Once the consulting services unit has worked with the customer to identify business needs, R&D will work to find the best technology to meet those needs. Three new technology projects

Online Campus—A Natural Fit for the University of Phoenix

Ten years ago, when the University began to research the idea of reaching students using electronic communications, it found that some early research done by the Ontario Institute for Studies in Education fit very closely with the teaching and learning model already in use on UOP campuses. Computer-mediated communications are very supportive of the highly interactive environment that is the hallmark of a UOP degree—a teaching model that revolves around students sharing ideas as opposed to students listening to a lecture. The University realized that the facilitative nature of UOP’s learning system would actually be enhanced by the ability to be asynchronous.

Thus in 1989 the University launched its Online Campus, succeeding in building a computer-based delivery system that provides interaction of the same quality as that found in its traditional face-to-face classrooms. According to Terri Hedegaard, vice president of the Online Campus, UOP was careful to adopt only mainstream technologies to deliver online education. “We wanted a cost-effective and rugged system that would be accessible and cost-effective for students as well. We could get ‘gimzier’ but our primary evaluation criterion is, does it add value to the learning environment. That’s why we aren’t doing ‘talking heads.’”

Currently, UOP is delivering online education using computers and modems and a computer conferencing system called Alex (Apollo Learning Exchange, based on a product from Convene). Students access Alex on a host system by calling direct via modem or through Internet service providers or other Internet gateways. As increasing numbers of students gain access to the World Wide Web, this will become a more universal resource for delivering online courses.

While classes that meet in physical locations have an average of sixteen students, the average online class size is eight because of the intensive nature of the online interaction.

More than 200 faculty are currently teaching online, with 50 in training. Faculty training is also intense, consisting of eight weeks of online training, followed by practice teaching and observation of an experienced faculty member teaching a course. The first time a faculty member teaches an online course, a mentor is assigned to advise them and monitor their class. From start to finish, it takes about three months to train a faculty member.

For online students, the curriculum is the same, but oral presentation skills are not included in the outcomes sought. However, writing skills and online communication skills are greatly enhanced. Students enrolling in the Online Campus take a brief communication skills class before taking courses.

The Online Campus is enabling hundreds of working adults to work toward degrees at their convenience.
Current Technology Environment

Hardware Standards:
- Sequent minicomputers at the server level
- Compaq microcomputers at the desktop level with Windows operating system
- Toshiba laptops

Software Standards:
- UNIX
- Oracle 7 relational database management system and development tools

Applications:
- Oracle financials
- SIRIS (in-house student records system)
- Contact management and enrollment tracking (in-house)
- Financial aid (in-house)
- Student and course scheduling (in-house, interacts with SIRIS)
- Faculty scheduling (in-house, interacts with SIRIS)
- Online transcript evaluation (in-house)
- Oracle mail (to be replaced shortly)
- Multiple desktop applications
- Transcript exchange through EDI (under development)

Networking and Telecommunications:
- Local area networks at campuses (Novell servers) are tied together in an administrative wide area network (frame relay through AT&T)
- Student wide area network (frame relay through MCI) provides Internet access
- PBX and key systems manufactured and supported by InterTel
- Voice mail
- Integrated voice response (IVR)

are currently under way: enterprise-wide electronic communications (new groupware products, such as Microsoft Exchange, for faculty and student interchange); a videoconferencing pilot in conjunction with the Salt Lake Campus; and wireless technology for use in the classroom to support such activities as recording student attendance.

A staff member within the central IS organization is responsible for assisting in the selection, training, and coordination of the work of Campus System Administrators (CSAs), who manage the information services functions on their campuses and serve as liaisons to IS.

Learning Resource Center
According to Kurt Slobodzian, executive director of UOP's Learning Resource Center, the University has been "on top of" electronic delivery of information resources for some time, offering an impressive collection of online and CD-ROM databases as well as full-image documents. Ironically, he says, one of the reasons UOP has been able to proceed so rapidly with electronic information delivery is its lack of a massive print collection, for which it has been criticized in the past. "In moving into electronic delivery," Slobodzian says, "traditional academic libraries are hindered by their massive legacy systems. It's not easy to convert collections of several million books! Also, because UOP's content area is very focused, we don't have to build a collection of chemical engineering or art history, so our collection can be smaller and we can really emphasize currency of the collection and full image. Unless they are working on a final thesis-type project, our students have little reason to delve into archival literature; they are much more interested in currency."

The University purchased a system called Powerpages from UMI, and adapted it to the Internet for student access. A million articles are housed on 1,500 CD-ROMs that can be manipulated to deliver documents to students. UOP has a fully automated access point for students and can deliver full image, rather than full text, which Slobodzian thinks is more useful.

Students can do their own searches through the University's World Wide Web interface to the Center's online databases and CD-ROMS and automatically retrieve the articles, using fax-back delivery, or they can phone or fax in their search request and have professional librarians do the search and return the results. There is a charge for the assisted document delivery, but not for the searches or consultations. UOP has chosen to use fax as the delivery mechanism because of its mainstream properties—all students have access to facsimile technology, but many do not have the capability to download imaged documents for local printing.

Many UOP campuses have workstations connected to the Internet so students can access a service from EBSCO that provides full enhanced text. Slobodzian has also built a collection of links on the Web, a kind of "virtual" library collection aligned to UOP's programs and available to the public.

A changing technology environment
At a recent 20th anniversary celebration, President Gibbs spoke of a vision for UOP's future that includes more intensive use of network technologies, especially the Web: "The face and nature of education is going to change dramatically in the next five years. What's different is the ability to have open systems, seamless communication and exchange of information. This is a huge paradigm shift; nothing in our history has ever been like this before. Technology will play an important part in the classroom of the future, enhancing our ability to put not only the faculty member in front of the classroom, but also key subject experts via multimedia, and to facilitate faculty sharing of best practices. But it will be important for us to marry these technologies to face-to-face interaction, providing students a combination of distance, online, and classroom education that will continue to reflect their professional world."
Teaming Up ...

(continued from page 27)

dean and department chair level. In both years, despite the fact that our initial survey results showed that faculty wanted to see other faculty demonstrate how they were using technology, attendance was highest at the hands-on workshops. Likewise the survey indicated that faculty wanted help with hardware, but very few came to the equipment-related demonstrations. Nevertheless, the group who attended general sessions and faculty demonstrations was different from the group who attended the skill-building sessions. This led us to conclude that the different types of sessions meet different learning needs.

We have learned not to be discouraged by the appearance of small numbers of participants in individual sessions. With any new offering, it is natural to expect a slow beginning, particularly in the area of technology, where faculty may be reluctant. However, in the course of one year, more than twice the number of people chose the options presented to them. As they have positive learning experiences that address their instructional needs, and adequate follow-up support, faculty will pass the word to their colleagues. We also expect participation to continue to increase as a result of the increased availability of new computing tools to faculty on their desks and in their homes.

Effectiveness

In both of the Institutes held to date, approximately 80 percent of the participants returned evaluations. Of these, 98 percent expressed a high degree of satisfaction with what they learned in the Institute workshops. In addition, 94 percent indicated that "yes" or "maybe" they would use what they learned in teaching their own classes.

Written evaluative comments were very positive, with many extolling the virtues of workshop leaders, the right pacing for their skills and understanding levels, and the individual assistance during the workshops when needed. This confirms our strong belief in choosing and training workshop leaders carefully and in structuring the content and pacing to accommodate novice learners.

Sample comments from the June 1996 Institute illustrate how faculty plan to use what they learned. The following are typical:

- "PowerPoint will give me an effective way to introduce each day's topics in my instructional TV class."
- "It will be helpful having off-campus students getting their information off my Web page."
- "This really helped my understanding of where to direct students for journal information."

Although attendance at the faculty demonstrations was light, those who attended indicated they learned what they wanted and liked meeting colleagues in other disciplines whom they can later contact for additional information. They especially appreciated seeing the wide variety of uses of technology that included using a simple videotape to ensure consistency in laboratory instruction across sections, using simulation software for student problem-based learning teams, using electronic library resources for resource based teaching, and developing Java applets to present mathematically accurate graphs in the classroom. (See sidebar for an example of one very successful faculty experience.)

Faculty who attended the first Institute were excited about what they accomplished during the fall semester. Many used e-mail or newsgroups to extend class discussions for the first time or had students retrieve syllabi and assignments via the World Wide Web. The success of the Institute is exemplified by the increasing number of faculty using mailing lists, Web pages, electronic library resources, library networked databases, and newsgroups, and ordering equipment for use in the classroom.

One business college faculty member came to the first Institute to present how he used newsgroups with classes. He was so impressed with another colleague's presentation on the Web that he now includes using the Web for marketing in his Introduction to Marketing course. A physics faculty member and self-proclaimed computer phobic totally immersed himself in the first Institute, attending every session he could fit in. He has gone from browsing the Web for the first time in June 1995 to creating PowerPoint presentations and Web pages for his classes, and recently received funding from the National Science Foundation to collaborate with K-12 teachers on how to use interactive software to teach about physics and the Internet. Two faculty members in Textile Design and Consumer Economics have planned a uniquely designed course for fall 1996, using technology. They met with librarians to help structure the course project, gain recommendations for electronic resources, and plan how librarians will assist students.

Faculty also indicated that they would like to have the opportunity for individualized assistance. The Library established and advertised to faculty a formal service to provide faculty with one-on-one individual instruction on using electronic information resources, including net-
worked databases and World Wide Web resources in faculty offices or in the Library by appointment. IT/US, CTE, and ITC have a long tradition of offering individualized consultations. In addition, IT/US with input from the other cooperating units prepared a Web-based document to familiarize faculty with the wealth of resources available on campus to help them get started using technology in their teaching.\textsuperscript{5}

Faculty are accustomed to being experts, and when they are novice learners they experience the same anxiety as any new learner. Being sensitive to these factors, while at the same time helping faculty come to grips with being a student again, is a key success factor in helping faculty to adopt new technologies.

Future plans
As we did between June 1995 and June 1996, the team will revise the offerings to best meet the needs and interests of our audience in planning the next Institute. Hands-on classes are the most effective instructional model for learning any new skill, and this applies to technological skills as well. Faculty indicated on the original survey that they would like to see what other faculty are doing; however, the 1995 and 1996 attendance indicates that we need to balance those offerings. In 1995 and 1996, the Institute focused on novices. In 1997, the Institute planning will build on the progress of previous years by developing workshops for intermediate users. We will explore new topics for seminars, such as teleconferencing software for distance learning, intermediate World Wide Web development, and library full-text database searching.

