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

Guidelines for Outsourcing Remote Access

A Management Perspective on Distributed Support at Rice University

Multimedia and Asynchronous Learning: Changing the Support Model for Information Technology Services

Teaching via Electrons: Networked Courseware at the University of Oregon

Reengineering Higher Education: Reinventing Teaching and Learning

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Rapidly changing technology continues to bring about parallel change in the campus organizations that support its implementation and use. As mainstream users across campuses demand increased access and training, many central information technology organizations are responding by decentralizing support services—especially to meet the needs of faculty who have, seemingly overnight, embraced the use of technology in course delivery.

This issue of CAUSE/EFFECT examines the impact of using technology in teaching and learning from two quite different perspectives—the challenge of supporting faculty in this endeavor, through the eyes of information resources professionals, and the benefits and limitations of using technology to teach, from a faculty viewpoint. The latter is a view rarely found in this journal, but one that we think important to present. Understanding the issues surrounding teaching, learning, and technology from an educator’s perspective can only strengthen the information resources professional’s ability to support faculty in this arena.

At Rice University, continuing reorganization in the past two years has resulted in a distributed support model involving the information technology division, the library, and departmental staff. The new model builds on the collaborative, matrixed-teams approach that Rice undertook several years ago in an earlier restructuring effort. The distributed model has brought about major changes in help-desk support and training areas and has required a different communications style. Some of the challenges faced include having fewer staff available in the central organization to deal with crises or new projects, supervising staff from a distance, and helping “backroom” staff develop interpersonal skills.

Both Virginia Commonwealth University and Randolph-Macon College have evolved plans and support models aimed at enabling the integration of digital technologies across the curriculum. Like Rice University, these institutions have found it necessary to change their academic technology support structures to meet increased faculty demand. At VCU, an Instructional Development Center was created, with staff reassigned from central computing, library, and media services. Randolph-Macon’s World Wide Web site is creating an online support and learning environment for both faculty and students.

According to author Greg Bothun, the compelling challenge for colleges and universities and their faculties in using technology-based instruction is programming content into this new medium. Rather than simply advocating the use of instructional technology, Bothun critically evaluates the results to date of faculty experiences at the University of Oregon in creating and using interactive Java-based courseware that allows students to actually do experiments and analyze data online. His article’s pervasive theme is that courseware expertise still resides within faculty on the campus, and that institutional investment in this expertise will make higher education institutions viable in the next millennium.

Successful reengineering in higher education, say authors Herbert Stahlke and James Nyce, must begin with teaching and learning, rather than administrative processes. Their article reviews selected literature in this area and presents a principled framework within which to think about reengineering teaching and learning, emphasizing the importance of achieving an appropriate match of tools and tasks in instructional design. They conclude that for reengineering to succeed in higher education, academic priorities must drive the process.

The subject of this issue’s centerfold profile is a good example of a campus that is, indeed, making educational processes a key component of an institution-wide reengineering effort. Santa Barbara City College has undertaken a major redesign project to make fundamental changes in institutional core processes, especially to use information technology to enable those changes. SBCC’s Project Redesign is addressing not just administrative processes, but also the processes that underlie the College’s teaching and learning mission. The project is providing the blueprint for technology acquisition and implementation, ensuring the application of technology “in context” rather than for its own sake.

Key to the transformation of colleges and universities as discussed above is access to a reliable, high-speed global network. Two related articles in this issue are Michael Staman’s analysis of the steady decline in Internet performance and Ardoth Hassler and Michael Neuman’s discussion of the advantages and disadvantages of outsourcing remote access to the Internet. While solutions to these aspects of our networking future are not clear-cut, these authors present thoughtful discussions that should help illuminate the issues.

Finally, Marjorie Hodges and Steve Wornna’s analysis of the legal issues associated with the networked information environment is an informative and quick summary that should help technology and other administrators involved in campus network policy initiatives.

Julia A. Rudy, Editor
Real Savings—Real Benefits

by Richard P. West

As the scholarly communication and publishing process moves from being print-based to being network-based, a significant question has been the potential impact on costs. CNI has sponsored an important project to represent this process as a “value chain,” identifying each of the component functions in the process, determining who performs each function, and assessing the costs related to each function.

From the writing and composition of the scholarly work to editing to distribution to archiving and every step in between, each major step or function in creating, communicating, and storing a scholarly work is being explicitly stated. Once they are identified, it can be determined who performs those functions in the value chain. For example, for print-based documents, scholars create the individual works, but the publishers of the works edit and distribute (sell) them. Libraries, and of course individuals, buy the works, and also organize, classify, circulate, and archive them.

The next step is a more difficult task—assigning costs to each of the functions. At this conceptual stage, it doesn’t matter whether absolute costs are calculated or whether simply a percent distribution is developed for each part of the total cost of creating, disseminating, organizing, circulating, and storing scholarly information. What is important is to show how the introduction of networked information technology can change the cost distribution among the functions of the scholarly information process.

A major challenge of this process has been that as the distribution medium moves from print-based to information-network-based, there are winners and losers, both perceived and real, since different players can perform the functions of the electronic distribution process than was true in the print-based process. Obviously if a journal is transferred from print to the network, the distribution process is handled by the Internet and not, for example, by the U.S. Postal Service. Other shifts in responsibility and profitability can be imagined as scholarly information becomes available in electronic form.

I have described in earlier columns the functions of the scholarly information process. This CNI-sponsored project on the costs and measures in the “value chain” of networked information will result in a report, expected in July 1997, which should shed significant light on these important questions of changing costs and players. And understanding of the “value chain” has helped us understand how another CNI-sponsored project, nearing its debut, can help generate real savings and real benefits by the intelligent application of networked technology.

The dissemination of government information, particularly from the federal government, has long been accomplished through the Federal Depository Library Program, an effective distribution strategy that uses a collection of libraries nationally to provide users no-fee access to government information. Many university libraries are part of this system of government information dissemination; as part of this public service role we organize, store, make available, and archive large amounts of government information. We do not charge the federal government for this service because we recognize that this function is critical to our public service and research missions.

Unfortunately, this program of federal information dissemination is now in a state of flux, ironically because of the ubiquity of the Internet. Federal agencies feel they can now disseminate their information to the public by posting some or all of it on a Web page. No longer do all agencies prepare all of their information in the more traditional printed format—which is good—but neither do they disseminate all of their information to the libraries in the depository library program—which is problematic.

If the information is on the Net, what is the rub? A quick examination of the “value chain” demonstrates that network-based distribution of government information does not perform all of the functions of the current print-based distribution system. The key change has been a shift from a static to a dynamic environment; when only current information is available on the network, there is no provision for archiving old versions. This shift has far-reaching implications for the collections themselves as well as for providing access to service and storage of these materials.

CNI is about to publish a white paper examining the current state of distribution and use of electronic federal information. While endorsing
the concept that government information can be distributed more efficiently by a network-based strategy, the white paper argues that significant service and policy questions need to be addressed, and soon. Primary among these is the need for third parties, such as libraries and other institutions, to develop strategies for providing long-term access to and service for this information. The tendency to place only current information on agency Web pages does not provide for all the functions in the value chain of scholarly communication.

University libraries involved in this program believe that the program is no longer working. Do I dare say it? This is a process made obsolete by new technology. Access to federal information desperately needs to be reengineered. The technology of networked information changes roles and methods of performing the same functions. Patching the old system or embracing only a part of a new system is no longer viable.

There are several opportunities in having the higher education community endorse a new network-based approach to disseminating, using, servicing, and storing federal information previously made available in the Federal Depository Library Program. Among them is the continuing responsibility to our public service mission, but we could also achieve savings in storage of government information by moving to digital storage rather than print-based storage that takes up yards and yards of library shelf storage. If your library is part of the federal depository program, go to the library and see how much storage these documents require. There are real savings to as well as benefits for us by changing this program, and at the same time continuing to make government information available for educational and research purposes.

CNI’s “Access to and Services for Federal Information” white paper was released for public review in November, and it can be found on CNI’s Web site (www.cni.org). I encourage all to become acquainted with these issues. How often can we be on the right side of an issue as important as a citizen’s right to information published by his or her government and at the same time demonstrate that real savings and real benefits can come from the intelligent application of networked information? It will require a different approach from the traditional strategy. Here is an opportunity for delivery, not proof, of concept. If we miss many of these opportunities and our investment in network technology is used only for mail and yellow pages, the dollars invested were misplaced. I encourage your comments.

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**In Memoriam**  
**Paul Evan Peters, 1947-1996**

We are very saddened to report the death of Paul Evan Peters, 48, Executive Director of the Coalition for Networked Information. He died suddenly on November 18, 1996, while he walked on a beach with his wife during a trip to Florida. Paul was the founding director of the Coalition for Networked Information and served as its head since March 1990. Highly respected in the library, information technology, and scholarly communities, he sought common ground for many constituencies in order to develop global networked information resources. A true imagineer, his vision and his ability to pull people together to build new realities were unique.

Paul led CNI through two cycles of formal evaluations by the sponsoring organizations and as recently as September saw it move from the status of a sunset enterprise to one of an ongoing nature, recognizing the achievement of its essential role in the North American dialogue to advance scholarship and intellectual productivity.

Before founding the Coalition in March 1990, Paul was Systems Coordinator at the New York Public Library from 1987 through 1989, and was Assistant University Librarian for Systems at Columbia University, where he also earned a master’s degree in sociology in 1986. From 1970 until 1978, Paul was a principal in a variety of research and development projects and he earned a master’s degree in library and information science at the University of Pittsburgh. Paul worked briefly as a Retail Systems Engineer for the National Cash Register Corporation immediately following the completion of his undergraduate studies in computer science and philosophy at the University of Dayton in 1969. Paul was a former president of the Library and Information Technology Association, was a former chair of the National Information Standards Organization, and served on the editorial boards of a number of networking, networked information, and library technology journals. He also served on the Council of the American Library Association.

He is survived by his wife, Rosemarie Kozdron; his parents, Austin and Mary Peters; and a brother, Philip Peters.

CNI Steering Committee Chair Richard West expressed his sentiments: “We do not yet comprehend how much Paul will be missed. His leadership, insight, and quiet competence has had an impact on all who have benefited from the CNI program. The many who had the chance to work with Paul know of his contribution and influence on our professional scholarly and technological activities—I cannot imagine his contribution being replaced any time soon. For me, this is also a great personal loss, for Paul was a trusted colleague and a close and wonderful friend.”

A condolence book will be available on the CNI Web site at http://www.cni.org/
Legal Underpinnings for Creating Campus Computer Policy

by Marjorie W. Hodges and Steven L. Worona

Ten years ago, institutions of higher education worried about computer hackers and crimes of unauthorized access—break-ins, stolen files, viruses, worms. Back then, computers were used by technical people to do technical things. Perhaps understandably in that environment, computer crimes were met with computer punishments. What worse penalty for a hacker than closing his computer account? Today, however, computers are an essential part of day-to-day life. Students, faculty, and staff use computers in course enrollment, discussion groups, assignments, research projects, and exams. The old way of punishing computer-related abuse would, today, be tantamount to expulsion or termination. And yet, on many college campuses, computer use policies and practices have not evolved in concert with the changing computer culture.

As computer use has changed, so, naturally, have the types of misbehavior occurring on computer networks. The same misbehaviors that colleges and universities have addressed in student residence halls for decades are now appearing in computer-related incidents. Rather than inventing a whole new way to deal with these computer-related incidents, it is generally preferable to utilize the existing institutional policies and procedures that address misbehavior. Ideally, these policies rest on the fundamental principles of the institution. For example, most colleges and universities have a well-developed and tested campus code of conduct and/or honor code. By relying on the disciplinary models found in these codes, colleges and universities influence the online culture in the same fashion as they affect the on-campus culture.

Moreover, employing existing judicial systems also indicates the importance placed on incidents of computer-related misbehavior. While this may seem counterintuitive—if it is important, then shouldn’t we treat it specially?—the best way to highlight the seriousness of an offense is to channel it through the offices capable of imposing the most serious institutional penalties—suspension and expulsion. Computer-based misbehavior is too serious to be treated as simply an administrative matter. As an added benefit, if complaints about network behavior follow the same procedures applied in residence halls, the institution will adhere to established procedures for due process, notification, representation, and the like.

If computer use policies are to rely on existing institutional principles, then there will be a variety of policy choices matching the variety of institutions. While computer use policies can fall anywhere on a continuum, all should include the following six components:

- a statement explaining the reason for the policy
- a statement about what the policy covers
- the individuals covered by the policy
- specific examples of inappropriate behavior
- instructions about how to report a violation
- information about potential consequences for violations

Computer use policies cannot succeed unless they represent the institutional culture; therefore, it is essential for community members to be a part of their creation. A representative community cross-section might include the vice president for information technologies, the vice president of student affairs, the dean of students, campus legal counsel, the judicial administrator, the vice president for human relations, and representatives of students, faculty, and staff.

Once a policy is adopted, institutions have the opportunity to offer instruction on acceptable computer use, thus raising awareness of the issues and increasing compliance. Such instruction may be instituted as a precondition to network access; remedial instruction may also be offered (or required). A further way to encourage discussions about computer policies with faculty and student participation is to use the never-ending stream of current news reports as a springboard for debates and dialogue.

The rest of this paper deals with five key policy areas:
- Adult material
- Harassment
- Privacy
- Commerce
- Copyright
Adult material

Although concerns about adult material don’t represent the majority of computer-related complaints, they currently cause the greatest public interest and are the most likely to receive media attention. Policies on adult material must be guided by both the institutional requirements imposed by law and institutional principles and culture. Especially with respect to legal requirements, the general class of “adult material” may be usefully broken down into these four categories:

- Pornography
- Obscenity
- Child pornography
- Indecency

For the most part, the laws that must be taken into account are the First Amendment of the U.S. Constitution, federal and state obscenity statutes, federal and state child pornography statutes, and indecency regulations.

The First Amendment of the U.S. Constitution prohibits the federal government from abridging freedom of speech, and the “due process clause” of the Fourteenth Amendment extends this prohibition to the actions of state governments. It is an accepted extension of these principles that public institutions, such as state universities, are also limited in their ability to control speech. Furthermore, private institutions, including private colleges, may be held to these same restrictions if they provide a “public forum” or if state legislation incorporates First Amendment language. Contrary to a widely held perception, however, the First Amendment protection of speech is not absolute. Reasonable time, place, and manner restrictions are permissible. The courts also give some speech a lesser degree of protection and have denied some speech protection altogether. We all know, for example, that “you can’t shout fire in a crowded theater.”

In common parlance, “pornography” is a generic term for erotic material of all types. In general, pornography receives full First Amendment protection, but there are a variety of important exceptions. For example, the Supreme Court has upheld the constitutionality of statutes prohibiting the sale and distribution of certain adult material (pornography) to minors.