Through the initial survey, thirty-eight faculty indicated they would be willing to teach other faculty how to use technology. One future goal is to create teams of faculty and technical specialists who will co-lead workshops. As faculty become more knowledgeable with these new teaching tools, it is expected there will be more expertise available to offer additional workshops which are focused primarily on the teaching and learning applications and less on learning how to use basic software.

Several technology interest groups exist on campus. During 1996/97 the team hopes to involve these groups in the planning process. These groups include the Faculty Technology Advisory Committee of CTE, the Multimedia Users Group (MUG), and the Teaching with Television Users Group (TTUG).

Specific suggestions for future Institutes from faculty evaluations include:

• Reduce the number of and include a moderator for faculty demonstrations, to provide more context for the overall significance of the technology and the potential beyond what is being demonstrated.
• Identify faculty to co-lead workshops with technical experts. The faculty can be primarily responsible for the “translations” to instructional applications.
• Promote departmentally organized demonstrations the first day, showing applications within the discipline. This approach is supported by research studies that suggest that at least one-third of faculty prefer to get their

Jorge Cubillos, Assistant Professor, Foreign Languages and Literatures, is a Faculty Training Institute success story. He attended the June 1995 Institute with the idea of putting together Web pages for his classes and textbook, but without the skills to accomplish this. Before he took the seminars, the idea seemed “daunting.” Now he has Web pages for all of his classes. These provide links to Spanish radio stations, newspapers, magazines, and even movie clips. These resources encourage students to participate in and investigate Spanish language resources. Having “live” links available for his students has enhanced the learning process for Cubillos’ students. They can immerse themselves in a variety of resources not available in a traditional textbook.

Cubillos’ textbook is currently one of the best selling intermediate Spanish textbooks published by Heinle and Heinle, and the book’s associated Web page is one of the factors that have contributed to its success. Not only can students get information from the Web, but Spanish teachers who use his textbook are able to publish the teaching strategies they use with the book, thus further enhancing the book’s value.

Throughout the Middle Atlantic states, K-12 administrators and teachers seek out Cubillos’ advice on how to best apply technology to teaching foreign languages. Because of his work in the area of foreign language, Cubillos was asked to co-teach a three-week summer course for teachers on effective uses of technology in foreign language education.

The most important result that Cubillos perceives is the increase in student motivation. Traditionally languages have been a requirement to be fulfilled, not something that students are intrinsically motivated to learn. Cubillos has used technology to entice his students into participating in Spanish language culture: “My goal is to ultimately make my Web pages as exciting as MTV.”\textsuperscript{6}

Cubillos was grateful for the classes offered by the Institute. They provided him with “very practical skills that have had a tremendous impact.”

\textsuperscript{5} See http://www.udel.edu/paulhyde/tt/
information about teaching from colleagues in their own disciplines.

- Encourage more faculty to do the research in their classrooms that will gather the data they need to show the effects of technology on student learning in their classes.

A variety of options are needed to accommodate the various ways faculty learn new skills. Workshops alone will not provide for the full range of learning needs. Other available paths for faculty training include informal lunchtime presentations, individualized instruction for faculty, sets of self-paced materials in printed text, and CD-ROM and videotape formats available in several locations around campus for faculty to borrow. Web pages are available from any classroom or office on campus.

MUG meets monthly to share their expertise with each other and maintains two listservs for ongoing discussion and updates on new technology. A number of novices have joined the group to learn more. TTUG has formed around distance learning and video/television-based learning. The feasibility of setting up additional instructional materials development labs with accompanying teams of instructional and technical consultants to assist faculty in developing educational materials is being explored. To enable the technology to be truly utilized in the classroom, those involved with planning the Institute have met with others in the University, such as the registrar, to assist in how best to provide comprehensive “classroom services” for faculty questions related to classrooms and teaching.

**Summary and recommendations**

Adding the technology tools to the teaching “tool kit” of faculty may enhance learning for many students. Practices that promise to bring mainstream faculty into this new era are those most likely to appeal to the intrinsic values and beliefs held by faculty:

- Providing additional consultation that specifically addresses the ways technology can enhance instruction adds another path to better teaching and learning.

- A positive institutional climate for teaching and strong institutional support may be the single most influential factor in efforts to improve teaching across an entire campus.

- The reasons people study most disciplines have very little to do with technology. Therefore, technology that contributes positively to what faculty and students do as they engage with each other in the learning process, and which addresses the concerns of faculty in effective ways, is more likely to increase mainstream faculty adoption of these new tools.

Finally, the experience at the University of Delaware has shown that educational technologies and resources, when supported by a far-sighted administration, have the potential to empower faculty to achieve unanticipated classroom successes. Faculty determine the curriculum, and the evolution of technology on our campuses needs to be driven by the learning needs of students and the faculty’s efforts to meet those needs. Furthermore, comprehensive course and program evaluations, particularly the inclusion of student evaluations of the applications of educational technology, should be used to help assess the pedagogical value of any uses of these new and exciting “tools for teaching and learning.”

The potential impact of technology has dimensions beyond its useful and important pedagogical functions. For example, without the project described in this article, our four cooperating areas would not be working together in quite the same way. Although our traditional ways of operating were very effective and rewarding, we will continue working together on behalf of the faculty, for we have also discovered new and respected colleagues in this effort. Our challenge is even more complex, since we are attempting to transform and empower a whole campus rather than just one individual faculty member at a time. This means that each of us must be able to see where the others contribute, engage in meaningful dialogue, and continually ask of faculty and of ourselves: “What do you want your students to learn?” “Why?” “What do we know about the students’ learning needs?” and “What do we know about faculty members’ learning needs?”

The University’s computing network and the various faculty development support efforts are increasing the use of technology in the classroom while also increasing opportunities for collaborations among teaching and research faculty. These factors have also created unique alliances among academic service areas that support faculty in using new information technology resources and new teaching strategies.
Structures, Plans, and Policies: Do They Make A Difference?  
An Initial Assessment

by Bruce Rocheleau

There is substantial variation in college and university computing and communications structures, budgeting and charge policies, and planning efforts. Although such management issues have been frequently discussed, there has been little systematic research concerning whether these structures, policies, and plans have any impact on outcomes such as the extent of access to and use of computing by faculty, staff, and students. This article draws on the 1994 CAUSE Institution Database (ID) Survey to provide an initial assessment of these issues.

A 1984 survey by Henry Lucas showed that information services departments had little power and visibility in most organizations.¹ But computing today is becoming a central activity of strategic importance to both higher education institutions and businesses. For example, Mara points out that the definition of a user of information technology at Cornell has changed from a hundred or so central office users to over 20,000 members of the university community.² If colleges and universities are to attract and keep top-notch staff, faculty, and students, they need to serve a full range of users and support teaching, research, and administration needs.

To achieve these goals, campus information managers need to know what approaches are effective. What measures can they take to help ensure success? For example, in recent years, many colleges and universities have spent a great deal of time developing technology plans that include strategic, telecommunications, networking, administrative, library, and academic components. Although plans may help to bring about enhanced effectiveness, there is skepticism about the utility of planning because many plans remain on shelves unused. Do institutions that construct formal plans (e.g., for networking) have more successful results (e.g., higher percentage of their workstations networked) than those who do not formally plan? Do plans that are updated annually or linked to the budget have more impact?

The chief information officer (CIO) has become a familiar position in higher education. Slightly more than 75 percent of institutions in the 1994 CAUSE Institution Database (ID) survey reported the existence of a CIO, though only about 56 percent said that the CIO is “recognized as such” in their organization. CIOs may come under attack if they are not viewed as being effective. For example, a Sloan Management Review article asked the question, “Is Your CIO Adding Value?”³ In the private sector, several CIOs have been fired, and in the public sector, CIOs have become the lightning rods for controversy in several states. As one former CIO noted, “States have to do more with less and they think that technology is going to pull a rabbit out of the hat for them.”⁴

CIOs in higher education may come under similar pressure as the strategic importance of computing grows. Some observers have noted that the organizational rather than technological challenges have been most difficult and that there still is disagreement about whether centralized or decentralized structures work best in a college or university setting.5

Pitkin studied the role of college/university CIOs and found that they differed from their business counterparts because they did not carry out some roles necessary to be an effective executive.6 The structure and power of the CIO job can vary greatly. For example, some CIOs (about 18 percent) report directly to the chief executive officer (CEO) of their college or university. About 33 percent report to the chief administrative officer, 19 percent to the chief financial officer, and the remainder report to a variety of others.

Does it matter whether there is a CIO or to whom the CIO reports? Is a CIO who reports directly to the CEO without any intervening layers of administration more effective? Does it make any difference as far as use of computers in the curriculum whether the head of academic computing reports to the CIO?

Finally, there has been controversy over what budget and cost recovery policies are most effective in encouraging use of computing by faculty, staff, and students. Thomas M. Schwen, chair of the Department of Instructional Systems Technology at Indiana University, stated that he was worried about a backlash when campus decision-makers found that faculty only made use of a tiny fraction (e.g., 12 percent) of the capabilities of high-tech classrooms.7

Do student fees and chargeback systems keep students and professors from using the Internet? There have been reports that high network costs have done so.8 Similarly, do colleges/universities with ongoing budgets (about 35 percent of our study sample) for replacing microcomputers and workstations have more faculty and students involved with computing in the curriculum and the Internet? Which policies, if any, positively influence the spread of academic use of computers?

The above questions deserve attention and careful study involving a variety of approaches, including case studies and the employment of experimental and quasi-experimental designs. Our study was exploratory, aimed more at focusing attention on these issues and developing hypotheses than at reaching final conclusions about the questions. But the importance of these issues should not be underestimated.

Many people argue that information technology has been slow to permeate the curriculum of colleges and universities. For example, Cotton found that the percentage of courses in which information technology was integrated into the curriculum was 17 percent, no higher than in her kindergarten to high school study.9 Stager, Williams, McClure, and Smith pointed to the dearth of evaluation studies concerning technology expenditures and the need to conduct such evaluations due to the shrinking economic resources available to higher education institutions.10

Can colleges and universities modify their structures, plans, and budgeting/charge policies to improve outcomes? We hope this article will help to stimulate research on this topic.

Methods

We studied the above issues by analyzing data concerning several relevant items from the 1994 CAUSE ID Survey. The survey sample we used excluded surveys from two-year, specialized, and uncategorized institutions. The total sample size was 296. The total response rate for the CAUSE survey was approximately 39 percent. There is no way to determine whether, or to what extent, the responding institutions are different from the institutions that did not respond to the survey, so caution must be applied in generalizing beyond the respondents to the survey.