“Obscenity,” by definition, is a type of pornography that is not protected by the First Amendment. The Supreme Court in Miller v. California (1973) narrowed the permissible scope of obscenity statutes and outlined a three-part test to define obscenity. To be legally suppressed as obscenity, material must meet all three prongs of the test, which asks (1) whether an average person, applying contemporary community standards would find that the work, taken as a whole, appeals to the prurient interest; (2) whether the work depicts or describes in a patently offensive way, sexual conduct specifically defined in applicable state law; and (3) whether the work taken as a whole, lacks serious literary, artistic, political, or scientific value. Virtually every state and municipality has a statute prohibiting the sale and distribution of obscene material and the federal government prohibits its interstate transportation.

Of all the types of adult material that fall outside the umbrella of First Amendment protection, “child pornography” carries the most far-reaching restrictions and the harshest penalties. Child pornography is defined as material that depicts minors in a sexually explicit way, which is much broader than the definition of obscenity—material does not have to be obscene to constitute child pornography. The age of a minor varies by state, but the federal child pornography statute applies the term to anyone under eighteen. The Supreme Court based child pornography restrictions on the state’s compelling interest in protecting the children used to produce such material. Child pornography is the only category of adult material whose mere possession is a crime.

“Indecency” applies to a type of adult material which, while generally protected by the First Amendment, has been found by the Supreme Court to be legitimately regulated, in certain instances, by a narrowly tailored statute. Broadcast radio, for example, is such an area, where the courts allow FCC regulations limiting indecency to certain times of the day. In the well-known case FCC v. Pacifica Foundation (1978), the Supreme Court upheld FCC sanctions against the broadcaster who aired George Carlin’s “seven dirty words” monologue during the middle of the afternoon, stressing its pervasiveness and the inability to exclude minors from the audience. The courts have also allowed regulation of indecency in telephone communications offered for a price, opening the door for so called “dial-a-porn” statutes, which require use of credit cards.

In addition to existing regulations on adult material, the Communications Decency Act of 1996 (CDA), attempts to criminalize indecency on the Internet. A number of states have already passed similar acts. Because the CDA was held unconstitutional by two district court panels, prosecutions are currently being deferred, pending decision by the Supreme Court.

The above summary, as further refined by applicable state and local laws, implicitly defines a range of legally acceptable institutional policies. Within this range, the institution is free to
create a policy consistent with its culture and values. There is no objectively “right” or “wrong” policy, and policies may be expected to change over time.

Harassment

According to the dictionary, to harass is to “persistently annoy.” While many types of harassment include physical contact, physical contact is not necessary for an action to be considered harassment. Various state and federal statutes prohibit certain types of harassing speech and expression, and these statutes have survived First Amendment challenges. In addition, most institutions of higher education already have long-established policies addressing harassment. Although harassment that occurs over computer networks is limited to speech—words, images, sound—it is still covered by existing laws and policies. The new, relatively unfamiliar media raise questions of analogies—is sending email to a list more like addressing a crowd or posting a handbill?—but no new concepts are involved.

The conventional definitions of harassment vary but usually require unwanted and repeated behavior targeted at one or more particular individuals. Even when harassment involves no physical contact, it is actions that are at issue, not speech. To ensure that this distinction is recognized, institutions need to rely on a clear definition of what constitutes harassment. For example, a single unwanted message to an individual is unlikely to constitute harassment. Repeated unwanted messages, especially after a request to stop, might well cross the line.

The distinction between behavior and speech is sometimes blurred, and the difference between general and specific targets is often overlooked. These issues were critical several years ago when a number of institutions attempted to promulgate “hate speech” regulations. Hate speech is a term used to describe speech which is uncivil, antagonistic, or derogatory, especially when applied to classes of people. These speech codes originated from a well-intentioned attempt to address a perceived decrease in civility on American campuses, and were not aimed at electronic communications in particular. While a few colleges and universities still have speech codes, those that have been tested in court have been found to be unconstitutional. Early cases held the first speech codes, which were ambitious in scope (such as those adopted at the University of Michigan and the University of Wisconsin) unconstitutionally vague and overbroad. The Stanford University speech code took these decisions into account, limiting its scope to the use of “fighting words” intentionally directed at another individual in order for the University to impose sanctions. Nonetheless, a court also struck down this speech code, arguably the most narrowly drawn and well written in the country.

The subtleties in this area can be difficult to understand, and are made even muddier by the concept of “hostile environment” harassment. This type of harassment is characterized not by individual acts of harassment but by a general pattern of behavior explicitly or implicitly tolerated by an institution. Recent efforts by the U.S. Office of Civil Rights (OCR) to clarify how hostile environment concepts relate to peer-to-peer harassment are considered problematic for a number of institutions of higher education. Despite the unsettled and confusing nature of hostile environment harassment, institutional policies must nonetheless address these concerns.

Privacy

Most Americans have a strong belief in the right to privacy, particularly students and other intellectuals on college and university campuses. This concern increases with each new technological advancement that has privacy implications (and each new technological advancement does seem to have privacy implications). The recent controversy surrounding Lexis-Nexis P-track services is a case in point.1

Despite our strong feelings about privacy, the legal basis for them is surprisingly tenuous. For example, neither the term “privacy” nor any synonyms appear in the U.S. Constitution. Privacy rights only became established in 1965 when Justice Douglas found them in the “penumbra” of the Constitution, an analysis still considered tortured by some legal scholars. (The penumbra doctrine holds that the federal government is authorized to take all actions “necessary and proper” to carry out a legitimate government purpose, even when these actions are not explicitly mentioned in the constitution.)

Traditional allegations of privacy violation involve such common-law claims as “intrusion,” “false light,” “disclosure,” and “appropriation.” These actions, however, generally apply only in specific circumstances. Their use in Internet-related privacy breaches is thus problematic. For example, intrusion is concerned with the protection of the commercial or property value of a person’s identity and likeness. False-light privacy involves erroneous negative publicity about an individual, but requires proof of actual malice. False-light privacy may also lose significance on the Internet because of the ease of reply, echoing a similar argument made by legal scholars in the area of defamation.

1See http://www.lexis-nexis.com/lncp/trak/index.html
The unreasonable transmission of private facts on the Internet potentially involves the greatest possibility of recourse, but related case law in the area of disclosure requires proof that the privacy invasion would be highly offensive to a reasonable person and is not “newsworthy.” Moreover, the First Amendment significantly limits damages for truthful publication of private facts.

In addition to these common-law actions for invasion of privacy, federal law requires institutions of higher education to pay special attention to the privacy rights of students. The Family Education Rights and Privacy Act of 1974 (FERPA) protects the education records of students from certain disclosure without authorization. Concern for and enforcement of student records privacy requirements under FERPA have traditionally been the province of college and university registrars. But new mechanisms for transmitting records and the emergence of new types of student records that can be generated in a networked environment are raising policy issues that must be more widely shared, suggesting the wisdom of engaging a broad segment of the campus community to address policy in this area.

In 1986, the federal government attempted to address privacy issues arising from new technologies with the Electronic Communications Privacy Act (ECPA). The ECPA was written as an extension of existing wiretap protections to non-telephone communications, making it illegal to intercept such communications in progress or to disclose stored private communications to a third party. The ECPA is relatively untested—it has never been applied, for example, to campus e-mail systems—and much of its language is confusing and contradictory. Nonetheless, it represents the only federal legislation in the area, and its strong support for privacy has influenced many college and university policies.

Privacy policy represents a unique challenge. New technologies offer the promise of significant cost savings and important consumer services—both in high demand—but frequently entail a variety of risks to personal privacy, some not understood or not evident until too late. In the absence of clear legal requirements, colleges and universities have both the opportunity and the responsibility to create privacy policies that are carefully considered, well publicized, and conscientiously monitored.

**Commerce**

For most of the lifetime of the Internet and of the Arpanet before it, commercial use of network resources was prohibited by law and by national policy. But a glance at almost any magazine or TV ad will show how anachronistic such regulations have become. Billions of dollars worth of commerce is flowing from coast to coast over the Internet. Once the network crosses the campus boundary, however, a new set of rules takes hold.

Both the tax code and local laws have traditionally exempted colleges and universities from taxes on the assumption—and, indeed, with the stipulation—that there is a wall between the educational and commercial sectors. With the stated purpose of avoiding conflict with the Internal Revenue Service, most colleges and universities forbid the use of institutional resources—both conventional and computer-based—for commercial purposes. Colleges and universities frequently feel the need to apply these policies aggressively to their on-campus networks and computers. (In addition, and for the same onensible reason, some institutions have attempted to regulate political speech on the Internet.)

Policy makers should review the facts, legal requirements, and policy motivations of their existing commerce rules, in order to determine how to reasonably apply them to computer- and network-based business. As the techniques and economics of network commerce evolve and mature, general policy principles will be more valuable than specific regulations. If a commercial World Wide Web server in a student residence hall is forbidden, based on use of the campus network, could that same server legitimately connect to a regional wireless net? As with the other areas covered in this paper, the key is creating a policy development process in line with institutional goals, principles, and missions.

**Copyright**

The mandate to provide for copyright appears in the U.S. Constitution as a means to protect the economic incentive to be creative. By current U.S. law a work acquires copyright as soon as it is “fixed in any tangible medium of expression,” which includes not only ink on paper, but also magnetized regions on a ferrous surface. That is, the SuperPaint doodle on your Macintosh hard drive is a copyrighted work as much as the article you are now reading.

2 FERPA is found at 20 U.S.C. 1232 g and is written in fairly plain language.

3 A task force created by CAUSE, in cooperation with the American Association of Collegiate Registrars and Admissions Officers (AACRAO), is examining these issues, with the intention of circulating a white paper providing guidelines for the creation of policy on privacy of student information in a networked environment.
No other area of law has been thrown into as much definitional confusion by the new network technologies as copyright. For example, the process of viewing an image on the World Wide Web entails making a copy of that image—several copies, in fact—in a very real way, a phenomenon fundamentally absent from the process of watching a TV show or even a VCR tape. In a recent interview, Steven J. MacDonald, associate legal counsel at The Ohio State University, said, “If you are applying existing copyright law literally … the Internet is really just one giant photocopy machine, and just about everything you do or see on it is technically a copyright infringement.”

And what about links: is a link to a Web page a copy? What about a link to an image embedded on that Web page? At least one publisher believes it has a right to control the use of such links. What about links to an infringing copy of a work, perhaps pointing to a server in a country that doesn’t recognize copyright law? At least one version of the NII Copyright Protection Act would make such a link illegal.

The last major revision to U.S. copyright law occurred in 1974, after years of debate among such interested parties as publishers, librarians, and representatives of higher education. A key provision of the Copyright Act of 1974 is the establishment of “fair use” as a defense against a claim of copyright infringement, exempting copies made “for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research.” The final determination of whether a use is “fair” is based on the court’s view of four factors, including the nature of the original work, the purpose of the use, and the economic impact of the copying. Also relevant is legislative history from 1976, the Agreement on Guidelines for Classroom Copying in Not-For-Profit Educational Institutions, a document adopted by the publishing industry and thirty-eight educational institutions. Notwithstanding all of these guidelines, and even apart from the technological morass of the Internet and the World Wide Web, court decisions regarding what is and is not fair use have been less than completely consistent or predictable.

Exacerbating this confusion is the fact that copyright is a “strict liability offense,” which means that neither intent to infringe nor knowledge of infringement is necessary in order for liability to exist. As a result, a number of colleges and universities have faced threats of lawsuits for the actions of their community members accused of online copyright infringement. Despite this, the law is still unsettled with respect to institutional liability for the copyright infringement of an Internet user. Courts have reached inconsistent conclusions regarding whether providers of various network services are more properly considered publishers or bookstores, whether they are completely responsible for content posted by third parties, or not responsible at all. Currently, the best advice for colleges and universities is to take allegations of such violations seriously and to consult with counsel.

A popular expression of Internet culture is “information wants to be free,” and there remains a sizable percent of Internet users—especially, it seems, among our student communities—who believe it to be immoral for publishers and other content providers to place limits—worst of all, financial limits—on the free flow of information over the net. A key goal of an institutional policy on copyright should be to help enlighten these and other segments of our communities to the facts of the law, if not its eminent wisdom.

As noted earlier, Congress is now considering another major change in the copyright law, the NII Copyright Protection Act, this time explicitly driven by computer and network technologies. No other technology-related legislation will have a greater impact on colleges and universities. Fortunately, it is not yet too late for higher education to affect the outcome.

“If you are applying existing copyright law literally … the Internet is really just one giant photocopy machine, and just about everything you do or see on it is technically a copyright infringement.”


See http://www.cs.princeton.edu/~dwallach/dilbert/


See ftp://ftp.loc.gov/
A Great Transition: An Analysis of the Privatized Internet as a Two-Year-Old

by E. Michael Staman

Within the past year we have seen a steadily declining level of performance of the Internet, and many wonder when, or whether, we might expect to see characteristics more typical of the network during the last year of the NSFNET program. As with any two-year-old, there seem to be days when the Internet behaves well and days when one wonders whether the atrocious behavior that it exhibits is somehow deliberate, designed to test the patience of its higher education creators, and determined to be forever incorrigible.

Privatization of a service is typically expected to yield advantages such as lower costs (or better cost performance), improved functionality, and rapid deployment of advanced technologies. Such advantages have not been realized following the privatization of the NSFNET, and many factors have combined to slow their realization. We are witnessing an unprecedented explosive behavior being driven by millions of new users, significant increases in use by the commercial sector, and the impact of browser technology that was not in existence twenty-four months ago. This evolution encompasses education, the private sector, and society as we create an infrastructure destined to become as pervasive as the electrical grid, telephones, and our system of roads. These developments are transforming the way we learn, conduct commerce, communicate, and interact with each other. At the moment our demand for bandwidth appears insatiable, and a real question is which parts of the commercial sector will step forward to meet the need, not whether the need will be met.

The above is not exactly breaking news. The following comment is from a 1994 hearing of the U.S. House of Representatives Subcommittee on Science:

The growth of both the number of users and the applications of the Internet (that element of the NII which is available and working effectively today) has astounded even those of us who have been its most optimistic proponents for many years. It has grown from a resource used primarily by the research and education sector as recently as five years ago to a significant force within the nation’s business sector today. It will become a major element of our global competitive posture within the decade.

The intent of this article is to reflect on why there are problems today and to discuss a number of efforts focused on fixing them. I will begin with a discussion of why the Internet appears to be broken, including some observations about both commercial and higher education use of the network, and conclude with a brief report on initiatives currently under way within the higher education community that are focused on creating the next generation of Internet applications, services, and technologies.

Why are there problems?

To begin, a great many of the “quality-of-service” problems that Internet Service Providers (ISPs) have been quietly trying to keep under control since the beginning days of the NSFNET privatization have become unmanageable, and most recently in ways visible to the user community. Most discussions about the why and what to do range from “higher education needs infrastructure devoted solely to its needs” to “the commercial marketplace is the only solution, and once the money formula is right all will be solved.” Discussions about the former are currently tending to focus on the needs of the Research Universities, while discussions about the latter (within the higher education community) tend to reject the thesis of a fully privatized solution but increasingly understand that money is part of the problem. One key conclusion is that for the majority of higher education there is real risk of continued problems, but that should not be translated into “it will come crashing down around our ears.”

Many elements are in rapid evolution, and these will continue to contribute to the turmoil that seems to be the norm today. Discussions in several areas follow.

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1 E. Michael Staman, Testimony before the U.S. House of Representatives Committee on Science, Space, and Technology, July 12, 1994.
The technology

The following is typical of the way the private sector views today’s Internet:

The Internet is a collection of cooperating interconnected TCP/IP networks. With no centralized management or administration function, troubleshooting and administration are complex and time consuming. In addition, performance is unpredictable, reliability varies greatly among Internet Service Providers (ISPs) and there is (are) no mature or common security standard(s) for virtual private networks.\(^2\)

First, recognize the nature and maturity of the technology. In a limited defense of the ISPs, ranging from large interexchange carriers to some of our smallest providers, the fact that the Internet works at all is somewhat amazing. There has been no other technological evolution that has grown at the rate of the Internet, and I can think of no other infrastructure, of any kind, that could withstand the pressures inherent in that growth and still be functioning. During the last months of the NSFNET we experienced growth rates of 10 percent per month, astronomical by any standard, and current estimates are that traffic now doubles on today’s Internet at a rate more than twice that of the NSFNET days.

Remember that the “privatized” net is less than two years old, and that we are in the midst of a very difficult transition. We can expect turmoil for some period to come. Not only are there now in excess of 5,000 Internet Service Providers in this highly immature industry, with its equally immature technology, no one—repeat, no one—predicted things such as real-time applications on the Internet becoming popular and commercial so quickly. Examples of these include packetized audio, video, electronic commerce, computer telephony, World Wide Web searching, and other Web-based applications. These are only beginnings as the entrepreneurial capabilities within the nation become unleashed. Note that the continued rapid change in all areas of technology (networking, hardware, software) makes any planning short-range at best. Recall that Mosaic was introduced about three years ago.

The commercial marketplace

Even so, evidence of commercial adoption of the Internet as a place to do business accumulates every day. Ghosh writes that for most businesses, the two most important benefits of the Internet are cost reduction and enhanced customer service and convenience.\(^3\) He goes on to discuss a range of problems that need to be solved before doing business on the Internet becomes truly routine, but the very fact that there is so much effort being invested in their resolution is testimony that we can expect the current level of commercial growth to continue. The private sector is not inclined to invest heavily if the right return on that investment is not in the offering.

The question of payment and electronic transactions is a typical problem and a good example of the above. We tend to think of typing in a credit card number as the mechanism for payment on the Internet, and we often hear that until the “security” problem is solved there will be no serious commerce conducted on the Net. However, not only does society appear generally quite willing to enter credit card numbers onto a Web page (indeed, there are some who argue that such a mechanism is at least as secure as providing the number to an unknown telephone solicitor), there are now many Internet payment mechanisms in varying stages of development or existence (for example, First Virtual, NetBill, Ecash, and CyberCash).\(^4\) Entrepreneurs quickly rush to fill voids if there is money to be made; if none of the existing schemes works satisfactorily, then there is little doubt that someone will invent one that will.

The regulatory and legislative arena

Legislative uncertainty and continued evolution add to the turmoil. One key issue is best embodied in the following argument: “No form of electronic media has grown as fast as the Internet, and [it] has grown precisely because it isn’t regulated” versus “The Internet will not achieve its commercial potential if this new frontier becomes the Wild West of fraudulent schemes.”\(^5\) The first quote is from Larry Irving of the Commerce Department, and the second from Jodie Bernstein of the Federal Trade Commission. We should not expect these issues to be resolved soon. Nor should we expect a quick resolution to other tough issues such as digital copyrights, usage policies (the Communications Decency Act, for example), cryptography, export regulation, and taxation. All will shape the nature of commerce on the Net, and we should expect continued uncertainty as these and related issues (telecommunications rates, bandwidth licensing, international selling of software or information) work themselves into some sort of stable legal and legislative fabric.

Changes in higher education’s regional networking infrastructure

The explosive growth of the commercial marketplace, then, is a real part of the problem. CICNet, my organization, has certainly felt such pressures. And while we have had fewer problems than many, we have not been immune from

\(^2\) From a description of the purpose and activities of the Automotive Exchange (AIX) project, currently available at http://www.aiag.org/anx/


either internally generated problems or failures within the larger Internet. We remain as the last large, not-for-profit, multi-state networking organization owned by a higher education consortium. We are increasingly finding that our commercial traffic is becoming such a significant part of the total that we will soon need to find a way to solve infrastructure problems and related organizational structure issues to protect both our commercial customers and our owners. We are owned by the CIC universities, a.k.a. the “Big Ten plus Chicago.” And while our not-for-profit and R&E focus will likely not change, what will change is that our services solutions will expand into areas involving inter-university project support.

I should note that the CICNet network, as a second-tier provider (one provider away from the Network Access Points), also has been adversely affected by many of the same external problems that universities see—large packet loss, congested paths through the Net, provider outages, hackers attempting to cause network nodal failures, and the like. Our backbone provider’s network (and we think our provider is the best in the business) continues to show congestion at the edges, even though they have made remarkable progress in the interior of their network. Many of the low(er)-end providers oversell their trunk lines by ridiculous amounts so it is hard to feel sorry for them when these trunks fill up.

It is also important to understand that the solutions of the past are generally not available. For example, the original R&E mission of many of the old NSF-sponsored regional networks (SURANET, in the southeastern United States, for example) is no longer relevant, either because the network is gone, sold by higher education to for-profit organizations, or because the network has become for-profit in its own right, or because the network has not been able to sustain itself financially and is now out of existence. The focus of the new incarnation of most of these organizations tends to be in arenas other than higher education. Not all, but many, have this problem.

Changes in higher education’s needs and applications set

Finally, higher education itself is in a period of transition. To begin, we are just beginning to understand and realize the potential of the Internet. In the process of gaining this understanding, the true nature of the problem and its magnitude are becoming increasingly clear.

We need access to a next-generation network supportive of research and education. Applications abound, and include things such as:

- virtual teleconferencing, where we can mix virtual reality or interactive three-dimensional graphics with teleconferencing activities;
- virtual prototyping, through which we can engage in shared visualization of three-dimensional computer-aided design models over the network in real time on a global scale, because engineering collaborations are not necessarily restricted to locations in close geographical proximity to their participants;
- solutions in which we immerse humans in virtual environments to capture best practices or to train them in the use of unstable chemical elements or in working in hazardous conditions anywhere on earth or in space, providing training-on-demand in the process;
- projects where we can shorten product development life cycles through simulation, three-dimensional, real-time visualization, group modeling, and the like;
- simulations of new architectural, automobile, or other expensive-to-prototype design activities in ways which improve quality, decrease costs, and increase the probability that projects and products that come to market are better, safer, more reliable, or whatever the value of the moment might be.

Serious stuff, and beyond our capability today. Indeed, there is reason to anticipate that such requirements, or their counterparts next year or in the next decade, will be forever beyond the ability of the commercial sector to provide at an affordable price. As Douglas Van Houweling said recently in a presentation at the University of Michigan on visualization and virtual reality, “If a picture is worth 1,000 words, then a moving picture is worth 100,000 words, and a virtual environment worth 100,000,000 words.”

For the sake of completeness, it is important to note two very important activities directly related to the applications space. Most readers are probably very aware of the excellent work being accomplished by the Coalition for Networked Information (CNI) and the National Learning Infrastructure Initiative (NLII), the former focused on intellectual property issues and the latter on the evolution of an applications set which realizes the potential of multimedia in a networked teaching and learning environment.

What’s happening at the national level?

The NSF has indicated that the acceptable use policy (AUP) for the vBNS (its national high-
speed backbone) will be relaxed to become something like from .edu to .edu, and approved universities and their partners will be able to use it for any such traffic. That’s good, and moves us in the right direction. So, too, are the discussions which are likely to result in good solutions for the ninety or so Research I universities. These beginnings also move us in the right direction. The current discussions about Internet II, gigapops, private sector partnerships, and the like are equally important, and we need to encourage and support such initiatives.

One of the most important initiatives on the national level is the Internet II effort. While a number of people began working on the idea of a new network for higher education shortly after the privatization of the NSFNET, initiatives to create national consensus really began at a conference held in Monterey, California, in September 1995. Immediately following that meeting a group of individuals formed an ad hoc group called the Monterey Futures Group (MFuG) to begin the effort of specifying both technical and application requirements for such a network. The work of the MFuG group included both an initial discussion of the future application space needed by higher education and a first cut at the technical requirements for its support.7

The work of the MFuG group was transitioned to the Networking and Telecommunications Task Force (NTTF) during a FARNET/NTTF-sponsored meeting in Washington this past April. As follow-up, FARNET then obtained funding for a nationally attended workshop held in Colorado Springs this past August and which was again jointly sponsored by a number of professional societies and organizations.8 Key outcomes of the meeting were a national discussion on the next steps and an accelerated effort by the leadership within the nation’s Research I universities to launch the Internet II initiative.

Where do things stand today?

First, as of November 1996, approximately forty of the Research I universities concluded that the time has come to launch a project targeted at creating a new, high-performance Intranet for their needs. This effort, now known as Internet II, is gaining momentum. Six subcommittees are working on the initiative, each of the charter members has contributed $25,000 to support the effort, and each has pledged $500,000 for its participation in the outcomes of this initiative. Internet II is not about bandwidth; it is about enabling applications. This effort can best be defined by the academy, and it is through the academy that such advanced technologies can best be understood, advanced, commoditized, and transferred to the private sector. This is a vitally important effort, and we need to support and encourage the participants to continue.

That said, there is little in the above initiative that helps the rest of the college and university sector, community colleges, K-12, libraries, and the like. It is here that I think we need to quickly turn our attention. We have a very difficult problem. At the least we need a forum to discuss the problems of the larger community so that some common understandings might evolve into proposals for solutions.

The challenge to be addressed might be stated as “Internetting for the rest of us.” Now that the Research I universities have launched the Internet II initiatives, how should the remainder of the academic community best position itself to participate, while realizing the fullest potential of current and evolving Internet technologies and services? I am sure that CAUSE would be amenable to working something into its general agenda if there is sufficient interest. So, too, would FARNET—the Federation of American Research Networks. Perhaps some kind of joint forum would be appropriate, and, as a point of reference, FARNET issued a press release outlining its “… plans to focus on a broad range of initiatives in 1997 that will extend the next generation Internet and its technologies, applications and services to the broader education, research and public services communities.”9

The privatized Internet as a two-year-old? It is behaving exactly as one would expect, and, as we tend to view most two-year-olds, we look forward not only to passage of the phase, but to the unlimited future that harbors our most optimistic hopes and aspirations for any of our children. We are increasingly seeing an analogy, initially prepared by Ivan Campos for the Colorado Springs meeting,10 as explanation of where things stand today. His claim is that we have evolved the Internet from an advanced research project to today’s commercial service, and that we are beginning a second cycle to create the next generation, this one capable of supporting applications which are now quickly evolving within higher education and which cannot be accomplished on today’s infrastructure. Stay tuned.
Guidelines for Outsourcing Remote Access

by Ardoth Hassler and Michael Neuman

As demand for Internet resources explodes on campus, faculty and students increasingly want network access from off-campus locations. Soaring demand has led numerous colleges and universities to investigate outsourcing. This article offers a discussion of the advantages and disadvantages of outsourcing remote access, including a sample checklist for an RFP, based on the examination of the RFPs for outsourcing remote access of six universities and a follow-up survey to determine their outcomes.

As the resources of the Internet—electronic mail, discussion groups, and the World Wide Web—become an integral part of the process of scholarly communication, faculty and students increasingly want access to these resources from the locations where they do their work. And given the asynchronous nature of Internet communication, faculty and students want this access from home as well as from campus. In the summary of his 1995 campus computing survey, Kenneth C. Green noted that between 1994 and 1995, use of e-mail (to cite just the most common Internet utility) increased from 8 percent to 20 percent among faculty surveyed.1 In the past year, growth in professors’ use of the World Wide Web is likely to prove still more striking. Because computing services departments find it difficult enough simply to meet the needs for on-campus computing, the demand for remote access naturally leads a chief information officer (CIO) or a computing services director to consider three advantages of outsourcing remote access:

✓ Improved service
Outsourcing can provide broader (and sometimes better) services than those currently available from on-campus systems, and it can permit extending those services to segments of the campus community (especially alumni) not served by existing systems.

✓ Cost-sharing by clients
Computing services, like library services, are generally not charged back to the segments of the campus community that use them, so there is a limit to the number of new services that can be introduced. Outsourcing remote access establishes or extends the precedent of cost-sharing with the college or university community so that scarce institutional resources can be used for other priorities.


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Partnerships with vendors

While many institutions are simply seeking to add such basic services such as PPP (Point-to-Point Protocol), TCP/IP (Transmission Control Protocol/Internet Protocol), and asynchronous access, contracts with vendors (commonly one to two years with the possibility of a one-year extension) may soon extend to an array of other protocols and information resources.

These advantages for outsourcing are compelling, but drawbacks become apparent when the remote access is viewed in relation to the current institution-based services and systems. This article draws upon experience at the authors’ university, Requests for Proposals (RFPs) for remote access obtained from five other universities, and a follow-up survey conducted by the authors to determine outcomes of those RFPs (see sidebar for details). The article describes the key technical and customer-support services that must be provided by the vendor, then describes ways to avoid the potential institutional problems of decreased control of systems and services, and concludes with a checklist of factors to consider when creating an RFP for remote access.

Outsourcing and Improved Service

Outsourcing, in conjunction with passing along the costs to the consumer, can expand services and extend them to a broader segment of the institution without significantly increasing charges incurred by computing services departments. Many such departments are under increasing pressure to extend service beyond the traditional client base to include alumni, patrons of the institution, and the community at large. Offering an array of network services to this extended community is good for public relations, but expanding the client base will inevitably impose peripheral demands on an infrastructure already overtaxed. Consequently, identifying in detail the vendor’s services—both technical and customer-support—will help to clarify both the extent to which outsourcing can extend campus services as well as the peripheral demands likely to be placed on the system.