Our study examined four major categories of independent variables (planning activities, CIO-organizational structure, computer charge and budgeting policies, and resource allocation variables) concerning their impact on the outcome variables. A detailed list of variables employed in the analysis is provided in Exhibit 1. We included composite measures of both the planning and CIO variables that represented the total of positive responses to the individual questions. Thus the composite measure of CIO power ranged from zero to five. For example, a score of five is assigned to those institutions in which there is a CIO, (s)he is recognized as such, the CIO reports directly to the CEO, and both academic and administrative computing report to the CIO.

Our inquiry used a variety of statistical analy-
Many variables are undoubtedly rough estimates, including many of our key dependent variables (e.g., what percent of the staff, faculty, and students have access to and use e-mail, Gopher, and the World Wide Web?). We need more accurate measures of access and use of these technologies.

In some of our analyses, there is a substantial number of missing cases for several variables, including some outcome measures.

Although our analysis examined a large number of potentially important factors, other important variables are undoubtedly missing, especially those measuring the quality of the planning efforts.

This is a cross-sectional study and we need longitudinal studies to test for causal relationships among the variables. Certain causal relationships could be the reverse of what we have assumed; for example, it is possible that increased use of computing leads to structural changes in the academic computing structure and replacement budgets. However, case studies reported in the literature suggest that computing structures and budgeting and charge policies tend to be more the result of the actions of a small group of people such as key information technology personnel, institutional leaders (e.g., president, provost, and other leaders), and a few influential faculty, rather than being due to mass participation in computing by faculty and students.

Despite these limitations, this study addresses significant issues and raises important questions about the nature of the relationships.
“Having a budget to replace micros/workstations ... appears to have a beneficial impact on networking and use of computing in the curriculum.”

Exhibit 2:
Outcome variables by predictors
(in their order of importance)*

Outcome #1: Percent of faculty making use of computing in the curriculum.
Predictor: Institution has an ongoing budget for replacing micros/workstations.

Outcome #2: Percent of faculty making use of software in the classroom.
Predictor: Academic computing reports to the CIO.

Outcome #3: Percent of academic micros/workstations that are networked.
Predictors:
(1) Academic computing reports to CIO.
(2) Institution has an ongoing budget for replacing micros/workstations.

Outcome #4: Percent of administrative micros/workstations that are networked.
Predictor: Institution has an ongoing budget for replacing micros/workstations.

Outcome #5: Composite measure of staff access and use of e-mail, Gopher, and WWW.
Predictors:
(1) Academic computing reports to the CIO.
(2) Institution has an ongoing budget for replacing micros/workstations.
(3) A composite measure of CIO power (negative).
(4) Institution is public.
(5) CIO is recognized as such.

Outcome #6: Composite measure of student access and use of e-mail, Gopher, and WWW.
Predictors:
(1) Institution has an ongoing budget for replacing micros/workstations.
(2) Academic computing is covered in the IT plan.

Outcome #7: Composite measure of faculty access and use of e-mail, Gopher, and WWW.
Predictors:
(1) Academic computing reports to the CIO.
(2) Institution has an ongoing budget for replacing micros/workstations.

The relationships are positive unless otherwise noted.

Presentation of results
Exhibit 2 summarizes our major findings. One fairly consistent predictor of outcomes was the presence of an ongoing budget for replacing micros/workstations. It was the only predictor of the percent of faculty use of computing in the curriculum and percent of administrative micros/workstations networked. It was also the best predictor of a composite measure of student access to e-mail, Gopher, and the World Wide Web. An organizational structure in which academic computing reports to the CIO was the best predictor of the percent of academic micros/workstations networked and a composite measure of faculty and staff access to the Internet. It was the only predictor of the percent of faculty using software in the classroom. It should also be noted that the strength of the above predictors was quite modest, ranging from about 5 to 15 percent of the total variance (out of a possible 100 percent). Given the limitations of our measures of independent and dependent variables, the weakness of our predictors is understandable.12

In the above analyses, we initially excluded the resource allocation variables because we wanted to focus on the impact of the CIO and the structure of computing, computing plans, and budgeting and charge policies. When we added the resource allocation variables to the analysis—such as percent of instructors with exclusive use of an institutional micro/workstation and student access to micros in their dorms—we were able to predict better the percent of faculty making use of software in the classroom and in the curriculum, though the percent of variance still remained modest.

Summary and conclusion
In summary, while our results were mixed, the significance of the ongoing budget and academic computing/CIO relationship suggests that budget and structural factors can have impact. Having a budget to replace micros/workstations is a very concrete activity and appears to have a beneficial impact on networking and use of computing in the curriculum. This impact cannot be explained by a difference in resources; having a replacement budget was not correlated with our measure of resources and wealth. Our results also suggest that a structure with the CIO in charge of academic computing has a positive impact on outcomes.

Generally, while the existence of a plan was

12 We have by design not reported statistics such as R-square and the slope coefficients. Our focus here is whether the independent variables had any statistically significant impact on the dependent variables.

13 Note that we only present here the composite results for the impact on the use of e-mail, Gopher, and World Wide Web. We did eighteen individual analyses which generally were consistent with the results we present here. However, in a few, the updating and linking of the plan to the budget did appear as predictors.
not a good predictor of outcomes, the existence of an academic plan did correlate somewhat with increased overall student access to the Internet. But the existence of an information technology plan that covered academics did not predict use of computing in the curriculum. Likewise, existence of a networking plan was not a predictor of the percent of micros/workstations networked, and updating the plan nor linking it to the budget proved to be predictors in the above analyses.13

The quality of the planning effort and the nature of the process may be crucial to the success of the plan, but we had no way of measuring these aspects of planning efforts. Institutions in which academic computing reports to the CIO more often reported superior outcomes. Other CIO-related variables were not important. The fact that the CIO reported directly to the CEO did not have any major positive impacts.

The computer charge variables turned out to be generally unimportant—student fees had no statistically significant correlations with the student index of access to the Internet nor use in the classroom or curriculum. The environmental variables (FTE, public or private institution, Carnegie classification, and our index of resources) had modest relationships with most of the outcome measures.

As expectations concerning information technology continue to soar, colleges and universities need to put more effort into linking their scarce resources (such as time putting together plans) to bottom-line results. Although many of the plans, structures, and policies did not have much effect on our outcome measures, might other variables not available for analysis—for example, incentives for faculty to use computers—have more effect? Finally, the above research was done using 1994 CAUSE ID Survey data. In the last year, there appears to have been a revolution in access to and use of the Internet. Has use of computing in the curriculum had a corresponding change? Can we identify any other practices that influence good outcomes? We need answers to these questions.

Have You Filled Out Your CAUSE ID Survey?*

Contribute your institution’s data:
✓ track your institution’s IT use
✓ become part of a network of peers
✓ enrich this unique resource

Make use of this valuable CAUSE member benefit, and discover how easily you can find information on peer institutions’ use of technology. Members can mine the ID Survey data via the Web and e-mail for reports on topics of general interest, and anyone at a member campus can request custom reports from the database at no charge. Most requests concern administrative applications, staff organization and size, or networking issues … the database also includes valuable information about technology budgets, salary information, computer hardware, campus information resources policies and plans, interconnectivity, communications, academic computing, microcomputers and workstations, strategic planning, outsourcing, support services, and new technologies.

✓ Access the ID Service
and find tips for filling out the survey at http://cause-www.colorado.edu/information-resources/id-service.html

“Generally, while the existence of a plan was not a good predictor of outcomes, the existence of an academic plan did correlate somewhat with increased overall student access to the Internet.”

“Generally, while the existence of a plan was not a good predictor of outcomes, the existence of an academic plan did correlate somewhat with increased overall student access to the Internet.”
Client/Server Conversions: Balancing Benefits and Risks

by Leonard J. Mignerey

Currently only a small fraction of the information created and used by an organization is stored in electronic format. An even smaller percentage is readily accessible to its potential users. Client/server computing and the broader concept of distributed computing have the potential to significantly increase both the percentage and the utility of organizational information captured in electronic format. The excitement surrounding these technologies is warranted: the potential benefits of distributed computing are manifold. However, general user excitement, coupled with intense vendor marketing campaigns, have created levels of expectation that outstrip the current level of technological reality.

For students with inventive minds, the gap between expectations and reality can provide opportunities for solving real-world problems in the rapidly evolving arena of distributed computing. However, such a gap is less positive in the environment of production-grade business support systems. Here the intense rate of change in underlying technologies, coupled with inflated expectations, often results in a high-risk environment. The client/server forms of distributed computing concepts are not old enough that there have been many valuable "lessons learned" from those who adopted technology early on (particularly in the private sector). There are many areas where tremendous benefits can and should be gained from investing in client/server technology. There are also at least an equal number of areas where this technology is not yet appropriate. This article explores and makes a case for why this is so.

Establishing a technology context

Since the 1950s, as computers became more powerful and multi-functional, they assumed more and more of the manual work performed within the business units of most organizations. The natural outgrowth of this process was a single powerful machine capable of supporting the core business functions. The hardware and software that supported the functional systems could be thought of as an environment in a box. Over the years mainframe architectures were refined to an extreme level of efficiency and reliability. These systems are able to service large numbers of users, enforce extremely complex sets of business rules, and deliver very rapid response time, while accessing extremely large databases of information.

Like the process that took place with mainframe hardware, the process of application development was gradually refined to several broadly acceptable methods for implementing the entire process—the software development life cycle, structured code, structured walkthrough, change control, documentation, and so forth. The result has been (for the most part) the evolution of highly reliable code that is currently supporting the mission-critical functions of most businesses and universities.

Over the last five or six years natural questions arose—"Why can't the ease of use and rapid development of applications that have become the norm in the microcomputer/local area network environment be extended to the mainframe environment?" and "Why not bring the mainframe into the network environment and make the data that it has been maintaining all these years available to everybody?" These are natural questions with difficult and rapidly evolving answers.

The traditional mainframe environment has the following components: a terminal attached directly to the mainframe, a CPU, main memory, data input and output electronics, and large storage devices. Today such environments run with a level of reliability that exceeds 99 percent up-time. This is called a "mainframe-centric" environment. The client/server concept spreads computing components across the network for a "network-centric" environment. It is a mix-and-match environment in which almost any one component can either ask for services from any other component (be a client), or provide services to other components (be a server). It expands the very deterministic (because all the pieces are tightly controlled) mainframe environment and creates a non-deterministic environment of loosely coupled components. Current industry wisdom indicates that the best reliability statistics for environments that are complex...
Environmental differences

In the mainframe environment, applications were written that supported enterprise-level (as opposed to department-level) applications. Typically such applications need to enforce the myriad rules and exceptions to those rules, which in total account for the operational essence of an enterprise. These applications are known as “mission-critical” applications. If mission-critical applications malfunction, some essential part of the enterprise will be seriously affected. One example of such an application is a payroll system.