Technical services

For what problems is the vendor’s service a solution? Circumventing a busy modem pool, extending Internet access to alumni, providing students with remote access to the Web, expanding access to the institution’s high-speed network—whatever the problems, the following five technical components of the vendor’s service are likely to require careful consideration, and information about them must be sought in the RFP for a remote-access vendor partnership.

Supported protocols

Should the vendor provide merely dial-up Internet access or should it supply access to campus servers as well? For the former, TCP/IP through SLIP (Serial Line Internet Protocol) and PPP are givens; for the latter, other protocols such as IPX (Internet Packet Exchange) or AppleTalk may be necessary and will entail more serious considerations of security measures and policy issues. Once the Internet is available by remote access, members of the community are likely to want remote access to the resources of the institution’s high-speed network as well. Cur-
rently, the majority of vendors are only able to support PPP. Only one institution responding to our survey reported a local provider offering IPX and AppleTalk. Many indicated that supporting such protocols as IPX and AppleTalk is under consideration.

✓ Client software
   Because the RFP should itemize the software that the vendor will supply, it is necessary to specify what the campus community will need in order to operate in a stable, familiar, and cost-effective environment. For stability, the vendor’s software must function on a full range of client operating systems, including DOS, Windows 3.11 or 95, and Mac OS. For familiarity, the vendor’s software should include common Internet utilities. For economy, the vendor’s pricing mechanisms should be noted carefully; for example, Netscape provides free licenses to its Navigator browser for the Web, so the RFP should seek to avoid charges for this utility. In our survey results, as specified by the institutions, the provider and/or institution are providing Trumpet Winsock (for Windows 3.1 clients), Netscape, Telnet, FTP, MAC dialer, terminal emulation (TN3270 and Telnet), and POP (Point of Presence) mailer client software.

✓ Bandwidth
   Access speeds/bandwidths determine the response time needed for downloading image files or large text files over the Internet, so the RFP should specify such standards as 28.8 kbps (or greater) and V.34 for dial-in ports. In the RFPs reviewed in our study, ISDN dedicated telephone lines, when mentioned at all, were generally included in future plans. Indeed, in the outcomes, only two institutions have obtained ISDN from their providers.

✓ Absence of busy signals
   The users’ tolerance for busy signals (as a percentage of calls to the vendor’s host computer) is generally known to the CIO or computing services director on the basis of previous complaints. The vendor of remote access, therefore, should be expected to match or exceed the current on-campus standards for minimizing busy signals. The RFPs generally specify the grade of service between P.00 (no busy signals) and P.05 (busy signals occurring on five percent of the calls). The majority of agreements examined in our study accepted P.05.

✓ Scope of access
   An increasing number of faculty members want remote access to the Internet not only from home but from a “home away from home,” when traveling for a conference or a vacation. Some vendors provide such “remote remote access” by means of an 800/888 phone number. The charges per minute should be negligible (either free or no more than $.10). Other vendors can provide local access numbers in all major cities, a service that can reduce the difficulties from dropped modem connections associated with cross-country dial-in on a toll-free (800) line. As would be expected, the larger, national vendors are better able to provide 800/888 access and/or local points of presence in major metropolitan areas. There is often an extra charge for this feature.

Customer services
   The vendor’s success in providing customer services will be even more obvious to the campus community than its success with technical services. And the vendor’s success in easing the faculty, staff, and students past obstacles—especially in the following four areas—will reflect well on the computing services department for brokering the contract.

✓ Rapid implementation
   Once the contract is signed, the campus community will be eager to take advantage of the service; consequently, a minimal implementation period is recommended. In the RFPs examined, the institutions typically expected implementation within sixty to ninety days of signing the contract. By contrast, survey respondents reported that implementation ranged from two days to four months. Those institutions in major metropolitan areas obtained connectivity more quickly.

✓ Installation and trouble-shooting
   Easily installed software is essential. It is important to consider setting a requirement that the client software will “plug and play” for 90 percent of the users, and to determine if the vendor offers installation assistance at a fee. Good documentation is also essential in order to minimize the impact on the computing services help desk. Even so, the help desk must be prepared for questions about the vendor’s service and will need its own special access to the vendor’s support mechanisms.

✓ Scope of support
   The RFP should specify expectations for service from the vendor’s help desk. Is coverage required twenty-four hours a day, seven days a week, 365 days a year? What are the minimum requirements for access to the vendor’s customer
service organization for order processing, billing information, etc.? The RFPs in our study typically called for toll-free services extending Monday through Friday from 7:00 a.m. to 10:00 p.m., and Saturday and Sunday from 7:00 a.m. to 8:00 p.m.

**Pricing**

Considerations here include start-up, usage time, and tiering. If there is a start-up fee, what services will it cover? Will the user incur a new start-up fee if he or she leaves home for the summer, or will the vendor permit a “stop out” fee that would keep the user’s account open but inactive? Will the vendor provide unlimited access? If not, what is an acceptable level of service? Typically, the study RFPs requested that “N” hours be included in the base rate with an hourly charge for anything over an N of about fifteen hours.

Can the vendor support tiering, that is, lower rates for off-peak usage? For example, usage might be unlimited between 1:00 a.m. and 6:00 a.m. or summer usage may be available at a lower rate. Most importantly, the cost of the remote access must be competitive. On the basis of the completed surveys, those institutions using local providers have typically been able to obtain flat fees for unlimited access. Those using a national provider typically have a base rate averaging around $12–13/month for sixty hours with a $.95/hour charge after that. Some have an option of a higher rate for unlimited use. One vendor offers unlimited use in off-peak hours, which vary from agreement to agreement. The majority have a $10–25 start-up fee.

**Relationship to current institution-based services**

Consideration of the scope of the vendor’s technical and customer services naturally raises the issue of the relationship of the outsourced services to the institution’s own. At one end of the outsourcing continuum, the vendor could be asked to provide all Internet services for the institution, though in the RFPs examined all preferred to maintain the relationships with their current providers of campus-to-Internet connections, while reserving the option to transfer to the dial-up vendor in the future.

More frequently at issue is the question of modem pools, which many institutions maintain simply for access to their mainframes and minicomputers. Should these be dismantled in favor of support from the vendor? If so, restricted-use pools may be desirable to allow institution staff access to these systems in an emergency. These “backdoor” pools may present a security threat if not closely monitored, so a backdoor pool with specified maximum size should be included in the RFP to ensure that this resource does not appear to “compete” with the vendor’s resources. Only one of the institutions surveyed is not continuing to maintain a modem pool. The majority have no plans to stop maintaining their modem pools because they support different services from those provided by the vendors.

Electronic mail and personal Web space constitute another issue, since some vendors will offer to provide them on their servers as part of the base offering. Vendor-supplied electronic mailboxes may not integrate well if the college or university system is attempting to standardize on one on-campus system for all users. The RFP should specify whether or not these services are available to subscribers who are funded from the institution. On the other hand, if alumni or other “friends” of the institution pay their own way under this plan, it may be desirable to allow them to select electronic mail and Web pages as an option, particularly if the institution does not provide this service for them. All of the institutions surveyed continue to provide e-mail to their users; however, eleven institutions permit the vendors to offer additional e-mail services. In some cases, there is an added fee for this service.

Finally, it is important to determine whether “downstream” connections through the institution will be blocked from off campus. Institutions are sensitive to having people from off campus access the Internet through their connection. Further, it is important not to impact the institution’s bandwidth to the Internet. By requiring the vendor to provide direct Internet service to those who dial in, the institution can filter traffic at the router level to ensure that dial-in users cannot leave the campus backbone by way of the institution’s Internet connection. This would allow the institution to use a separate provider for Internet service for the campus backbone. However, vendors generally assign users an IP number from a block of their own. This may prevent off-campus users from accessing some online services, such as Encyclopedia Britannica, since they must be accessed from an IP number with the institution’s domain. As for campus users of the Internet, a “non-circuitous” routing should be specified, since institutions will not want their clients routed “across town” or across campus via distant nodes.

Because the vendor’s technical and customer services will have an impact on so many corresponding systems on campus, the institution ought to conduct a pre-test of the remote access. Prior to signing the contract, the institution should obtain five to ten demonstration accounts, encourage faculty and computing per-
Outsourcing and Decreased Control of Systems and Services

In ways even more important than modem pools and mailboxes, outsourcing remote access must be carefully coordinated with the institution’s existing computing services and systems. At the most basic level, directors of academic computing frequently must balance the conflicting goods of responding to requests for new services while managing the limited resources of a complex system. The new services available by remote access, even though provided by a vendor and billed directly to the customer, nevertheless come at a cost of decreased control over systems and services, especially in such areas as security and management. In preparing their RFPs, CIOs and computing services directors can minimize the complications of decreased control.

Security and authentication

As faculty experience network access from home, their list of requested resources has grown beyond e-mail and discussion groups to include the World Wide Web and, more recently, the resources of the campus high-speed network. Protecting the institution’s Internet connection and the campus LAN infrastructure will become increasingly difficult as remote users press for more complete access to files and servers. Systems that had not been previously exposed outside the campus backbone, such as Novell file servers running IPX, may suddenly be open to attack if IPX is specified as a protocol requirement. These dial-in ports may need to be classed as on-campus resources in order for legitimate users to have complete access.

If alumni or other “friends” of the institution are permitted access to the modem pool, the vendor may be exposing the campus network and its resources to outsiders who would otherwise be considered unauthorized. Access to this pool should be restricted to faculty, staff, and students in order to reduce security risks. Consequently, the institution’s needs for security must be carefully spelled out in the RFP in four distinct areas.

✔ Global network security

Teamwork with the vendor is essential. All of the RFPs in our study articulated general responsibilities for security, including working closely with one another, with the campus Internet provider, with the Computer Emergency Response Team (CERT), and with organizations such as College and University Information Security Professionals (CUISP).

✔ Authentication

The conditions under which the vendor seeks authentication from legitimate users at remote sites must strike a balance between maintaining security of campus systems and avoiding inconvenience to the campus community. For example, while it is appropriate to permit only one session per username, it may be helpful to achieve consistency between the vendor’s policies and the institution’s on such matters as length of usernames and passwords so that the user need not learn two different sets of rules.

✔ Audits

The vendor should be required to provide complete auditing of every user given access to the system. The institution may also require the vendor to accept requests for new accounts only from an on-campus service provider who can screen the applications. Or the vendor may need access to the student information system and lists of faculty and staff in order to validate requests to sign up for the service.

✔ Non-disclosure

Because the vendor is likely to learn a great deal about the security systems that the institution has in place, the contract must contain a non-disclosure clause about security and privacy. The good news from the completed surveys in our study is that most respondents who have had sufficient time to evaluate security and procedures report that the vendor’s security provisions meet or exceed their expectations.

Management and marketing

Campus computing organizations are continually engaged in the effort to establish control over an array of constantly growing and changing systems; consequently, the decreased control of systems and services that accompanies outsourcing must be managed satisfactorily within the terms of the contract.

✔ Location of equipment and maintenance

If the servers and other equipment necessary for remote access are located at the vendor’s site, the institution must determine (and express in the RFP) its tolerance for outages. If the equipment is to be located on campus, the vendor is likely to request conditioned space and utilities. The vendor may also expect the institution staff to monitor the equipment and swap “hot spares,” return-
Checklist for an RFP on Outsourcing Internet Access

Services from the Vendor’s Server

**Supported Protocols**

- **TCP/IP**
- **SLIP, PPP**
- **IPX**
- **Appletalk**
- **Others:**

**Client Software Provided**

<table>
<thead>
<tr>
<th>Software</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trumpet Winsock</td>
<td></td>
</tr>
<tr>
<td>Netscape Navigator</td>
<td></td>
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<tr>
<td>TN3270</td>
<td></td>
</tr>
<tr>
<td>VTxxx emulation</td>
<td></td>
</tr>
<tr>
<td>MAC dialer</td>
<td></td>
</tr>
<tr>
<td>FTP</td>
<td></td>
</tr>
<tr>
<td>Telnet</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

**Speed/Bandwidth**

*Specify the modem speed capable of being supported by the host:*

- **28.8 Kbps**
- **14.4 Kbps**
- **9600 baud**
- **V.34 protocols for dial-in ports**

**Busy Signals**

*Specify the grade of service desired (and cost):*

<table>
<thead>
<tr>
<th>Response</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.00 (no busy signals)</td>
<td></td>
</tr>
<tr>
<td>P.05 (busy signals on 5 percent of calls)</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

**Scope of Access**

*Specify the telephone charges required for the following connections:*

<table>
<thead>
<tr>
<th>Point of Call</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>From institution city or town</td>
<td></td>
</tr>
<tr>
<td>From surrounding metropolitan area</td>
<td></td>
</tr>
<tr>
<td>U.S. connections from beyond current area code</td>
<td></td>
</tr>
<tr>
<td>International connections</td>
<td></td>
</tr>
</tbody>
</table>

**Vendor’s Customer Services**

**Implementation Period for Contract**

- **30 days**
- **45 days**
- **60 days**
- **Other:**

**Guaranteed Success Rate for Software Installation**

- **N.A.**
- **75 percent**
- **90 percent**
- **Other:**
Vendor’s Documentation

Content. Check all that apply:

___ Software installation guide
___ Trouble-shooting guide
___ Vendor help-desk information

Availability. Check all that apply:

___ from vendor by surface mail
___ from institution
___ via World Wide Web

Vendor’s Help-desk Coverage

Hours per day Specified days per week Weeks per year

Pricing Options

Start-up: Specify any costs and conditions.
Stop out: Specify any costs and conditions.

Usage time and costs per month

Unlimited use:

Base costs: (number of hours) (incremental costs per hour)

Tiering options for off-peak use: Specify options and prices.

Institution Systems and Services

Current Systems

Modem pool:

___ Retain ___ Discontinue

Electronic mail and Internet access:

___ Retain ___ Discontinue

Security

___ Collaboration with security professionals: Specify.
___ Consistency with institution structures and policies:
    ___ simultaneous logins
    ___ passwords
    ___ other:
___ Auditing of access privileges and user transactions
___ Non-disclosure clause about institutional security and privacy procedures

Management

Location of vendor’s servers and maintenance

___ on campus ___ off campus

Reports requested of vendor:

Kinds Frequency Format

___ Utilization reports
___ Sign-up rates
___ Time-of-day usage statistics
___ Lists of complaints and resolutions
___ Statistics on blocked calls
___ Other:

Marketing

Access to addresses:

___ students ___ faculty ___ administrators ___ staff

Permissions/safeguards regarding institutional logos and trademarks. Specify.

Billing mechanisms. Check all that apply:

___ Direct billing to customers only
___ Full and partial billing to institutional departments
ing the bad parts by mail for repair. If such “pair-of-hands” maintenance is considered acceptable, the institution should have exclusive use of the equipment and could expect a per-user rebate as well. In either case, it is necessary to specify how much notification must be given for maintenance and upgrades (typically, forty-eight hours). Given the likelihood that computing services staff will become engaged in on-campus support of the vendor’s equipment, it may be advisable to reject that option. Indeed, the majority of institutions responding to the survey report that the equipment is located off campus. Of the four institutions in our study who have the equipment located on campus, the vendor is performing monitoring and maintenance.

✔️ **Management reports**

It is important to specify the types and frequency of reports required—including utilization reports, sign-up rates, time-of-day usage statistics, lists of complaints and their resolutions, and statistics on blocked calls—and to determine the frequency of the reports—either monthly or quarterly—and specify that they be delivered in machine-readable format as well as hard copy.

✔️ **Marketing**

Even though the vendor will be providing services to the campus community and charging individuals directly, the institution must still have the final word on how, when, and where the remote access is marketed. Because faculty and students are likely to argue that Internet access has always been free on campus and should be free from off campus as well, a careful job of publicizing and “selling” the service will be necessary. Consequently, while information from the vendor can facilitate the process of education, it will be the task of the computing services department to muster the fiscal arguments for remote access in order to win the endorsement of relevant advisory committees and constituencies. For this purpose computing services will need data on the costs of maintaining and upgrading modem pools and of adding new SLIP/PPP services, and then will need to weigh these services against enhancing and upgrading modem pools and Internet access. In addition, the RFP should attempt to ensure high standards of security and authentication, marketing and management, and use of the institution’s name and insignia.

In the context of this educational effort, the institution may want to promote the new remote access service by giving it a name that resembles its telephone and video services. For example, at Georgetown University, where the sports teams are known as the Hoyas, the service could be called “Hoyanet Access” or “GUnet Access.” It is important, however, for the institution to guard the use of its logos and trademarks, and designs for all marketing materials should receive the expressed permission of the institution before being distributed to clients. One-third of the institutions responding to our survey have elected to let the vendor solely market the services.

✔️ **Billing**

Ideally the institution should also be able to propose billing practices to serve the interests and practices of its clients. For example, since the institution may want to subsidize its faculty in varying degrees, the vendor should agree to bill academic departments, or even to share the billing between a department and one of its members. Flexibility in payment plans should also be arranged, so that users can choose to be billed by the month, academic term (semester or quarter), or academic or fiscal year. Discounts for pre-payments—either by individual or the institution—should be incorporated into the plan.

**Summary**

*Information Week* reports that by 1997, corporate spending for remote access will average $8.5 million per company, up 81 percent from 1995. Hardware and software acquisition costs for remote access will be about 23 percent of the $8.5 million, meaning that about 77 percent of the costs will be for sustaining an installed base.3 While we have not found data specific to higher education, similar trends must be occurring in colleges and universities as the demand for remote access increases. For many institutions, outsourcing remote access is proving to be a viable option for providing service. Nevertheless, the institution’s request for proposals from vendors must carefully spell out the technical services to be provided and acceptable levels of performance, the customer services ranging from implementation to pricing, and the relationship of the new service to such current services as modem pools and Internet access. In addition, the RFP should attempt to ensure high standards of security and authentication, marketing and management, and use of the institution’s name and insignia.

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A Management Perspective on Distributed Support at Rice University

by Andrea Martin and Vicky Dean

Prior to 1995, Rice University’s information technology (IT) organization used a centralized model to support the computing needs of our 6,000 users. Over the last several years, we had distributed one consultant into each academic division, but our focus was still on using central services to support the University community.

Under the centralized model, the faculty felt they were not being adequately served. The rotation of staff through the central help desk resulted in a lack of continuity; faculty wanted computing help through one contact. Few faculty would attend centrally sponsored short computing courses, but they nonetheless needed and wanted training. They had minimal direct contact with the second-tier support who configured and maintained their systems. Faculty held a perception that the technology organization was overstaffed, yet support issues were not being resolved, leading to questions of competence. Several departments chose to fund their own computer support staff from research grants.

In 1993, funding was discontinued for a major infrastructure support grant in the computer science department. When a chargeback model was evaluated, the labor costs were substantial, and the group approached IT for supple-
mental funding. In the spring of 1994, we folded their systems support staff into the IT organization. University funds that supported these staff were pooled into the IT budget to help offset the cost. At the same time, top IT management established the distributed teams support model to respond to faculty support issues.

**Distributed Teams Support Model**

Under the distributed teams support model, information technology staff and reference librarians are assigned to matrixed support teams and dedicated to specific academic divisions. Each divisional dean appoints a faculty advisor to set priorities for resource allocation within that division. An information technology director is assigned to each team to resolve escalated issues and facilitate communication. The model can be viewed from three perspectives—the division, the team, and IT.

**Division Perspective.** The academic division provides space for the team and a faculty advisor. The faculty know their support staff by name and face, have easy access to team members, and set priorities for their division through the faculty advisor.

**Team Perspective.** The teams know their customers and provide day-to-day and long-term project support. Dedicated consultants provide one-on-one or small-group training and front-line user support. Reference librarians provide reference service and training, and system administrators provide first- and second-level support. Second-level staff from the core team are designated to support each divisional team and may be contacted directly. The team leader facilitates the team’s work—coordinating dispatch of problems and escalating issues to management.

**IT Perspective.** IT facilitates a campuswide view of technology and architecture and maintains a central view of budget and staff. The “core” team represents second-level technical support for team members in the field. We provide central services that include e-mail, news, networking, consulting and training for students, support for the campus computing labs, volume purchases, and site licensing. We also implement projects with a campuswide view, such as operating system transitions, software standardization, security, and classroom technology.

**Implementation**

Implementation of distributed support began with building the teams. It resulted in some major changes in our help desk and training areas, and required a different communications style. For the management team, implementation brought challenges in staffing, team relations, supervision, and using technology to our advantage.

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**Table 1: Distributed support teams**

<table>
<thead>
<tr>
<th>Division</th>
<th>Faculty</th>
<th>Distributed Team</th>
<th>Other Rice Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Micro</td>
<td>UNIX</td>
</tr>
<tr>
<td>Architecture</td>
<td>23</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>187</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Humanities</td>
<td>195</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Business School</td>
<td>57</td>
<td>0.2*</td>
<td>1</td>
</tr>
<tr>
<td>Music</td>
<td>49</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>158</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>87</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Continuing Studies</td>
<td></td>
<td>0.2*</td>
<td>1</td>
</tr>
<tr>
<td>Owlnet Labs (Students)</td>
<td>4.5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>21</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

* = contract support

*This table can be compared to staff remaining in the core team (Table 2). Notice that about half the staff were distributed to the field.*
Building the teams

To build the support teams, the IT directors examined the number of faculty in each division, their computing sophistication, and the installed base of computers. We then collectively reviewed the staff for technical depth, interpersonal skills, maturity and judgment, ability to work with minimal supervision, and leadership capabilities. The resulting distribution is shown in Table 1.

After the roster was created, each director discussed the distributed team concept and specific team assignments with their staff. Reaction ranged from enthusiasm to skepticism that the project could work. Several staff chose to leave the University rather than participate.

Changes

Given the redeployment of staff, we had to rethink our business in several areas. We needed to retool the help desk, transform our training program, and create new communications paths.

Many help desks

Under the new model, we distributed the central help desk into the divisions. Consultants who formerly worked on the help desk were deployed on the divisional teams and took that function with them. Each team decided how to run their helpline and utilized various approaches; for example, the Social Science hotline rings on all team-member phones, whereas Humanities designates one team member to receive and dispatch calls.

Support for students is provided from the central help desk and the consulting station at the library’s reference desk. Additional student consulting is provided in each major microcomputing lab. These help desks are staffed by students and are managed by a staff consultant from the core team.

We still support a central helpline, but users now get a phone menu that enables them to select their divisional team or the student help desk. Faculty and staff are referred to their support teams. Calls for student help ring at the help desk and at the consulting station in the library.

Training goes to the divisions

Given that we deployed two-thirds of the training staff into the teams, we needed some creative approaches to handle the training load. First, we relied on the teams to provide “just in time” one-on-one training for the faculty and staff. For topics of broader scope like Web building, we worked with the teams to set up a monthly training schedule in which our training coordinator delivers classes in divisional space. To teach evening courses and to help with special training projects like Web camp, we relied on our student trainers.

We also tried to be proactive in anticipating needs. For example, we knew that wiring the residential colleges in summer 1995 would create a demand for training the next fall, so our student trainers were ready to teach classes when the wiring was completed.¹

Intensive communication

When staff are distributed over the campus, the need for communication intensifies. Good relationships between management and the staff enabled a smooth transition to the new support model, but we needed to rethink our information flow for the long term. Our approach included traditional methods such as electronic mail, listserv lists, and the problem-tracking system. However, we needed to facilitate timely one-on-one contact, so we issued beepers to support staff and management and created an e-mail paging service.

Challenges

Migration to a new support model presented several challenges to the management team in the areas of staffing, team relations, supervision, and using technology to our advantage.

We really do more with less

Allocating half of the staff to divisional teams means that fewer staff are available to deal with crises or new projects. This translates into a need for better planning among the teams and management. For example, our help desk is staffed primarily by students. During midterms and finals, however, students focus on their studies and are not available to work consulting shifts. Students still need consulting help, so we rely on staff in the divisions to work the desk.

The distributed approach also mandates flexibility in dealing with assignments. When


<table>
<thead>
<tr>
<th>Skill</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcomputer</td>
<td>5.5</td>
</tr>
<tr>
<td>Unix</td>
<td>3</td>
</tr>
<tr>
<td>Networking</td>
<td>5</td>
</tr>
<tr>
<td>Management</td>
<td>5</td>
</tr>
<tr>
<td>Clerical</td>
<td>6</td>
</tr>
<tr>
<td>Technicians/Operators</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35.5</strong></td>
</tr>
</tbody>
</table>
team members are on vacation or sick leave, other staff adjust their schedules to help deal with the shortfall. In divisions where problem loads become too high, a “SWAT team” from the core is assigned to help on a temporary basis.

Working through the rough edges

User Services staff are hired based on a combination of interpersonal and technical skills. Until recently, other parts of the IT organization based their hiring decisions primarily on technical skills. When some of these “backroom” staff were assigned to teams, we had to help them rework their interaction styles.

Some of these “rough edges” appeared during the 360-degree team evaluations and the selection of team leaders. In the team evaluations, several staff did not want to deal with confrontation and give peers a poor review; this was also the case with several of the faculty. We view team leaders as facilitators, not bosses, and finding the right match of leadership and interpersonal skills was a challenge on a few teams. In the short term, several staff are in an uncomfortable position. Over the longer term, we are hiring staff who can work with our customers and with each other.

From a distance

Several divisions were concerned about supervision of deployed staff. Given that staff work all over the campus, how can you monitor their performance? How do you handle discipline problems?

Our solution to performance monitoring was to put a renewed emphasis on the use of our problem-tracking system and hold staff accountable for their problem load. We upgraded our problem-tracking system, developed log sheets, and distributed summary reports to the entire IT organization and the faculty advisors. Team members want to get credit for the work they do, faculty want to understand how they spend their time, and the staff know that we need to document the load to justify additional resources. However, staff sometimes get too busy to enter data, which leads to questions about accuracy of the load portrayed, and some staff who work at high capacity are concerned about whether the numbers reflect their load.

Completing a discipline procedure for a team member is an exercise in cooperation with the customer. While a total variance in problem load from the rest of the staff can signal a problem long before the customer complains, problems dealing with team dynamics can be more subtle. Once a procedure is initiated, management must rely on the customer and team leader to help with monitoring, which can raise questions about objectivity and secondhand information.

Using technology

As we distributed our staff, several questions arose about using technology to help us cope with the load. For example:

1. Our problem-tracking system captures twice the information that it used to—data from the central help desk and data from the divisional teams. What can these data tell us? What are the trends in our divisions? Who is working or just not recording data? For example, the FY96 problem load for Computer Science surpassed that of the rest of the Engineering division, which helped us justify another position for the division.

2. As we wired the dorm rooms for cable TV and Ethernet in summer 1995, we realized that we could use the cable network as another way to train students. This year, we will pilot internally developed and commercial training videos. Will this program reduce our need to offer central classes for the students?

3. An interest in telecommuting resulted in an ISDN pilot project. The project was successful and is being expanded to accommodate additional users. How will management need to structure jobs and communication for this program to succeed? How will the telecommuting model affect the distributed teams?

4. We are installing video conferencing capabilities in a new classroom in the library and recently acquired several Mac-based video conferencing packages to test among the staff. How will video conferencing enhance our team interactions? How will it help facilitate distance learning opportunities?

Progress Report

To date, the distributed model has been an outstanding success. Faculty are regularly giving management positive feedback. Here are some recent insights related to the implementation of our distributed support model.

1. When the support model was first implemented, some of the reference librarians participated, but most did not move into or work from the team space. The New University Librarian has made Library Public Services a primary focus. As part of a restructuring, reference librarians will dramatically increase their participation in teams to increase their visibility with the faculty. They are also beginning to use the problem-tracking system to track reference questions.

“We view team leaders as facilitators, not bosses, and finding the right match of leadership and interpersonal skills was a challenge on a few teams.”

2 A 360-degree evaluation process involves polling all the segments of the community that a staff member serves for their input. For IT staff, the reviewers include faculty and staff customers in their divisions, peers on their divisional team, peers in the rest of the IT organization who support them, and management. Reviewers complete a short seven-question “check-off” survey that is tallied and appended to the staff member’s Rice evaluation form.
2. While the staff have remained distributed, we continue to retain central control over the budgets. IT management is exploring compensation models with the University’s human resources office.

3. For staff evaluations, we employed a 360-degree process to get feedback from our customers on individual staff members and the teams. We polled selected faculty and staff in each division. User comments were overwhelmingly favorable and helped us justify new positions for this fiscal year.

4. After two recent comprehensive surveys, faculty were tired of yet one more broad service survey. However, when selected faculty were asked to complete a five-question survey for specific team member evaluation, they were very supportive and returned most forms.

5. The observable problem-tracking loads in Engineering and Natural Sciences helped us justify three new positions this year.

6. We are still working on research-support funding issues such as providing consistent base-level service versus addressing special needs.

7. A year after implementation, the beepers and e-mail have worked to facilitate communication. However, the field staff sometimes feel isolated from the organization, and important information does not always get communicated between the central and divisional teams. We are exploring ways to promote “proximity communication,” i.e., team-building and technical meetings with food provided.

We have been using matrixed teams for over five years. Our current support model adds one more level to the matrix. Given the success of the program to date, we will continue to evaluate ways to grow the model and put more staff into the field.