In the monolithic software model, mission-critical applications generally have a large business-rule component, a small user-interface component, and a large data-interface component. PC departmental applications generally have a different structure. Here the majority of the code (generally machine generated) is in the graphical user interface (GUI) and in the data interface layer (also mostly machine generated). The business rule component is extremely small. Traditionally these applications are not mission critical, and are limited to a relatively small sphere. An error in such an application is typically easy to spot, and will not affect the general functioning of the enterprise. Since the majority of the code is machine generated and the domain of the application is limited, alterations to the application are generally easily accomplished. If necessary, an entire application can be scrapped and re-written from scratch.

This type of application development has spawned the concept of rapid application development (RAD). The tools of RAD have been termed fourth-generation languages (4GL) and fifth-generation languages (5GL). Much of the enthusiasm surrounding the client/server concept comes from the desire to create enterprise-level applications using this machine-generated coding concept. Extravagant claims of success notwithstanding, there have been a number of stumbling blocks to achieving this goal. The business rule component is the major difficulty. The complexity involved in coding applications that are mission critical to the entire enterprise is orders of magnitude more difficult than developing departmental-level, non-mission-critical applications. Some 4GL/5GL products have been fairly successful in dealing with the general rule portion; however, it is the exceptions to the rules that are the Gordian Knots of RAD.

For a few years high expectations were placed on a class of technology called computer-aided software engineering (CASE). Few technology professionals would argue the point that the usefulness of CASE tools fell far short of expectations. Attempting to represent the exceptions to business rules with CASE logic was often more difficult than not using the tool at all. We are seeing a new wave of CASE-like tools and techniques (distributed object computing is one) that are attempting to solve this problem.

Politics vs. technology

The major factor contributing to such failures is that the business rules, and particularly their exceptions, are really political issues, not technical issues. Technology cannot now, nor will it ever be able to, replace the political process that is necessary for making decisions or coming to consensus on the business rules (or their exceptions) in an organization. The process of examining business processes, facing and managing emergent personnel issues, reaching consensus, and so forth, is time consuming. Technology has been able to do little to compress the time that is needed to do it properly. The wider the scope of the project, the more people and departments involved, the more difficult and lengthy the political process is. It is easy to slip into thinking that there must be some new technology to deal with this tedious process. Individuals familiar with the limited scope of departmental projects often fail to understand why those at the enterprise level “just can’t get it done.” The complex political process is the primary reason.

The current interest in business process reengineering (BPR) is an outgrowth of the problems caused by process vs. technology issues. BPR attempts to put the process before the technology. With BPR the organization must first redefine what it wants to do, then establish the political and functional structure to get it done, and only then select and implement a technology to facilitate the redefined process. There have been documented successes with BPR, and there have been at least an equal number of failures. There is a school of BPR thought that believes that the real process with BPR is “failing until you succeed”—the first one or two iterations of process reengineering should be expected to fail. Without debating the merits of the argument, I think it at least makes the point that BPR is not rapid.

Exhibit 1 offers a list of some of the business

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Exhibit 1: Business issues to be resolved in conjunction with choosing a technology solution

- Does the institution know what its key business strategies are? Is there upper level, administrative consensus on what major projects should be undertaken and in what order? Where does the proposed project fit in that list?
- Are the business assumptions of the proposed project documented, and is there agreement on the definition of those assumptions?
- If the proposed project is accepted, what effect will its implementation process have on other proposed projects? If this project is undertaken, could its scope delay the benefit that could be derived from equally important alternative projects with a smaller scope?
- If the planned project will be replacing an existing system, has the institution really changed (or can it really change) the organizational structure that the original system is supporting? If not, then the actual benefit of the new system will likely fall far short of the expected benefit.
- If the project will be supporting organizational change, do the key individuals in the respective functional areas have a deep understanding of their jobs? Do they have the ability to conceptualize how to cross the gap from the old model to the new model? Can they lead this effort for their area? While some individuals are excellent in the functional demands of their existing jobs, they do not always have a deep theoretical understanding of their areas of responsibility. If this is the case, is the institution willing to delay the project and rectify key personnel issues?
- Few (if any) organizations actually run by their formal documented procedures. This fact can bring significant resistance to the change process. The informal procedures are often buried deeply in the organizational structure and are difficult to ferret out. Will the project have an appropriately powerful administrative body to find and resolve the resultant issues in a timely manner?
- Does the institution understand the risks of project failure? Based on initial projections, if the project is not implemented within a reasonable timeframe or fails outright, will any mission-critical functions be in jeopardy?
- Are expectations for the new system based on proven product performance or on vendor promises? How closely has this been examined?
- Does the institution understand the full costs of the project? For example, if it is a client/server project, is the necessary infrastructure in place? If not, can the institution afford to purchase and maintain all the desktop equipment that will be necessary to fully deploy the new system? If the institution does not have or cannot afford a robust network infrastructure, and if the full project rollout cannot be centrally funded, then a client/server, distributed computing project is probably not the right institutional choice regardless of the inherent benefits of the actual product.
- Has the institution examined the transition costs of maintaining the old system while implanting the new system?
- Related to the previous issue, will the institution be able to retire the old system when the new system is implemented? If not, does it understand the costs and ramifications of running both the old and new systems?

Issues that should be resolved prior to discussions of what types of technology would be appropriate for a given project.

Huge technological advances and associated high expectations (too often inflated by eager vendors), often lead organizations into a premature attempt to find technological solutions to the difficult but necessary political process. It is often at this point that consensus for a purchased package gains substantial momentum. The process of evaluating, selecting, and budgeting for a package is a process that produces tangible results. The participants in the process feel that they have finally accomplished something. In reality the problems of BPR have simply been deferred. The organization now has the much larger problem of attempting to do BPR simultaneously with or after a major software installation/conversion. The disruptive force on the organization is extreme and becomes a prime reason for project failure. The culmination can be a large financial loss and organizational disarray.

Some client/server realities

Much of the confusion and misunderstanding surrounding client/server stems from the fact that it is the wrong subject to focus on. The fundamental environmental change in technology is not client/server technology; it is the existence of ubiquitous networks and the technology to operate them at a reasonable level of reliability. Networks add to the computing environment what air, road, and rail systems add to an industrialized nation—the ability to effectively distribute goods and services. Networking brings distribution of services to the computing environment and leverages the effectiveness and power of the connected computing components in a way analogous to the industrial example.

To continue the industrial analogy, it is clear that the establishment of a transportation network did not eliminate large centralized manufacturing plants. The reverse is true. Larger, more centralized plants grew to replace many of the smaller regional production facilities. And, as with computing, aggregate investment in industry did not decline, but expanded exponentially.

Cost issues

The issue is not “mainframe bad, UNIX good, PC better.” It is a question of which technology to use where, for the greatest efficiency and the lowest cost. Lower cost per function does not mean that the cost of computing in general is less now than it was in the past. In fact computing in aggregate is becoming more expensive at an expanding rate. Certain parts of the process may be accomplished more cheaply with smaller
machines, but the overall number of computing tasks is increasing; and the necessary hardware, software, and staff to support these tasks are also increasing.

LANs cost nearly three times as much per user as do mainframes, according to a study by International Technology Group (ITG), a consultancy based in Los Gatos, California. After surveying 250 sites and analyzing 20 percent of them in depth, ITG found that the yearly cost per user of mainframe installations averages $2,282, while LANs average $6,445. ITG also found that the average cost per mainframe transaction is 3 cents, compared to 43 cents for LANs.\(^2\)

In April of 1994 the Gartner Group released *A Guide for Estimating Client/Server Costs.*\(^3\) In what has become a widely cited report, they estimated that the total five-year costs for client/server applications per user were approximately $50,800 for small enterprises; $66,350 for medium-sized enterprises; and $48,400 for large enterprises. It was also interesting to note from the component cost breakout that hardware costs represented a small fraction of the total costs. Labor costs were, overwhelmingly, the largest component (see Exhibit 2).

### Conversion risks

There is large risk, large investment, and tremendous complexity involved with mass conversion of existing central systems into the client/server model. Even if successful, such conversions do not necessarily provide significant additional access to central data and may actually delay the ability to do so. (Is it really necessary to replace transactional processing systems that are functional when what the campus really needs are decision support systems, which can be created without systems replacement?) In addition, one must seriously question the conversion of a highly stable system into a less stable system, unless there is some overriding benefit to be gained from the conversion.

Organizations often fail to grasp the depth to which centrally maintained systems are woven into the fabric of the enterprise. These systems are not layered on top like a hat; they cannot be swapped on a whim. In the monolithic model of traditional systems, the business rule section is the predominant issue. To convert these systems, regardless of the target technology, the business rules must be re-examined. This is the BPR process that was discussed earlier, and there are few shortcuts in that process. Mission-critical applications almost always have a significant business rule component. The cost of converting an application with a significant business-rule component will be high because of technical complexity, conceptual complexity, testing to ensure that the application still does what it is supposed to do, and the non-compressible political/process component.

### Rapidly changing technology

Client/server computing is in its infancy, and the architectural models are changing constantly. With each client/server application the question must be asked, “Can we afford to scrap, re-build, or re-buy this application in two years?” In view of the factors surrounding mission-critical applications, it is a very serious question. In industry, this question can often be answered in the affirmative. In the private sector, even a marginal competitive advantage can have extreme benefit. The windows of competitive advantage are generally very narrow. Two years is a long time. An application that provides or supports such an advantage, and that can be developed quickly, is of high value. It is worth a significant short-term investment to gain the advantage. There are few analogs to this scenario in the higher education environment.

### Increased complexity

The risk factor of distributed systems requires some explanation. There is a well-accepted rule that each additional component introduced into a system (any system) raises the complexity of the system geometrically. Over the last decade automobile manufacturers have been applying this principle to automobile production. They have intentionally eliminated as many parts as possible from their designs; a reduction in the number of parts reduces the failure rate of the vehicle. The complexity of distributed systems is at least an order of magnitude greater than traditional systems.

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2. Ibid.

centrally based systems. The controlled environment in a box has been spread out over a network, and the optimization that had been achieved with the former model is lost in the latter.

Response time is a key area affected by increased complexity. Colleges and universities generally run public networks, and all students are entitled to a computer account that includes network access. There is no control over the amount of network traffic that the student (or anyone else on the network) can generate. The exponential growth of network traffic, coupled with the exponential growth of new uses for the Internet, makes it impossible to ensure acceptable levels of on-demand capacity for mission-critical applications.