Related work:

Flowers, Kay, and Andrea Martin. “Enhancing User Services through Collaboration at Rice University.” CAUSE/EFFECT, Fall 1994, 19-25. This article is available electronically at http://www.cause.org/information-resources/ir-library/text/cem9435.txt/or by sending e-mail to search@cause.org containing the message: get CEM9435

Martin, Andrea, and Vicky Dean. “Back to the Future: A Management Perspective on Distributed Support.” In Realizing the Potential of Information Resources: Information, Technology, and Services, Proceedings of the 1995 CAUSE Annual Conference (Boulder, Colo.: CAUSE, 1996), 4-3-1 to 4-3-9. This paper is available electronically at http://www.cause.org/information-resources/ir-library/text/cnc9527.txt or by sending e-mail to search@cause.org containing the message: get CNC9527

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“… the field staff sometimes feel isolated from the organization, and important information does not always get communicated between the central and divisional teams.”
Multimedia and Asynchronous Learning: Changing the Support Model for Information Technology Services

by Arthur S. Gloster II and Steven A. Saltzberg

Although the nature of the workforce is changing and the demands of higher education make it clear that institutions need to reach students both on and off campus, the way that information technology service units support faculty, staff, and students has not kept pace with these changes. Furthermore, the ability to improve instruction by integrating digital technologies across the curriculum is becoming a reality. To effect these changes, the support paradigm of information technology service units—academic computing, user services, libraries, network services—will need to be transformed. This article describes plans and support models at Virginia Commonwealth University and Randolph-Macon College aimed at enabling such a transformation.

After decades of promises based on overhead projectors, classroom video, teaching machines, and other instructional technologies, the ability to improve instruction by integrating digital technologies across the curriculum has now become a reality. Incorporating digital text, audio, graphics, animation, and full-motion video into lecture, laboratory, self-study, and interpersonal and intergroup communication activities that are fundamental to teaching and learning promises to improve the quality of instruction.

Education in the future will support both synchronous and asynchronous interaction between the learner and the sources of knowledge and information. Real-time, simultaneous two-way video presentations, multimedia presentations, and “education on demand” can be delivered to students on the campus, in their homes, or at their work places. Connectivity to the Internet and World Wide Web already is allowing students and faculty to access educational resources. Escalating costs, declining financial support, increasing demand, and diverse demographics have placed significant pressures on higher education to become more productive.

Dr. Arthur S. Gloster II (agloster@vcu.edu) assumed the position of Vice Provost for Information Technology at Virginia Commonwealth University in August 1994. He is responsible for communication services, computing, and libraries. Previously he was Vice President for Information Systems at Cal Poly, San Luis Obispo for eight years. He has over twenty-five years experience in information systems in both the public and private sectors.

Steven A. Saltzberg (ssaltz@rmc.edu) has been Director of Information and Technology Services at Randolph-Macon College since July 1996. Prior to that he served as Director of Multimedia Development and Director of Academic Computing at Virginia Commonwealth University, and previously to that was Assistant Director of Computing at California State University, Fresno. He holds BA and MS degrees from the University of California at Los Angeles.
graphics have placed significant pressures on higher education to become more productive. The focus for productivity improvement must be on learning.

It is this realization that is leading to increasing use of a teaching model in which students gain access to information resources, faculty lectures and demonstrations, conferencing, and tutorials over networks from content organized by the faculty. Productivity gains occur in information retention, more efficient use of the student’s time, easy access to group study over networks, better feedback to faculty, and organized self-assessment and self-pacing. Faculty and traditional classrooms are not replaced, but another dimension is added that greatly improves learning efficiency. As this new process develops, more students will be able to take advantage of this type of instruction.

At large research institutions such as Virginia Commonwealth University (VCU) and at small liberal arts colleges such as Randolph-Macon College (R-MC), technology is enabling new teaching and learning models that are designed to improve learning productivity, reduce labor intensity, and provide new ways of delivering education and service to students while improving the quality of instruction.

**Strategic plans and goals**

VCU’s strategic plan defines the future role of information technology in support of the University’s academic and administrative programs. The plan states that technology will be used to deliver traditional education to the University, the community, the Commonwealth, the nation, and the world. Randolph-Macon College began a technology initiative last year and is in the process of redefining the use of technology for teaching and learning. The College will change its IT support paradigm to include various technology innovations and mentoring models, and is also developing plans to include cooperative instruction with peer institutions using information technologies.

The vision that has emerged at both institutions recognizes that technology can benefit learning when it:

- allows a student to take a more active role,
- allows a teacher to express the content of a course in more than one format,
- affects students by using techniques that reach various learning styles,
- broadens the array of resources brought to a classroom and the student’s workstation,
- increases opportunities for interactions between teachers and students and among students,
- increases the productivity of those who support the learning environment.

Plans at both institutions envision that instructional computing in the next decade will be symbolized by communications using network connectivity between machines—office to office, classroom to library, teacher to student, and the campus to the world. The next revolution will be about access to information and ways of sharing information. Consequently, this revolution will involve most members of the college and university communities, not only those who have been traditional beneficiaries of technology. In the new environment, every instructor or student working alone at their office desk or working with others in any campus classroom will access not only the powerful tools of the desktop computer, but also the networked applications and information resources of the campus and the world beyond.

These plans include providing high-bandwidth network connection to faculty offices and classrooms, network ports distributed throughout the campus, and high-bandwidth or telephone access from off-campus sites or residences. Classrooms will be equipped with systems for displaying prepared lecture material and sharing information resources and there will be online processing of grades and other student records. From the desktop, the user will search and retrieve a wide variety of library materials, including multimedia, international journals, databases, reference works, and scholarly discussion groups. Envisioned is a new methodology for faculty to conduct and publish research, create and deliver lectures, and interact with students.

The speed and scope of change in instructional methods promised by the new technology is unprecedented in educational history and will require unequivocal institutional support, not only to create the infrastructure to make this possible but also to meet the need for faculty motivation and training. These plans call for institutional policies to encourage individual faculty to make the required investment of time and effort. The institution could provide incentives for faculty development, such as release time or direct pay to conduct and/or attend training; consider professional development in this area for retention, promotion, and tenure purposes; or support faculty with well-defined projects for experimenting with new technologies and innovative ways of employing them in the teaching, learning, and research processes.

Achieving these goals will move our institutions toward becoming fully integrated “virtual universities,” utilizing asynchronous learning networks in which students, faculty, and staff are linked by electronic mail, two-way interactive
video, online processing, electronic databases, library services, multimedia on demand, and other information technologies, without regard to physical locations. The potential benefits of moving in this direction include:

- enhanced quality of instruction
- access to information and library resources
- high levels of support services to existing students
- increased access to academic programs by non-traditional students
- improved effectiveness in uses of limited human, program, and financial resources
- net revenue streams to offset infrastructure and operating costs
- incentives to faculty to develop new educational materials

**Infrastructure requirements**

Several infrastructure elements are required to effectively use technology in teaching and learning.

*Electronic campus and digital library*

VCU and R-MC are rapidly becoming “electronic campuses,” providing access to all major resources through a ubiquitous network. This fiber-optic network connects all buildings and residence halls at both institutions, and at VCU it will link to a “digital library.” The ubiquitous network infrastructure is the baseline required to support the concept of a virtual university and asynchronous learning, as shown in Figure 1. The digital library will provide faculty and students with access both on and off campus to a full range of information technology resources (voice, data, video) in an integrated, networked educational environment. It also will facilitate local and state-wide access to full-text articles and publications, electronic library services, databases, multimedia presentations, a central repository of CD-ROM materials, interactive television, and a wide variety of other material, including slides, graphics, and video.

*Authoring workstations*

State-of-the-art multimedia workstations must be available to faculty for scanning and digitizing images, video, and audio, and they must be loaded with complete editing tools to produce professional quality work. VCU is equipped with both IBM and Apple authoring workstations and software tools, including image editors, video editors, and authoring packages. Other resources available to faculty include scanners and digitizing stations to convert source material from word processors, VHS tape, laserdisc, CD-ROM, illustrations, and artwork. Full video production facilities include a videotaping studio, hand-held video cameras for off-site work, digital, video, and sound editing studios, and in-house support for creating VHS tapes and CD-ROMs.

(continued on page 34)
Founded in 1909, Santa Barbara City College (SBCC) is a two-year community college situated on a 74-acre campus overlooking the Pacific Ocean at the foot of the Santa Ynez Mountains in the city of Santa Barbara. One of the leading community colleges in California, the college’s “open-door” admissions policy allows anyone over 18, or with a high school diploma or equivalent, to attend. Currently SBCC serves 12,000 students in credit programs, and 17,000 non-credit students in its Continuing Education program each term.

SBCC offers associate degrees in arts and sciences, as well as occupational/technological training and business programs. The College is known for its success in transferring well-prepared students to the University of California, California State Universities, in-state independent colleges, and out-of-state four-year colleges and universities.

A culture of strategic planning

SBCC has a long history of strategic planning and evaluating institutional effectiveness, and enjoys a reputation for excellence and innovation. Under the leadership of President Peter MacDougall, the College recognizes the need to address an ever-changing external environment in an ongoing process of shared values and vision. That need is fulfilled through an integrated and systematic planning process, conducted every three years by the College Planning Council with input from diverse campus constituencies. According to MacDougall, the overriding goal of the planning process is to constantly improve and redefine the teaching and learning process, because the ultimate measurement of the College’s success is the success of the students it serves.

As part of the current planning process, the Council met with an outside facilitator to examine external trends and factors, identifying many technological implications in the process. The resulting plan is not just visionary and strategic; measurable outcomes with timelines are included. Among the specific goals of the 1996-99 plan are many technology-related directions:

- to provide multiple options on and off campus for access to information and matriculation processes;
- to increase student access to courses and to information needed for success in those courses by designing and field testing alternative methods of delivering instruction;
- to reconceptualize instructional methods to fully utilize the potential of technology to promote student learning; and
- to develop and implement strategies to ensure the effective use of information technology and resources to support the work of the College, particularly as that work is being redefined through Project Redesign.

Project Redesign (see sidebar, page 32) was prompted by SBCC’s realization of the need to make fundamental changes in institutional core processes, especially to more effectively use information technology to enable those changes. The processes being addressed are not just administrative in nature, but those that underlie the primary mission of the institution—teaching and learning.

Information Resources Planning and Management Organization

From the top, left to right: Jack Friedlander, Vice President for Academic Affairs; William Hamre, Associate Vice President for Information Resources; George Gregg, Director of Educational Technology Support; George Beahan, Director, Information Systems Development; Mark Ferrer, Director, Faculty Resource Center.
THE GREATEST CHALLENGE

that higher education is facing is technologically induced, but the greatest capacity we have to respond to that challenge is going to be enabled by technology. Technology is both the source of the problem and the source of the solution.

That great challenge is competition. Until recently, we really have not had much competition in higher education except from each other. But competition in the future will be from private entities that will be providing high-quality degrees for people in alternative ways. Some of that will be from traditional sources—I can see institutions such as Stanford providing degree opportunities over the Internet and perhaps in other forms that will compete with other undergraduate institutions. Other competition will emerge from private industry sources such as Motorola University, Jones Network and Cabling System, and other delivery systems that will continue to be refined to offer highly variable and high-quality options over a period of time.

So we are going to have to be much more customer oriented and much more effective in delivering what we deliver. And we are going to have to look for niches in how we serve our communities more effectively. I see technology as being an enabler for us to be able to craft a much more responsive and diversified structure than we have in the past.

The modal instructional delivery mechanism has been pretty much the same—we create a campus with facilities and classrooms, and students come at selected periods of time, mostly between Monday and Friday, to attend classes that translate into a degree. If we continue to rely on that modality in the future as our sole means of providing what we provide, we’re not going to be as effective as we need to be. In California, much more so than other states, what we call Tidal Wave II—half a million additional students expected in the higher education system over the next several years—is going to require colleges and universities to respond in much more economical ways to delivering higher education. Either we are going to be a part of that solution or we are going to deny access to people. We have to look at how we provide that access at a per-student cost that is less than what we have at present. Demand for education and need to provide access are two key variables, and our ability to respond will be enabled by technology—it will provide the more diverse mechanisms needed to compete in the future.

From an interview with Peter MacDougall, September 1996

Project Redesign is providing the blueprint for technology acquisition and implementation at SBCC, ensuring the application of technology “in context,” rather than for its own sake. At the same time, a great deal of technological infrastructure has been laid in the past three years, with a major investment in fully networking the College—viewed as fundamental to changing College processes. In addition, the College demonstrated its belief that information resources, like human and financial resources, need cabinet-level leadership, by creating an associate vice presidential position to ensure effective College-wide planning and administration in this area.

Planning for and managing information resources

Prior to 1992, SBCC’s automated administrative systems were outsourced through a joint powers agreement with the Santa Barbara K-12 school district, but it had become clear that the College needed to bring these systems in-house to develop more efficient and responsive integrated information systems. At about the same time, the College created a director’s position to provide central coordination and support for educational technology and microcomputing, and shortly thereafter a new Information Resources (IR) division was established to encompass both educational and administrative computing support. As head of this division, Associate Vice President William Hamre is responsible for coordinating information resources planning in conjunction with SBCC’s executive leaders, while also overseeing IR division operations.

Until recently, the process for planning for, acquiring, and funding technology was based on the independent development of technology plans by each vice president for his or her area in parallel with the IR division’s development of an Information Technology Visions and Directions Statement. A number of weaknesses in this process were identified by a Project Redesign team who recommended an entirely new technology planning process, one that is centralized and more cross-functional in its approach, based on a number of planning principles articulated in the redesign team report.

A major outcome of this work was the establishment of a District Technology Council (DTC), to be responsible for institutional technology planning through integrating multiple unit plans for technology into institutional directions, for policy development, and for resource allocation. The DTC is chaired by Hamre, with a membership made up of vice presidents, faculty and classified staff representatives, the chair of the Instructional Technology Committee, and the Director of Educational Technology. The IR division is responsible for bringing standards and directions to the DTC...
and for technology infrastructure planning.

While Director of Educational Technology Support George Gregg provides support from within the IR division, planning and coordination for faculty use of instructional technology lies with Vice President for Academic Affairs Jack Friedlander. Recently Friedlander recognized that more and more of what SBCC is planning with respect to instructional technology cuts across specific academic programs, creating a need for cross-discipline academic affairs administration. Dean of Academic Affairs Susan Sargent has been charged with responsibilities in this area, overseeing projects that will have a College-wide impact. She also oversees several units that contribute to and support SBCC’s vision for redesigning teaching and learning—including the Faculty Resource Center, the Library, and Learning Support Services (see below).

In the past year, Friedlander worked jointly with SBCC’s Instructional Technology Committee to develop the Academic Affairs Instructional Technology Three-Year Plan. The purpose of this plan is to articulate strategies that promote student learning in an effective, flexible, and efficient manner through the effective use of technology. The plan sets forth eight goals to be achieved, lists eight criteria for instructional-technology-related projects to be approved, and identifies ten issues that must be resolved for the College to capitalize on the ability of technology to increase student involvement and learning. Hamre’s division will work toward resolving the issues and implementing infrastructure solutions.

Supporting information technology

In just three years, SBCC has implemented a solid technology infrastructure; installing a fiber-optic backbone network linking every building on campus, purchasing computers for all faculty who did not have one; installing standard software on every desktop computer; equipping all classrooms with Internet connectivity and many others with high-end multimedia projection capabilities; and creating many computer labs for student and instructional use, including a new thirty-station Multimedia Computer Lab to support a new multimedia arts and technologies degree and certificate program.

With the infrastructure in place, support issues have become paramount. The Information Resources division is currently providing support for information systems implementation and educational technology, as well as user and network support and media services. Hamre has realized in the brief life of the division how important it is to remain a flexible organization that can easily realign and redirect resources in response to emerging needs: “In the three years we’ve been a division, we’ve recast the organization as many times. Our greatest challenge has been and will continue to be, first, how to retrain, reallocate, and redeploy staff within the organization to support the great demand for informa-
tion technology resources, and second, deciding what pieces of that support to outsource or co-source. The latter is really a key issue for us, as we simply do not have the capability of adding staff for everything the College wants to do.”

Along these lines, the College has chosen to employ the services of consultants, especially for Project Redesign, and half-way through the project realized the need to create a full-time but temporary (two-year) position—Director of Information Systems Development—to oversee the implementation of redesign recommendations that require new systems acquisition or development. Three options are being considered: purchasing systems products, developing systems in-house, or co-sourcing to an industry partner. A Request for Information from Prospective Strategic Partners has resulted in Hewlett-Packard being selected as the general partner for Project Redesign. Negotiations are still under way for communications and courseware development partners.

To provide additional instructional support, the College established a Faculty Resource Center under the direction of Mark Ferrer, an English instructor who was given a three-year full-time assignment to serve in this position. According to Ferrer, the Center was established in response to the College’s strong faculty development emphasis and goal to involve 60 percent of contract faculty in one or more professional development activities. The Center has two major objectives: (1) assist faculty in selecting and evaluating instructional technologies-related equipment and software, and (2) keep staff informed about new developments in learning technologies. Currently a major emphasis is on the World Wide Web to help faculty make presentations that will change the way they teach. Ferrer says faculty response has been overwhelming, with faculty far more willing and open to change than anticipated.

The Library also provides strong support for electronic information resources. Library systems are fully automated through the VTLS system, which is available by dial-in access. Plans include linking from VTLS workstations to the public catalogs of the University of California Santa Barbara and local public library systems. CD-ROM collections are being built and the OCLC FirstSearch System (via the Internet) is used for periodic indexing.

One outcome of the close cooperation that exists between the IR division, Library, and FRC was the development of an “information literacy” course to be incorporated into a basic, required English course. The Library has also developed Web pages to help students learn to use the library, and works closely with the FRC in training faculty to use the Internet.

Serving students

SBCC’s vision for student services is to move toward a more student-centered approach to delivering information and support services from the time of the initial contact with the College through the student’s period of enrollment and transfer and/or career transition. Technology is seen as key to improving numerous processes that affect student success.

Several Project Redesign teams have addressed such student-related processes, including registration, financial aid, and student access to information. The registration redesign process team has recommended that students be able to register on a “7x24” basis—seven days a week, twenty-four hours a day, anytime, anywhere. New processes recommended by the financial aid team center on the acquisition of document imaging technology that will enable the College to more efficiently store financial aid documents and a variety of other information.

According to Dean of Student Development Keith McLellan, who led the redesign team that addressed access to student information, the team articulated the basic principle that students must have access to their data, and that such access should be provided in multiple ways—through kiosks, workstations in labs, the Internet/World Wide Web, and/or voice response technology.

A key driving force for the recommendations of these teams was the belief that students’ most valuable possession is time; thus administrative processes need to be streamlined so that students can spend less time mired in bureaucracy and more time focusing on educational pursuits.

According to Director of Information Systems Development George Beahan, SBCC’s technology strategies for administrative systems are based on converting current administrative legacy systems to a client/server environment. The first pilot will address student information access, implementing the recommendations of the redesign teams by providing a user-friendly graphic interface and independent access to student information.

This year, SBCC was gratified to have been provided an opportunity by the Accrediting Commission for Community and Junior Colleges to do its self-study for accreditation in a unique way. The College requested and was granted permission to focus on Project Redesign and use the accreditation standards as a means to view how redesign activities were affecting the College. The resulting Institutional Self-Study for Reaffirmation of Accreditation demonstrates SBCC’s continued commitment to innovation and continuous improvement, and to the effective use of technology to achieve these ends.
Multimedia …  
(continued from page 29)

Electronic classrooms
Another element of the required infrastructure is the “electronic classroom,” equipped with high-resolution projectors, quality audio systems, and microcomputers with high-speed network access and presentation software. Faculty using these classrooms connect to a local or remote server, and access a wide variety of digitized materials to enhance a classroom lecture under their individual control. This concept is illustrated in Figure 2. VCU and R-MC have several classrooms equipped with large-screen video projection systems, Macintosh and IBM-compatible computers, and network connections. Although delivery of full-motion video remains limited, several programs at VCU (e.g., the School of Pharmacy and the Department of Radiology) are developing content that requires the delivery of full-motion streamed video.

Virtual classrooms
The evolution of the digital library and products such as VCU’s Web Course in a Box™ (WCB) are extending teaching and learning beyond the walls of the classroom.¹ The authoring workstations provide the capacity to digitize lectures, which can be edited, indexed, and stored along with course materials. Both the lectures and materials can be retrieved later to supplement existing classroom instruction, either as stand-alone video, or more likely integrated with interactive multimedia presentations. Several systems for interactivity are being used to encourage conferencing and interaction between participating faculty and students. Initially, this was accomplished through electronic mail, bulletin boards, and newsgroups.

Today both VCU and R-MC are actively promoting the use of the Web for instruction and using WCB to create these courses. To date VCU has delivered slow-motion video over an ATM network to a multimedia classroom in the School of Pharmacy, and there are approximately 100 courses that distribute instructional materials on the Web, half of which were created with WCB. With these tools, students and faculty can communicate electronically whenever they like. Assignments can be given and received electronically. Faculty can hold virtual office hours, freeing them from rigid schedules, and enabling students to obtain information quickly. Although the method for student/faculty interaction will change, these technologies should enhance the quality of interaction or improve it over current levels. VCU has experienced tremendous success with an accredited master’s degree program in Health Care Administration, which utilizes the virtual university concept.

The infrastructure requirements continue to change with rapid advancements in technology, and to take advantage of innovation, higher education must restructure information technology services. The traditional academic computing or library services role in audio, visual, or media instructional support faces significant restructuring to support asynchronous learning and other non-traditional instruction.

Restructuring IT services: Using the tools of asynchronous learning
Prior to 1980, information technology support units in academe typically operated a mainframe and provided software consulting support to the users of these large, timesharing machines. When the personal computer revolution began, academic computing centers invariably took the lead in offering all levels of support: consulting, training, even repair. A decade later, personal computers became ubiquitous. In the 1990s the use of instructional technology finally matured, and client/server technologies forced a change in the infrastructure we had relied upon for decades. IT support units are now struggling to find creative ways to support a new generation of computer users with increasingly sophisticated applications and desktop equipment, while rebuilding their aging hardware infrastructure.

At VCU and R-MC the increased demand for IT service is beginning to change the IT units in many ways.

Faculty support
The role that IT service units play in faculty development is changing. In the past, the training has primarily been given in brief training sessions of one to three hours, and has been a scatter-gun approach that usually only provided resources and training to the 10 percent of the faculty interested in being at the leading edge of technology. Academic computing and library services staff have offered “brown bag” lunch series in the use of various information technologies to faculty, staff, and students. This series of training sessions has grown, as new databases and new technologies are introduced and created in the academic environment.²

VCU and R-MC are now developing ways to provide intense hands-on training for all interested faculty members in all the newest technologies of multimedia and asynchronous learning. Workshops and institutes have been developed to provide instructional support to faculty to

1 WCB is a Web-course creation system, using templates, forms, and clickable options. See http://www.mmd.vcu.edu/wcb/wcb.html
create content that can be accessed over the University’s data network, the Internet, and the World Wide Web. Faculty members come away from training ready to take an active role in planning and implementing changes in the way they teach. At both VCU and R-MC, strategies are being developed to support a faculty mentoring program. These programs seek to provide the tools, training, and release time for interested faculty to develop multimedia programs and serve as future expert resources to other faculty within their own schools and colleges.

**Instructional development**

Teaching faculty are only now learning to use multimedia workstations to deliver instruction. A new faculty support unit was created at VCU as part of the restructuring of technology units. The Instructional Development Center (IDC) was created with staff reassigned from University Computing Services, Library Services, and Media Services. The mission of this new unit is to support faculty use of instructional technology through consulting, training, project development, and creation of teaching media. The IDC works with individual faculty and with academic units in the planning and development of computer-based instructional projects, using both network solutions such as World Wide Web and stand-alone authoring environments such as Macromedia Authorware.

Given its limited staff, the IDC strives to maximize the assistance it can offer by creating tools to enable faculty themselves to create computer-based learning materials (such as Web Course in a Box, described earlier). IDC is committed to helping faculty become knowledgeable about innovations in instructional technology and find effective ways to use technology to enhance learning. Each summer a series of seminars is hosted by IDC; summer and winter institutes offer longer-term learning opportunities. IDC’s Web site features a “self-study lab” with information on learning resources as well as locally created demos and tutorials. VCU is evaluating Lotus Notes Domino as a hybrid approach to deliver MPEG standard video through the integration of a CD-ROM in a client with Internet access.

Although R-MC is just planning a multimedia studio, their Website is creating an online support and learning environment.

**The virtual consultant**

The traditional role of technology support staff has been to provide Socratic-style support, sometimes in a small training classroom, but usually one-to-one and face-to-face. As faculty

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![Figure 2: Electronic classrooms](image)

The electronic classroom provides a mechanism for delivery of content and a facility to access content from the “digital library” and other network resources.

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3 See [http://www.vcu.edu/mdcweb/](http://www.vcu.edu/mdcweb/)

4 MPEG refers to a standard for data compression and storage of full-motion video produced by the Motion Picture Experts Group.
and staff demands increase and the base of support fails to expand at the same rate, the consultant will need to learn how to provide consulting services without necessarily seeing the person face-to-face. In fact, the consultant will use the same tools that are being developed for teaching and learning at the virtual university.

Library services

Libraries and librarians have assumed new roles to support information technology use. The explosion of electronic resources, and the demands by consumers to access those resources at any time and regardless of location, have forced changes in library operations and management. New statewide networks like the Virtual Library of Virginia, better known as VIVA, have been created to maximize state funding to negotiate licensing agreements with online vendors of bibliographic and full-text databases. Libraries are creating digital collections of unique in-house materials and making them available on the Web. Like their computer colleagues, librarians play a vital role in faculty development by teaching faculty to use and organize digital information.

Access to the ubiquitous network

Providing full Internet access is a major support issue. Since R-MC is primarily a residential campus, wiring each dorm room and office has met its major access requirements. Although computers are not required at R-MC, more than 50 percent of the students have one in their dorm room, and in the first few months of implementation, over 25 percent of student computers have been networked.

VCU, with the majority of students living off campus, has, in addition to wiring their campuses, outsourced Internet access from home to a private Internet provider. This piece of the infrastructure offers additional support challenges. The infrastructure to create this function for 2,000 faculty, 5,000 staff, and 20,000 students is prohibitively expensive in today’s changing market. In fact, it is likely that the entire infrastructure will need to be changed in two years. Today’s 28.8 kb modem over analog dial-up may be the current technology choice, but ISDN and the 56 kb modem are likely to replace it in the next several years as the need for higher and higher bandwidth to the desktop is dictated by the emerging technologies of the World Wide Web and the digital library (e.g., full-motion video and high resolution imaging). VCU and R-MC are both exploring higher bandwidth alternatives to deliver integrated video, data, and telephony with both voice and cable companies.

The role of technology support has changed because the level of access to information has become so pervasive. In a brief twenty years, requirements have increased from supporting a few mainframe users with terminals on campus to supporting students, educators, and staff who demand better service from their office, home, or residence hall.

Conclusion

Technological advances to deliver education on demand are progressing rapidly. Not only has technology changed the way instruction is delivered, but it provides cost-effective solutions to the technology support issue. VCU plans to take this technology and apply it to education in order to overcome the economic, cultural, and physical barriers to learning facing the United States and the world. R-MC’s plans include not only an improved infrastructure for delivery but implementation of new support models.

The current economic restructuring is being combined with unprecedented growth in demand for higher education, and will require colleges and universities to mirror business and industry by delivering “just-in-time” rather than “just-in-case” education and support. We will also have to pursue cooperative efforts with other higher education institutions and the private sector to achieve this vision. Institutions like Virginia Commonwealth University and Randolph-Macon College will proceed deliberately, with a careful eye on changes in technology that may change the goals, and on vicissitudes in the economy that enable them to implement the new pedagogical paradigm. Still, colleges and universities must begin proceeding now toward a networked learning environment and a new faculty and staff support model if they are to deliver the education the students will need and demand, and provide the level of faculty and staff support to enable this change.
Teaching via Electrons: Networked Courseware at the University of Oregon

by G. D. Bothun

The University of Oregon (UO) has been recognized as a leader in campus networking and the development of networked courseware. This article details the evolution of the UO campus network into an effective teaching tool and discusses both the possibilities and the limitations of interactive courseware.

Today’s classroom model has become considerably more complicated over the last two to three years. The words “distance education” and “virtual classrooms” echo in the mostly analog halls of administrators as colleges and universities grapple to do “more with less.” Due to an enlightened legislature, faculty at the University of Oregon have become experts in doing more with less at a time when state demographics predict an increasing enrollment. Our current budgetary condition (one in six operating dollars comes from the state of Oregon) makes it difficult to plan and construct new facilities or expand faculty ranks in response to this demographic wave.

Technology-based instruction, especially network-based instruction, is widely viewed as a means to increase faculty productivity and to accommodate more students with existing facilities. But how exactly will this occur? Forty-five years ago, television was hailed as a new mechanism for information delivery that would replace the blackboard and chalk. Television, however, evolved to be a content-free medium that has arguably stunted the intellectual growth of society. The difference between television and the network, however, lies in the ability for each individual to program his or her own material. Herein lies the compelling challenge for colleges and universities and their faculties: How do we program content into this new interface that simultaneously improves the quality of undergraduate instruction and opens the way for effective distance education?