The software development environment suffers from increased complexity as well. For example, in a distributed computing project, different parts of the project may be developed by different entities both internal and external (vendors) to the organization, under completely different management domains. The design and project management that was formerly centrally controlled becomes design and project management-by-committee. This causes many levels of indirection. Slippage in one area of the project is leveraged as it propagates throughout the entire project. Scheduling and re-scheduling of the project pieces, and even the committee meetings to manage the project, can become a logistical nightmare. In addition, such a project is often made up of components that are supplied by different vendors and yet must interact as an integrated unit.

Need for standards and reliable level of service
This is an area where the current lack of distributed computing industry standards is of particular concern. To successfully implement a project one must ensure that all the pieces are going to “hand shake.” Once the project is implemented, it must be continually monitored as the various components from disparate vendors go through version upgrades. A version upgrade to the product of one vendor must be compatible with the existing version levels of all the other vendor products. The need to keep pace with the version levels that the various vendors are supporting can often mandate conversion/upgrade projects that are entirely vendor driven, meeting no expressed internal need. For these types of projects the cycle time on version upgrades is extremely frequent; twice a year is conservative. If a project has three components (a very simple project), and each vendor changes versions twice a year, and there is no coordination between the vendors on the timing of version upgrades, and all of the components must continue to support each other, then the maintenance problem becomes obvious. Sometimes everything does work fine together. However, significant time needs to be invested with each change to ensure that it will. Otherwise the application cannot be considered a production-level application, i.e., an application that delivers a reliable level of service.

It will be a number of years before the distributed computing environment approaches the level of stability that has become the norm for traditional computing architectures. Client/server application-development models from as little as a year ago are being questioned and replaced. The vaunted “open environment” is still a long way away from having standards for application development and deployment. Industry standards are the “glue” of the client/server distributed computing environment. The much advertised “open” concept should not be confused with industry standards. Open means that a vendor has published the application programming interfaces for a product. This simply means that other vendor products can interface with the open product. That does not make the product an industry standard, although obviously most vendors would love for that to be the case, for at least some of their products.

Client/server technology cannot stabilize until standards are in place. Therefore, investment in this arena is risky. In the absence of standards, companies that are investing in pre-packaged client/server applications are becoming increasingly dependent on their chosen vendor’s proprietary solutions. “There is a danger that IS managers will buy applications or tools that have proprietary middleware underpinnings that don’t interoperate. Many vendors are using middleware as a convenient way to lock users into their product lines.”

with the vendors' version upgrades, which have associated high costs.

The vendors and other devotees of client/server technology claim that the new development tools are powerful enough to rapidly convert existing application suites to keep them current. The fallacy of this claim lies once again with the business rule component and the political process. Vendors of large-scale client/server applications have yet to prove that major version release transitions can be a trivial affair.

Alternatives to core systems investments

Two conceptually different sources of data need to be maintained by an organization. The traditional systems are data accumulation systems. They generally access/add/modify/delete information into the organization’s operational databases one record at a time. This is also known as transaction processing. The newer systems are data access systems. The information that they access is contained in data warehouse databases.

The data warehouse is a concept that is receiving tremendous amounts of attention. The reason for all the interest is that data warehouses provide a new and much needed service and probably represent the greatest benefit in relation to cost of any other client/server project. Data warehouses are the new information access engines into the vast store of data that has been accumulated by the traditional operational systems for years.

The data warehouse has another major benefit. Since it is an access tool and not an accumulation tool, it does not have to incorporate the myriad business rules that are such a large part of the traditional systems development process. Therefore, it is an area where an investment has a low risk of failure, enjoys a high degree of user acceptance, and can be developed in relatively quick time frames. In addition, since the business rule component is the weak link of client/server development, and since this is an extremely small component in the warehouse architecture, it is an excellent place to develop client/server applications.

Much of the perceived need for new core systems stems from data access issues rather than data accumulation issues. The benefits that a data warehouse can bring to an organization, such as improved decision-making, improved service to our students, and so forth, have been documented in many excellent articles during the last two or three years.5

Conclusion

For all of its problems, there is little if any doubt that distributed computing is the computing environment of the future. As solutions are found to some very difficult technological problems, more and more traditional computing applications will migrate to the distributed client/server model. In the meantime, it is important to clearly understand what it can do well today, and what it cannot do well. In some areas client/server computing can already provide valuable enterprise-level services that are not possible with traditional computing architectures. However, industry wisdom is clear that it is not wise to convert existing mission-critical applications to client/server technology if the only reason for doing so is simply to convert the system to client/server technology. It is also clear that client/server technology does not mean one technology at the exclusion of another. The future of distributed computing will see many types and classes of machines doing some part of the electronic “magic” that each does particularly well. Unless there is some overriding strategic reason to convert an existing system to client/server, there is a much greater potential benefit in a client/server investment that will provide some currently non-existent service.

The information technology market will look much different in the next five years and will be radically different over the next ten years. Five years is an eternity in the technology business, but it is only a heartbeat in the higher education environment. This “time reality” mismatch represents an area of high risk. By evaluating our institution’s current investment in existing administrative systems, and the benefits that some of the newer technologies can realistically provide, we have an opportunity to significantly improve the service level that administrative computing can provide to the institution.

“Much of the perceived need for new core systems stems from data access issues rather than data accumulation issues.”

5 See http://cause-www.colorado.edu/information-resources/ir-library/subjects/data-warehouse.html
Can Higher Ed Jump the Curve?

by William H. Graves

Management gurus and the books that make them are an interesting lot. Their advice, in retrospect, usually seems commonsensical and seldom profound when measured against the marketing hype their publishers generate to attract corporate readers. Reading *Jumping the Curve*, 1 you might even wish you had grown up to be a business school professor who wrote a bestseller in 1994 noting the “epochal” changes under way in the commercial world and suggesting a process for “jumping the curve” to sustainable business success in the new millennium. For then, like authors Nicholas Imparato and Oren Harari of the University of San Francisco’s McLaren School of Business, you would have assured yourself a steady flow of corporate clients for your lucrative consulting practice, as well as an attractive income stream for you and your publisher. But “hot” management authors often do us a service by crystallizing a few axioms for success and illustrating their efficacy both with inspiring, in-the-know exemplars and with sad, failed-to-get-it debacles. This is certainly the case with Imparato and Harari. So I’ll set aside any skepticism born of too much paradigm shifting during the last few years and treat their work with the due diligence it deserves.

Imparato and Harari argue that civilization is in the midst of its third epochal (discontinuous) change. The first started in the Fourth Century and thrust the Classical Age into the Middle Ages; the second started in the Fourteenth Century and eventually transformed the Middle Ages into the Modern Age. We are now, they say, on our way to the Fourth Epoch, in which well-led organizations will “jump the curve” by tenaciously adhering to four organizing principles: (1) look a customer ahead; (2) build the company around the software, and build the software around the customer; (3) ensure that those who live the values and ideals of the organization are the most rewarded and the most satisfied; and (4) treat the customer as the final arbiter of service and product quality by offering an unconditional guarantee of complete satisfaction.

Should these principles apply to a college’s or university’s information technology (IT) service organization? I nervously believe so, while only being certain that asking the question is an interesting exercise. More generally, I believe any college or university, public or private, would do well to ask to what extent its overall institutional goals and practices should reflect Imparato’s and Harari’s advice. Here’s why.

Both looking one customer ahead and offering an unconditional guarantee of complete satisfaction imply an institutionally shared definition of customer and attendant service. Research universities might reasonably claim several customers—students, faculty, and granting agencies, to mention just three. It is even arguable in the case of a public research university that the state is the primary customer—buying the statewide socioeconomic benefit accruing from the university’s efforts in instruction, research, and public service. In any case, some members of some research faculties are inclined to treat their disciplines or professions as the customer, belying any institutionally shared sense of customer. Even among those institutions of higher education which might claim the student as the customer—surely many community colleges and liberal arts colleges, as well as others—how many would be willing to offer an unconditional guarantee of complete satisfaction? Would they be guaranteeing the quality of their faculty’s teaching or the quality of their students’ learning—guarantees of input or of outcome?

Ensuring that those who live the values and ideals of the institution are the most rewarded and the most satisfied is very problematic in the face of such mixed signals. For example, research universities, which may arguably be viewed as having differentiated customer sets, have done little to differentiate their reward structures accordingly. Or put another way, if those who live the values and ideals of a research university are being favored in its reward structure, then the evidence in most cases suggests that its sole customer is research—the discipline or the grantor/contractor. Through these dissonant observations and questions, I am suggesting that mapping institutional goals and strategies against Imparato’s and Harari’s four organizing principles would be a revealing and worthwhile exercise for any college or university.

In such an exercise there is a basic perspective which, if adapted to institutional context, might position an institution to understand better how to “jump the curve.” It is arguably that a

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primary goal of any educational institution is to create learning opportunities for its customers. From this goal arise a number of points of institutional differentiation. The choice of customer focus differentiates the nature and scope of an institution’s learning opportunities. Viewing faculty members as customers, for example, recognizes that scholarship and research represent learning at its deepest levels. From this vantage point, some colleges and universities are creating subsidized learning opportunities for their faculties. That is, faculty experts are subsidized (paid) to advance the boundaries of knowledge and to provide related apprentice learning opportunities for students—majors and graduate students.

A second point of differentiation is the degree of subsidy offered to different customers. Faculty subsidies (salaries) differ across institutional types, with smaller subsidies—in community colleges, for example—driving lesser expectations for individualized learning (research) opportunities and outcomes. In an inverse manner, student subsidies also differ, with smaller subsidies—in private institutions, for example—driving greater expectations for individualized student learning opportunities. And there are other points of institutional differentiation arising from the goal of creating learning opportunities for “customers,” however defined.

Which areas of the knowledge base are to be included and at what depth? What will be the nature in time and place of these learning opportunities—on campus in a classroom, in the workplace via real-time interactive video, at home via the Internet and its asynchronous communications technologies, in well-equipped laboratories, in a research library? Will opportunities to certify “chunks” of learning (courses) be available and, if so, how? Will opportunities for institutional endorsement of overall learning be available in the form of degrees or certificates?

But I did not set out to contest traditional ideas about the nature and goals of higher education. So I’ll leave it to readers in the context of their institutions to decide whether there is merit in pushing further to map my proposed learning perspective, which can include the faculty as a customer, against the four organizing principles of Imparato and Harari. Meanwhile, I’ll get to where I thought I would be by now: relating their four principles to the work of IT service organizations in colleges and universities. The four principles would have been as useful fifteen years ago as today. By failing to look one customer ahead, central IT support organizations remained too wedded to the mainframe and minicomputer in the early days of the personal computer. In a recent article, Polley McClure essentially argues that central IT support organizations in higher education may be at a similar blind spot today as they wrestle to balance a mix of central and distributed IT support services. The evidence for this includes the growing dissatisfaction with the central IT support organization being reported by campus after campus. There appears to be no easy way to look one customer ahead today, but IT professionals must do their best to understand the direction of the Internet and the Web and the institutional implications of their continuing phenomenal growth.

Today’s rapid changes in technology and escalating demands for IT services in higher education make it difficult to contemplate offering an unconditional guarantee of complete satisfaction. Doing so would require a very careful delineation of IT services and the customers they support. But this is the point, and a good point. It would be necessary, for example, to understand whether a particular service is targeted at individuals or at a department or departments. E-mail is an example of the former and a facilities management package of the latter. Such distinctions were easier to make a few years ago than today. For example, is the customer for a student services package the office of student affairs or the entire campus community? The answer should be the latter if the institution is committed to “building the company around the software, and building the software around the customer.”

Unconditional service guarantees also would require a change in attitude on the part of some IT professionals. For example, some of the most brilliant technical specialists are among the least service-oriented professionals. They frequently do not live the values and ideals of their organizations, yet they often are rewarded handsomely for their technical prowess. Imparato’s and Harari’s challenge in this area is an important one to any IT support organization hoping to treat the customer as the final arbiter of service quality.

All in all, the four principles for “jumping the curve” heightened my determination to understand and improve the experiences of those using the central IT services I oversee at my university. I am more determined than ever to link these services to institutional objectives. I am also determined to define available services more sharply and, equally important, to clarify what services are not available. Perhaps most intriguing of all, I now find myself engaged by the notion of service guarantees. Reflecting on the four principles could be dangerous to your modus operandi, too.

—IT professionals must do their best to understand the direction of the Internet and the Web and the institutional implications of their continuing phenomenal growth.”

The Sticky Side of the Web

by Kenneth J. Klingenstein

Of the various inventions implemented over the last twenty years on the Internet infrastructure, none has had the impact that the World Wide Web has had. Begun as a tool to assist scientific researchers in sharing scholarly data, the Web arrived at the right moment, when the fusion of computing and digital communication was reaching fruition. The result has been breathtaking growth and the beginning of a remarkable societal transformation. The Web, in its ease and power, offers a profound new mechanism for information and communication. Among its many benefits, it promises economic opportunities, new efficiencies for government and social services, and significant environmental relief.

But not all of its effects have been positive. In dimensions ranging from network impact to cultural preservation, from laws to mores, the Web presents difficult challenges in an urgent time frame.

From being a mote in network traffic two years ago, the Web is now over 50 percent of total Internet volume. Its ease of use, both for navigation and content presentation in multimedia and interactive formats, has brought legions of new users and new uses to the network. And in its propensity for complex graphics, the Web represents a massive number of bytes to convey. (A picture may be worth a thousand words, but most graphics contain an order of magnitude more bytes than a thousand words.) Multiply new users and uses by such a volume per usage, and the current severe network congestion is the result.

Moreover, all this traffic is carried by a somewhat inefficient protocol that is insensitive to network load. Most network applications employ a “slow-start” approach that transmits packets at a limited rate until the current carrying capacity of the network is determined. This “good citizenship” by applications helps deter the chronic death-spiral that congestion can create. HTTP, the underlying Web transport protocol, does not employ slow-start, likely because its designers assumed that the typical Web user, flitting from host to host, would have such brief connections as not to justify implementing slow-start. Thus, the large, bursty transfers of Web data can cause, and exacerbate, network congestion.

If the Web is technically boorish, it is a social radical. Its power as the ultimate printing press means that it can push the limits of our societal bounds. For example, while it presents powerful opportunities for diverse populations to inform the rest of the world of their own lives, it represents a real threat to those in the community who are trying to preserve their cultures from contamination.

Many of these issues are illustrated at universities, where our traditional leadership in networking has brought us to the forefront of its associated problems. We are having to create new policies to deal with self-expression on the Web. When a student in a dorm room, operating on his or her own machine, posts offensive material on the Net, what authority does the institution have? Who determines if an image is libelous or harassing? Such issues were once largely academic, but given the reach of the Internet, these questions now have world-wide impact and implication. Indeed, the Net’s global scope complicates the matter by removing the context of local standards for policies.

The Web also poses significant threats to our personal security and privacy. In particular, while Web clients help users to glean information from the servers, the clients also can convey information, surreptitiously, from the client back to the server. Today the clients may report to the server the identity of the client’s owner; within months they will be able to report the contents of the user’s hard drive and convey files back to a server. While legal precedents have been established in other areas of privacy (for example, barring public disclosure of what books you have checked out of the library or what videotapes you have rented) there is no guidance on privacy in cyberspace. The temptations for businesses, or government, to know details of the people who visit their Web sites may lead to unforeseen abuses.

The Web, much like other transformational inventions, has consequence far beyond its first assessment. While we have, as institutions and as a society, already begun to reap the benefits of the Web, we have yet to deal with its sticky side.
Spinning the Web: The Design of Yale’s Front Door

by Robert Callum

As time passes, the term “the Web” proves to be remarkably prescient nomenclature. The World Wide Web has infiltrated and entangled our lives much like its natural namesake. More noteworthy, however, is the way the Web has mimicked biological processes, showing the ability to metamorphose and evolve in a manner that would make Darwin proud. As the Web changes, the pages and people who are stuck to its digital threads must also evolve, or face the fate of those not “naturally selected.”

The story that follows will resonate with many readers. The same scenarios are currently present across campuses all over the world. Redesigning a college or university home page is both necessary and challenging—necessary because an epoch on the Web is six months, and stasis for much longer ensures that technological and design innovations have passed you by; and challenging because design choices are not science. Building consensus around one choice, especially at institutions that pride themselves on freedom of thought, is an unenviable task.1

Early efforts at Yale

The history of the Web at Yale followed a familiar course. Scientists and programmers, the early adopters of any new technology, latched onto the Web and produced the first University “Front Door.” The results for the time (early 1993) were superb. Yale had a presence on the Web where the digital cognoscenti could “hang ten.”

By 1994, the world was markedly different. The early adopters had been joined by mainstream users, and recognition of the Web, both on and off campus, had grown dramatically. Academic Computing Services (ACS), fine purveyors of the Gopher-based campus information system since the early 1990s, realized that the Web was a mature information dissemination tool. The Front Door represented all of Yale, and required substantial managerial and technical attention. The Web was now a major responsibility, and it was time to move that responsibility to an institutional home. Day-to-day operations of the Front Door were transferred to ACS.

At the same time that ACS assumed custody of the Front Door, the Office of Public Affairs (OPA) became increasingly concerned about the Web’s public relations implications. The director of OPA convened a design group, and shepherded the creation of a new image (“the books”) to be the main graphical statement of the Front Door.2 The new image was grafted onto the pre-existing organizational structure, and the resulting Front Door served the University’s needs through 1994.

By early 1995, however, the organizational schema of that original Front Door, basically unchanged since 1993, was showing signs of wear. The arts of managing information, creating categories, and identifying audiences had matured along with the Web. Adding new links to the Front Door in an ad hoc manner quickly created a rambling litany of resources that daunted newcomers and created a skewed perception of the University’s offerings.

The maturation of information organization mirrored a greater appreciation of the Web’s importance by University officers. Through frequent use and conversations with sister institutions, Yale’s governance now understood that the Web was a new form of publication, the impact of which on the school’s image was equal to, if not greater than, standard paper fare.3 As such, any redesign of the Front Door needed University-wide approval. That approval would come straight from the top: the president.

In only two years, the Front Door had evolved from the exploratory musings of the technologically enabled to an image-bearing tool that required the imprimatur of the chief executive officer. To garner that imprimatur in an effective manner brought other challenges, however.

Building consensus for a new design

A steering group large enough to accommodate key University decision-makers would be too large to actually create change. Large groups pontificate, while small groups get things done. The solution was to divide the redesign process by creating an advisory team and a design team.

The advisory team included members of the larger University community, including representatives from the Provost’s Office, the University’s Governance, and the alumnae association. The design team, which was comprised of representatives from the Web and an ad hoc group of students, was given the task of presenting the results of the redesign to the advisory team.

The design team presented their findings to the advisory team, who in turn presented the findings to the design team. This process was repeated until the design team had a product that the advisory team was willing to present to the University.

The University’s approval was the final step in the redesign process. The University’s governance, which had been involved in the design process from the beginning, was now ready to approve the design.

The redesign of the Front Door was completed in 1995 and launched in the Fall of 1996. The new image was grafted onto the pre-existing organizational structure, and the resulting Front Door served the University’s needs through 1999.

1 This article does not mean to imply that industry is immune from these challenges. Industry is, however, equipped with two advantages (in this context) that academe does not share: hierarchical control over subdivisions and the ability to impel, rather than cajole, compliance and consensus.

2 See sidebar page 51.

3 The value of a publication can be measured in many ways, only one of which is the number of eyes that view it. However, in a straight measure of exposure, Web publications transcend paper. The Yale Front Door main page (http://www.yale.edu) is “hit” over 80,000 times per month, and institutional Web pages account for 1.2 million transactions in the same time period.
The design team wanted a minimum of categories, clearly defined and organized, that would put each visitor immediately at ease.

With hindsight, we would suggest that future advisory teams invite participation from the admissions and alumni offices as well.

Existing resources (such as YaleInfo, the campus information system) were already focused on the campus community. The needs of the campus user are far different from the needs of the visitor, and by trying to design one page to be all things to all people, the redesign would do a disservice to both clienteles.

The design team wanted a defined and organized system (C&IS, the University computing organization), the Office of Public Affairs, the faculty, and the president’s designee. The design team included a graphic designer, along with two members of the library staff, the de facto University Webmaster, and the Director of Academic Computing, who convened and led both teams. The two teams met in tandem to discuss goals and concepts for the new Front Door. Then the design team would actualize those concepts. The two teams would come together again to discuss the design team’s progress, and the cycle would continue. The new Front Door was born out of this iterative process.

The teams first identified a set of principles to guide the design process.

1. The page should be small and compact, accessible in total via one mouse click (on a “standard” browser the image would take up the first screen, and a single click would scroll the text into view).
2. The page should be designed primarily for visitors.
3. The page should be universally accessible, which meant that minimal browser-specific HTML would be used.
4. The page should have a statement of purpose, which would make clear for whom and for what the page was designed.
5. The page should be distinctive, yet easy to grasp.

Summed together, the overarching goal for the Front Door was to produce appealing and effective access for visitors to Yale. Visitors, however, are a heterogeneous group, each wanting very different resources from the University. Relying on anecdotal and commentary evidence, statistics, and a good dose of common sense, the design team was able to subdivide the Front Door’s target audience: scholars (Academics), prospective students (Admissions), former students (Alumni Affairs), and the greater New Haven community (Campus & Community Life).

With the audience defined, the design team went about the work of creating categories for the Front Door. What quickly became apparent is that categories based on existing University divisions (organizational topography) or sectional appeal (e.g., libraries, athletics) were limiting. Organizational topography can be daunting, even for insiders. Sectional appeal leads to the “me too” phenomenon. If one section is allowed on the Front Door, other requests naturally follow, and even if the sectional categories are well conceived, a new sectional division will undoubtedly come into being, wrecking the underlying structure. Eventually, the Front Door will return to the “litany of links” model that the redesign was attempting to banish.

The design team wanted a minimum of categories, clearly defined and organized, that would put each visitor immediately at ease. If you were a prospective student, the design team wanted you to know, at a glance, exactly where to go for admission information. The solution was to use the particular segments of our target audience as category names. Arriving at the Front Door, prospective students would see “Admissions,” and there find all the currently available University admission information, as well as links to other resources of interest to applicants. The same would hold true for alumni, and the other targeted categories. Where information crossed boundaries, links were duplicated in each section.

These links would eventually lead a visitor into YaleInfo, the campus information system, where the information actually resided. The Front Door and its appurtenant pages would serve to triage targeted audience members to the information they wanted. For internal users, such a system would be unwieldy and prevent quick access to known resources. The first-time visitor, however, is thankful not to be thrown into the middle of an informational morass.

Such an audience-defined category approach fulfills the vision of the Front Door, offering elegant and effective access for visitors to Yale’s electronic resources. The very effectiveness, however, highlights an intrinsic drawback to the system: what about visitors who wish to browse? Academe is littered with stories of scholars who made a critical breakthrough by rifling through a card catalog and following a flight of fancy initiated by random chance. Tight and efficient categories remove the opportunity for intellectual cross-pollination. Because of the varied and rich culture at Yale, the design team wanted a place to highlight interesting resources, without regard to category. The answer was the “Yale Sampler” section, which endeavors to present vignettes of life at the University. The sampler is rotated periodically, to showcase new or changing pages in the community.

A new front door— but not for long

The redesign complete, the new Front Door was released to the world, and specifically the hyper-critical campus and alumni populations. The teams were pleasantly surprised at the response. To date, the feedback has been overwhelmingly positive. The new categories are intuitive, and the arduous process of information gathering has been made much easier. Certain users have bemoaned the lack of “glitz” that
accompanies many Web sites these days, but the majority has applauded the simple elegance of the redesign.

The Yale advisory and design teams have no illusions concerning the permanence of their work. While it is hoped that the organizational schema chosen will scale well, a life cycle of more than two or three epochs (18 months) is impractical. The Web will evolve further, and so will our understanding of it, so that what now feels visionary will soon look hackneyed.

What will have lasting value, we hope, is the process used to create the schema. Audience targeting, knowing who comes to your pages and why, is invaluable in the design process. So is keeping the design team small. Consensus building and participation from across the University is imperative for both the conceptual phase and the overall acceptance of a new Front Door, but that consensus cannot come at the cost of a bloated design force. With too many hands in the Web, process becomes hopelessly entangled.

The redesign of the Yale Front Door, here presented in a straightforward narrative, belies the difficulty that the design and advisory teams had in creating the new pages. Open discussion and debate, sometimes strenuous and heated, created a crucible that withered many lesser designs. Those that were “naturally selected” from the milieu showed both adaptability and vision, two qualities that will be indispensable for the continuing evolution of the Web. Darwin would indeed be proud.

The author would like to thank Phil Long and Matthew Beacom for their help in making high-quality web pages a reality at Yale.

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“The Web will evolve further, and so will our understanding of it, so that what now feels visionary will soon look hackneyed.”

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Frank Tierney, a graphic designer from Yale University Printing and Graphic Services, created “the books.” The image was based on a portion of Elihu Yale’s library, part of his original gift to the University. The different sizes and shapes of the original eleven books conspired to form a stunning graphical milieu, not unlike the “Manhattan Skyline,” in the words of Paul Mellon Professor of History of Art, Jules Prown. A distinctive identifier for Yale, “the books” were unlike anything then available on the Web.

While “the books” earned raves from the Internet community, they were subject to intense controversy among students, staff, and alumni. The image was “humanity-centric,” “scientifically bankrupt,” and “failed to show the beauty of New Haven.” One perturbed alumnus asked why we could not “…have a nice view of the Charles River, like Harvard.” He failed to provide relocation funds with his critique.

During the redesign process, both the design and advisory teams spent many sessions discussing changes to “the books.” Despite yeoman work by both Mr. Tierney and team members, in the end, no metaphor could be found that equaled the visual impact of the “Manhattan Skyline.” A campus scene, no matter how beautiful, cannot display the academic or cultural richness of Yale. The designers finally compromised on a revamped version of “the books,” whose original impact was somewhat dampened by the exigencies of the improved organizational format. The graphical issue has not been laid to rest, however, and even now the teams are planning additional image work in the near future.

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This article is adapted from “Spinning the Web: The Design of Yale’s Front Door,” first published in the April 1996 edition of Omnibus: Computing at Yale (http://www.yale.edu/omnibus).
Actually Useful Internet Security Techniques
by Larry Hughes, Jr.
(New Riders Publishing, 1995, $32.00, 371 pages)
ISBN 1-56205-508-9

Reviewed by Mark Bruhn

“In an era where there is no possibility that even the best security analysts can be knowledgeable about all aspects of computing and networking, having a reference such as this is invaluable.”

Interest in the Internet continues to grow dramatically, and more and more of our veteran (and some not-so-veteran) colleagues are taking advantage of the explosion of users by sharing their knowledge and experiences. However, in my somewhat pessimistic view, it appears that many are taking this opportunity to throw together a text with an interesting title in an attempt to make money on this new and unsuspecting audience. This is clearly demonstrated by the myriad of not-so-useful volumes on the shelves of our favorite stores. I think I can say with some confidence that this particular author’s motivation is much different. I offer two items of proof: first, I know and have worked with Larry as a colleague at Indiana University for many years, and have long admired his enthusiasm and knowledge in the area of network and computer security—especially considering that he is not primarily a security analyst. Second, I am an Information Security Officer, and have actually read and used this book quite successfully. Larry is genuinely interested in the subject—enough to take a lengthy sabbatical to review and refresh his knowledge in order to get the stuff right.

The text begins with an easy-to-read section dealing with “the basic anatomy of Internet communications,” which gives the reader a good basis for the rest of the material. It then pursues very helpful discussions of specific related security exposures, such as “address spoofing,” “hijacking,” and “message replay,” followed by descriptions of solutions such as “application proxies” and “packet filtering.”

Subsequent chapters delve into other areas of particular security interest: mail, file sharing, user authentication, encryption, Kerberos, World Wide Web security, and a good-sized section called “Actually Useful Security Tools.” In nearly every area, there are sidebars with notes and tips to highlight specific areas of concern or additional information that may help the reader better understand the text. In addition, there are helpful diagrams and sample program code for those who learn best by doing.

In an era where there is no possibility that even the best security analysts can be knowledgeable about all aspects of computing and networking, having a reference such as this is invaluable. This book provides an ideal level of depth, which at the very least enables readers to formulate much better questions about implementations and potential problems to present to those techno-specialists who are responsible for their systems and networks.

Reviewer Mark Bruhn is a Senior Manager and Information Security Officer at Indiana University Computing Services.

Public Access to the Internet
Edited by Brian Kahin and James Keller
(MIT Press, 1995, $20.00, 390 pages)

Reviewed by Paula Kaufman

One can hardly pick up a contemporary newspaper, popular magazine, trade publication, or scholarly journal without reading about the miraculous wonders of the Internet. Communication is enhanced, new information resources are at one’s fingertips or the click of a mouse, fortunes are waiting to be made, new research discoveries are accelerated. The worlds of business and commerce, of higher education and research, of elementary and secondary schools are being transformed by this wondrous new technology.

And so they are. Yet, little attention has been paid to the Internet’s potential for transforming communities, for accommodating new classes of users, for changing community cultures. The editors of this volume sought to address these issues at a conference on public access to the Internet held at the John F. Kennedy School of Government in 1993. This volume contains revised and updated papers from that conference.

Every technological innovation has been seen by visionaries to have the potential to reform education, enhance participation in the democratic process, make government more accountable, and improve the quality of life. As Lewis Branscomb points out in his essay, “Internet is egalitarian for those who are on it; it is elitist for those who cannot use it or do not have access to it.” Society must address such issues as: Who will protect the public values in the information infrastructure? Who will protect the culture built into the Internet by the users who created it? How will people with few financial resources access the Internet? What is the role of the federal agencies that advance the National Information Infrastructure, and what policy provisions should they incorporate in it? Essays by Branscomb, Richard Civille, Beverly Hunter, and Brian Kahin stand out among this group of solid contributions for the eloquently compelling way in which they address these issues and propose approaches to finding solutions.
The Harvard Information Infrastructure Project, now six years old, has had a serious influence on thinking about the impact of a digital infrastructure on many aspects of society. In this work, the Project’s editors have sustained their role in raising issues of special import to American society. For that we are grateful.

Reviewer Paula Kaufman is Dean of Libraries at the University of Tennessee, Knoxville, and a member of the CAUSE Board of Directors.

**Working Wisdom**

by Robert Aubrey & Paul M. Cohen  
(Jossey-Bass Publishers, 1995, $25.00, 192 pages)  
ISBN 0-7879-0058-3

Reviewed by Kathi J. Dwelle

With the increasing rate of change, it’s a given that organizations need to develop employees who are life-long learners, and create an environment where there is cumulative “organizational learning.” Easy enough to say, but how to do it? Authors Aubrey and Cohen are among the first to tackle this challenge with empirically derived and thought-provoking insights.

Wisdom is more than knowledge transfer. It comes from reflection on action. Aubrey, an international management consultant, is fascinated with the question “How did you learn what has been most useful in your working life?” and has been asking the question in his seminars. The answer, he discovered, was almost never “in a training class,” nor was it as simple as “on the job.” Most often it was through the help of a non-dogmatic mentor.

The authors identify and define five skills organizational leaders and coaches can use to impart wisdom in everyday workplace activities, a process that they regard as a journey. They categorize these time-tested and pragmatic strategies for accelerating learning as: accompanying, sowing, catalyzing, showing, and harvesting. The book contains an energizing mix of practical, current-day examples along with the methods of ancient masters.

If you’ve been expecting instantaneous results in your organization, their concept of organizational learning as a journey with stages can help you understand the necessary progression and give you the patience to persevere. The authors also present a vision of how technology can help impart wisdom, and propose new roles for managers in learning organizations.

*Working Wisdom* is highly readable, with ideas so interesting it is best digested slowly, a chapter at a time. If you’re looking for strategies for your organization’s learning programs (or just want to impart your own wisdom to others), check this out.

Reviewer Kathi J. Dwelle is Director of Organizational Effectiveness for the Division of Information Technology at the University of Wisconsin, Madison.

**Standards Policy for Information Infrastructure**

Edited by Brian Kahin and Janet Abbate  
(MIT press, 1995, $35.00, 653 pages)  
ISBN 0-262-61117-1

Reviewed by Clifford A. Lynch

This book is another of the very valuable collections of papers prepared by the Harvard Information Infrastructure Project; it is based, in large part, on (updated) contributions to a workshop held at Harvard on the same topic in June 1994. This book is relatively unique, and I believe fills a real need both as professional reading and as a potential text for a number of classes. While it looks at issues surrounding a number of specific standards (such as High Definition TV) as case studies, and examines the process and bureaucracy of standards-making in a number of areas, these are used as case studies to get at much more basic and important issues. In particular, the essays in the book look at the interplay between formal (i.e. ANSI, ISO) and informal (i.e., industry consortia, the Internet Engineering Task Force) standards-making approaches, the appropriate role of government in standards development and implementation, and the pivotal role of standards in the development of infrastructure (obviously, with emphasis on information infrastructure in various contexts). It includes excellent coverage of international issues in standards and also other key topics too seldom discussed, such as how to finance the standards development process and intellectual property issues related to standards. It also considers in depth the various definitions and implications of “interoperability,” a now much overused term that has become common advertising hype.

One does not need to know (or care) a great deal about the technical details of specific standards or standards-making processes to learn a great deal from the essays in this book...
**Question:**
Is your institution experiencing a crisis in support for information technology, in terms of both human and financial resources? How is your organization responding? What are some of the mechanisms that are working well?

The University of Houston, an urban campus of some 30,000 students, has approached the mushrooming demand for information technology support by enhancing its infrastructure and by bringing support closer to the user.

Recently the campus has begun to standardize on several popular productivity tools. While these tools are not the solution for everyone on campus, Netscape, Eudora, and the Microsoft Office suite are favored by a large majority. Standardization allows support providers to become expert in these popular packages.

A major program this year is to replace most faculty workstations below the 486- or Macintosh 68030-level. A similar program for administrative workstations will be initiated in fall 1996. Student workstations in IT laboratories, as well as an NT-based Instructional Support Network of file and print servers, are upgraded annually through funding provided by a student computer use fee.

IT must take bold steps to ensure that user support avoids a crisis. Web development and all of the emerging technologies it encompasses demand a non-traditional support solution. While various IT departments are positioned to provide elements of this support, we are also exploring ways to partner with “cutting-edge” faculty to enrich Web support for the campus.

IT now provides most of its technology support centrally. The UH academic officers recognize that the campus needs far more support. They plan to allocate funds this fall to provide “local” or college-based user support. These support providers will report to, and be coordinated by, the central IT organization, but their duties will be articulated jointly by IT and the participating colleges and departments.

Other major initiatives include establishing an integrated Support and Network Monitoring Center, right-sourcing dial-in support, and migrating support providers from fire fighters to fire prooers. Of all the challenges, the last may be the greatest.

Toby Sitko
Director
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The Marriott Library of the University of Utah is being forced into massive changes, in terms of both staffing and services. This is strikingly demonstrated by what is occurring in the audio-visual division of Public Services, which is now moving into the library expansion wing as the brand new Multimedia Center (MMC).

Because of the huge increase in expected/demanded services and a dearth of staff, we are trying to institute team management/organization at both the MMC and throughout the entire library. It is only by appropriate, formal sharing of well-trained, expert staff that we can hope to cope with our expanded mission. Working in teams is certainly not a new concept, but it is to this library, especially for teams that integrate career staff and librarians, and support and front-line staff.

Our new MMC organization chart includes one horizontal line of full-time staff who will be responsible for a team—the team leaders. Some will have at least one person as a permanent team member, while others will have no permanent members; they will be responsible for accomplishing their team’s missions and goals and will be evaluated on this primarily. Some will also be temporary members of other MMC and/or library teams, and this will be a secondary but formal responsibility, reflected as one part of their performance evaluation. As an example, the MMC Trainer (who will be responsible for all the center’s technical training of full- and part-time staff) will also be a member of the Library Training Team, probably under the direction, supervision, and evaluation of our Library Instruction Librarian.

This team concept should work in both directions. For example, now that the general reference librarians do not have to be in a print book/index reference area to provide their service, they might work part time in our area as part of the Counter Consultants Team. They could make up for the lack of “content” assistance provided by our part-time and full-time technical specialists. We all would gain very valuable and extremely necessary cross training—they in the technical and electronic area and we in content and evaluation.

All this is supposition, as we will not complete our move until the latter part of September, and the library is still in the midst of major reorganization. We hope that any success of ours in utilizing this shared responsibility concept of flexible teams will be extended throughout the entire organization. I strongly believe that this approach is the only way we can hope to address the challenges facing libraries and higher education in the next several years.

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The University of Utah is experiencing a serious support service “crunch.” The problem became particularly noticeable in fall 1995, when Novell’s GroupWise was implemented University-wide and all faculty, staff, and students were given free GroupWise accounts and access to an integrated e-mail directory. It is clear that we are no longer trying to support just the “tech-junkies.” Information technology is now a mainstream user support problem.

Since November 1995, WSU’s Computer Support Center has logged 3,362 formal requests...
for service and has an average backlog of 60–100 unresolved formal requests (this does not include numerous informal requests). We are exploring a number of ways to improve service and cut the backlog, but haven’t found any magic solutions yet!

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At St. Olaf College (Northfield, MN) growth in technology support services has to be accompanied by an associated decrease in another service area. The Academic Computing Center is fortunate, because we know how much time it takes to provide a certain service. Each staff member logs the amount of time each day that is devoted to such things as systems/network management; student, faculty, and staff support; educational services; retail operations; etc. Through careful evaluation of these time logs, we are able to identify the actual amount of time required to provide specific services. Using this information, we can calculate the value of the service against the staff time involved, the number of individuals served by that service, etc.

One outcome of our ongoing evaluation was the decision to migrate our retail sales operations (computers, peripherals, etc.) to the campus bookstore. While this is a critical service, the bookstore has the expertise, hours, and location far better suited to this operation. Academic Computing will use this opportunity to transform our current retail facility into a walk-in help facility for the community. Another service we will be eliminating is the repair of personally owned microcomputers. Since Northfield does not have a local computer repair business, we have made arrangements with a small company in another city to provide repair services, including free pickup and delivery three times weekly. Individuals will not see any substantial increase in price, but they will see an improvement in the turn-around time on repairs of campus equipment.

Another trick we are using to handle the support crisis is time management training. At least once yearly the staff as a group watches a time-management videotape. We discuss our own time traps, as well as identify the time traps that lurk within the staff. These sessions have been highly effective at increasing our productivity!

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Obviously we are all going through a support crisis, and I don’t think Pepperdine University (Malibu, CA) is any different than others. There are several important issues facing all of us, including the migration to newer technologies and the integration of these technologies in the teaching/learning environment. The most important new technologies are perhaps those that impact the telecommunications infrastructure. These issues drive our work, and require more to plan, develop, finance, manage, and support than perhaps any other issue that we’ve faced in the past.

There are three items I would proffer that have assisted us in dealing with this support issue:

Technology standards. We have attempted to control some of our support costs by having a clear and well publicized set of hardware and software standards. These are put together with help from our user community, and are enforced at the purchasing office. Standardized technology standards helps contain staffing, training, inventory, and R&D costs.

Outsourcing. We have identified various segments of our operation that we regularly outsource. Photocopy maintenance, major cable pulls and dial-up Internet services are examples of opportunities where we have utilized outsourcing to minimize our costs.

Technology management. I’ve always thought that one key way to leverage your staffing resources is to provide them the tools they need to manage the systems they support. Therefore, we have invested and are continuing to invest in system management tools. At the same time, the industry needs to provide better (and less costly) management tools for us.

Finally, as the administrative, academic and technological arenas are pulled closer together, it is becoming more important than ever to develop effective planning and budget models that are collaborative, cohesive, and strategic.

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Information Resources & Technology (IRT) at Bradley University (Peoria, IL) has worked with the University to develop and implement four strategies to address the support crisis:

The IRT Scholar Program: This program annually selects a student to participate in a “forgivable loan” program. For the final two years of the student’s program, the University loans full tuition and employs the Scholar as a student assistant. Upon graduation, the Scholar is employed as a full-time entry-level employee. After three years of University employment, the tuition loan is forgiven.

Enhanced use of graduate assistants: We have determined that it is more effective to assign graduate assistants to specific projects rather than to assign them as generalists. Because this approach better meets the needs of all the participants—graduate assistants, IRT staff, and clients—
and provides specific, tangible outcomes, the University has provided additional graduate assistants.

Market parity funding: Bradley salary increases have not kept pace with general market salaries for experienced technical staff. IRT unit managers researched comparable market salaries of high turnover and other “key” positions. Based on this research, IRT was able to persuade administration to provide a limited pool of supplemental funding to address the most serious market parity issues. Factors considered in distributing the funds included criticality of the position, merit-based performance evaluations of the individuals, ability to fill the position should it be vacated, and market parity.

The University Technology Service Center (UTSC): The UTSC was established in June of 1996 as the help desk for all IRT services. The UTSC will reduce service strain on staff while increasing reliability of service to users. The Remedy Action Response System software will give us a centralized system for managing service calls, and will allow us to provide users with some ability to resolve their own problems, to develop service histories, and to assign service calls to appropriate technical staff.

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Selected responses to the Winter 1996 Readers Respond question will be printed in the next issue of CAUSE/EFFECT, space permitting. All replies will be included in the online edition available on the CAUSE Web server at http://cause-www.colorado.edu/cause-effect/cause-effect.html

Winter 1996 Readers Respond Question
Looking ahead to the year 2000, is your institution planning to modify existing information systems to handle the new date, or are you planning to investigate the purchase or development of new applications? What steps have you taken so far to address the “Year 2000” challenge?

Please send your response, along with your name, title, e-mail address, phone and fax numbers by electronic mail to eharris@cause.colorado.edu; by fax to 303-440-0461, or by regular mail to Elizabeth Harris, CAUSE/EFFECT Managing Editor, CAUSE, Suite 302E, 4840 Pearl East Circle, Boulder, CO 80301.

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