Clearly, the use of the Internet for educational purposes must have a far more profound outcome than the television equivalent of a content-free network. At the UO we are taking small, concrete steps towards achieving this outcome. In so doing, the University has established national leadership in campus networking and the subsequent development of networked courseware. The UO has made a significant investment in information technology and is actively engaged in an ongoing experiment to determine its effectiveness. In this article we critically evaluate the experimental results to date. In the true spirit of an experiment, failure is an acceptable outcome as long as we can demonstrate that use of instructional technology has, in fact, failed to achieve our main pedagogical goals. It is thus important that the reader not confuse the presentation of our experimental results with an advocacy of instructional technology even though we...

1 In recognition of its outstanding networked information environment, the University of Oregon was recently awarded the 1996 CAUSE Award for Excellence in Campus Networking.

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"... using technology to teach does not guarantee effective learning, and there remains a pervasive fear that it gives the student a more impersonal experience and less contact with an actual professor."

We begin this article by describing the evolution of UO's network; then describe the process by which networked course material is created, presented, and accessed by the students; and finally we describe truly interactive courseware, written in the Java interface, that allows students to actually do experiments and analyze data. In so doing, we hope to illustrate both what's possible to achieve and what's practical to implement, given the natural institutional resource limitations that can hinder the development of networked multimedia and interactive courseware. The pervasive theme in this article is that courseware expertise still resides on the campus and that institutional investment in this expertise will make higher education institutions viable in the next millennium.

Institutional vision and implementation

Networking was launched in 1975 at the UO with the construction of a twisted-pair low-speed asynchronous terminal network. Interactive use of the network relied on a DECSYSTEM-1050, which was updated to a 1091 in 1981. The original scheme of port allocation by operators in response to user telephone requests proved quite cumbersome and was replaced in late 1981 by a Gandalf PACX-IV data switch. This marked the beginning of the era of switched networking at the UO where the user could connect to several hosts in one remote session. By 1983, the UO had installed a broadband cable system network that supported up to ninety simultaneous sessions.

In this early period, expansion of the UO network was supported by institutional dollars. However, to move significantly beyond the cable network required a sizeable capital investment. In 1987 the UO was fortunate to receive a large grant from the U.S. Department of Education to upgrade our research computing environment. In the spring of 1988, the first leg of our now expansive fiber-optic network was laid. Within a few months, "UOnet" connectivity was established between the Computing Center and thirteen buildings on campus. In 1992, $1.3 million was made available for the Strategic Network Expansion Project (SNEP), whose goal was to provide network connectivity to all faculty offices and research labs. This program included no-cost installation of Ethernet cards for faculty machines. This expansion was completed in the spring of 1993.

By fall term 1993, this completed infrastructure had opened the door for new forms of curriculum delivery and student learning that centers on the use of technology. However, using technology to teach does not guarantee effective learning, and there remains a pervasive fear that it gives the student a more impersonal experience and less contact with an actual professor. Moreover, there exists widespread faculty apprehension over the preparation time involved with the creation of an electronic curriculum. In any emerging technology there are early adopters. The efforts of early adopters are often hard to evaluate or validate, as the technology is largely unfamiliar. This makes it difficult to lead by example. Success with instructional technology therefore demands clear pedagogical goals and a means to evaluate whether they have been reasonably achieved. Once that is achieved, other faculty will be more willing to engage in the activity.

The first phases and four positive outcomes

In the fall of 1993, the UO made an aggressive and far-reaching commitment to improve undergraduate science education by utilizing high-speed networking and electronic curriculum development as the means for integrating research directly into teaching. This commitment was motivated by a desire to make learning more effective and interactive while simultaneously providing students with "real world" skills to facilitate their assimilation into an information-oriented society. The overarching principle behind this new endeavor is to teach science, at all levels, as a data-driven discovery process that promotes student-driven inquiry and critical thinking.

Our curriculum development strategy centers on two principal goals: (1) construct an interface that more easily allows the integration of professional research data with undergraduate teaching, and (2) perform a realistic experiment, using all available software tools and network technologies, to test whether the quality of instruction and student comprehension of and interaction with the material shows improvement. The target audience for this strategy are the 150-250 students enrolled in introductory survey classes in the sciences.

To meet these goals we have created courseware in beginning astronomy, introductory energy physics, and environmental studies. The courseware makes heavy use of the hypertext capabilities of World Wide Web browsers. Linked images, graphs, and scientific visualization/animation are integral to the lecture material, resulting in a structured multimedia presentation of the material. This material would normally be presented to a class via chalkboards, overheads, slides, and video tapes with no facility for the student to access or review the material outside of the actual lecture.

do report on several positive outcomes.

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An electronic gateway to knowledge

While we can present no conclusive evidence that this courseware represents a significant improvement in pedagogy, we have identified four positive outcomes to date:

1. Technology-based instruction facilitates the direct manipulation of real data using real analysis programs as part of the regular classroom presentation. Furthermore, it allows the professor to customize a curriculum to center on his or her particular area of expertise.

College and university faculty in general are hired because they know some aspects of a particular discipline much better than most others. Ironically, in most cases this expertise is not exploited in the classroom, as a third party's textbook is used to educate the students. Network technology affords the opportunity for faculty to become their own "textbook publisher" for the classes they teach. Instructors can integrate their own expertise directly into the curriculum in a manner that is archived for the students and can be updated easily by the instructor for future classes. In many cases, the instructor's personal research data is vastly superior to that portrayed in the textbook. This research often involves intensive use of computers. It follows that bringing the computer into the classroom environment facilitates the direct integration of research into teaching. For instance, in astronomy, network access and computer projection in the classroom allows access to digital images and the ability to perform image processing as part of the lecture material. The use of a networked platform in the classroom gives the curriculum direct access to the latest images from the Hubble Space Telescope or another observatory. At the UO, all astronomy classes are now Web-based, so that the personal research data of UO astronomers becomes part of the curriculum.

2. Software such as Netscape allows for an extremely convenient way to organize, prepare, and present lectures. One can easily integrate text with graphics and animation into one seamless presentation.

This is a much under-appreciated aspect of instructional technology, even though it remains the most widely used. This is because exaggerated faculty fears about equipment failure often preclude its actual use in the physical classroom. With good facilities, projected Web lecture materials can be much richer and in-depth than standard presentation techniques allow. In fact, our current effort in electronic curriculum development has not really altered the fundamental nature of teaching in the classroom despite the perceptions of colleagues that somehow the classroom environment has been radically altered. Instructional technology is primarily used as a lecture presentation tool and there is no doubt that the material is organized in a far superior manner.

3. Web-based courseware seems to better engage the more motivated students, and they end up making a contribution to the curriculum. A 10 percent improvement in exam scores was also measured in these courses.

The platform independence of the Web browser means that students in these classes are able to retrieve all the lecture material (notes, graphs, images, sound bytes, animations, etc.) outside of class. For the first time, students were no longer compelled to take unnecessary notes during the lecture, but instead would come and listen and focus more on conceptual issues than memorizing facts. Improved exam performance showed that this new mode of teaching can lead to better student comprehension of the material. The use of class newsgroups and e-mail allowed the students to work collaboratively on some class assignments as well as provide more useful feedback to the instructor than is provided in the traditional lecture format.

As is well known, the vast majority of students in these introductory science classes are not there due to intrinsic interest in the subject matter, but are being forced to occupy a seat to satisfy some distribution requirement or prerequisite. Engaging and motivating intrinsically uninterested students is exceedingly difficult to do. On a personal note, I have been teaching these classes since 1979 and by the early '90s became completely fed up with the whole process. I therefore decided to try instructional technology for two reasons: (1) a strong desire to integrate my research into the teaching curriculum, and (2) a desperate attempt to find a new interface for curriculum delivery that might engage the MTV generation.

For Web-based classes at the UO, assignments are given to the students that require them to use the UOnet infrastructure. For instance, students are now required to turn in their assignments via e-mail. Despite some grumbling, 95 percent of the students in these classes actually do this. More advanced exercises require the student to use the Internet as the primary resource for finding material. In the Web-based classes for environmental studies, assignments are structured in such a way that the student is required to find multiple sources to challenge what might have been presented in class. In fact, this is one real advantage of network access for students, as they can interact with a distributed, diverse, and expert knowledge base. The professor is just one component of that and no longer the sole keeper of the knowledge.
Student teams work together to design and incorporate this source material into their own student-authored Web pages. In some cases, the student-authored material is so good that it becomes part of the curriculum for that class. This is highly rewarding for the student and helps break down the student-professor barrier, which can be a hindrance to student enjoyment of the course. Figure 1 shows a sample student-team-authored Web-page that concerns offshore oil drilling.

4. Use of technology in teaching facilitates the development of a dynamic core-course curriculum, which can react almost instantaneously to feedback from students and other professors.

In an open system, other professionals in the field will have access to the developed curriculum products and can build on them. The curriculum development effort at the UO has certainly not been done in a vacuum, as material from elsewhere has been used. In turn, we make all our developed material freely available. This open exchange of resources potentially allows for joint curriculum development among experts in a format that is easy to update. It has long been customary in most disciplines to choose certain textbooks which define the core-course curricu-

lum. Unfortunately, textbooks do not rapidly respond to feedback from the users to redesign the curriculum. In theory, network-based curriculum resources could rapidly evolve into a very high quality, somewhat standardized product. Clearly, this has not yet happened in any discipline. Herein lies another profound challenge for the higher education community. A wide variety of knowledge sources are making their data and research available on the World Wide Web. The key is for effective integration of these individual knowledge sources into subject-based curriculum products. Will this integration be done by the content experts located at colleges and universities or will it be done by the commercial publishing houses that may only offer limited access?

Identified disadvantages of instructional technology

While it is too soon to declare that instructional technology has led to improved pedagogy, it is also too soon to declare the enterprise a failure. We are still very much in the learning stages and remain empirically driven. During this process we have identified several areas that need to be properly addressed to maximize the probability of success.

Alienation of some students

Student evaluations and homework responses indicate that 80-85 percent of the students strongly prefer networked delivery of curriculum. They find it easier to stay engaged with the material since it is always available. However, 15-20 percent of the students strongly resent the use of computers that is imposed upon them. Arguments about the need to become network literate in a networked world carry no weight. Much of their dissatisfaction is based on fear of technology or the dehumanization of the curriculum by the machine. This latter aspect is particularly ironic since (1) the large class size already is dehumanizing, and (2) these students never appear during office hours. Nevertheless, for these students the standard pedagogy probably serves them better. At this time, it is unclear what to do about this issue.

Campus infrastructure needs

Once the network curriculum has been developed, equitable student access to this material is paramount. In fact, without a good campus network infrastructure and functional student e-mail accounts, it is pointless to even engage in this enterprise. The ramp up of networking at the UO discussed earlier greatly facilitated curriculum delivery. The missing piece was student

West Africa: Chevron led the way. An increase in the operation is foreseen in 1995-96 in the Gulf of Guinea. Other coastal African nations are promoting investment and developing aquatories.

Mexico: Exploration and development in 100–2,000 meter depths. There have been three 1995 Gulf of Mexico site discoveries: Petronius, Fuji, and Gemini. All support deepwater and subsalt potential.

Norway: Exploration of underdeveloped region. There are also existing sites and/or consideration in the following countries: China, Vietnam, Malaysia, Indonesia, Japan, and Russia.

Here are some additional fossil fuel links to check out. Don’t forget to come back, though…

- Offshore Magazine, a periodical with an extensive site containing lots of issues of interest to the off-shore oil drilling sector. Read all about how we consumers cut Boss Hogg’s paycheck.
- U.S. Department of Energy’s Fossil energy Worldwide Web Network
- U.S. Department of Energy’s oil program
- A faulty Russian oil pipeline’s home page. A well-organized collection of data about the region and the possible impact of a prolonged oil leak.

Find some locations/countries in the world which are considering OFF shore oil drilling.

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and-place constraints, peer learning, and time that has been committed to this process. Currently, there are approximately 15,000 undergraduate student accounts on large UNIX systems (from Sun Microsystems), 500 networked machines in various computing labs distributed across campus, 350 incoming modem lines, and six 250-seat classrooms that are fully outfitted with good projection equipment. These efforts are coordinated by an Educational Technology Committee, which is appointed by the provost and chaired by the author. The current situation provides a level of network access for students which is adequate for the present. The challenge for the University is to be able to incrementally scale the infrastructure and access to keep up with the demand and the increasing amount of curriculum material that is flowing across the wires.

Instructor preparation time

This is by far the most serious drawback of using technology in instruction. The UO experience has left this author, and others who have used technology-based instruction, in a deeply ambivalent state about its overall worth. At the moment, there is little institutional reward for the time that has been committed to this process. Some progress was made last year, as the Educational Technology Committee did succeed in getting UO promotion and tenure guidelines revised to acknowledge this time-consuming effort as a true form of scholarship that combines the traditional triumvirate of teaching, research, and service.

Faculty are now encouraged to engage in the development of an electronic curriculum that is both innovative and original and incorporates their own research as part of the classroom curriculum. This encouragement is done under the belief that instructional technology should facilitate the transition from a teaching to a learning environment. One outcome is that faculty should spend less time on in-class “information delivery” and more time on integrating research results into the curriculum. Additional benefits would include increased communications between students, learning that is freed from time-and-place constraints, peer learning, and achievement-based evaluations. However, before any of this can be realized, resources must be made available to faculty to support these efforts. Herein lies the biggest challenge of all—can colleges and universities really marshal the resources to engage in a system-wide revamping of traditional curriculum sources?

Clearly, the potential for the individual faculty member to be both the author and publisher of multimedia courseware raises a number of important development issues that remain largely unresolved. While the creation of an HTML document requires little more than basic word processing, the production of supplemental material such as graphics or animation can be very time intensive. In fact, it is unreasonable to expect an individual instructor to do more than the basics of HTML curriculum presentation. Much of the physics courseware described below has been supplemented with original graphics, animation, and interactive experiments. The production of this material was coordinated by the instructor, but the nuts and bolts were produced by graphic artists and computer programmers working for low pay and supported largely by external grants.

Institutional investment via faculty release time or curriculum development support personnel can greatly facilitate the production of these educational products. Without this commitment, it is a significant drain on an individual faculty member’s time to produce this kind of curriculum. This is a critical issue that needs to be addressed if the promise of quality electronic curriculum produced by content experts is to be fulfilled. If this cannot be achieved, the enterprise will be taken over by the commercial sector, and we will all have to start worrying about the accreditation issues associated with MicroSoft University or some other Silicon Campus.

Towards real interactivity

At Oregon, we have developed courseware that takes full advantage of network delivery and the latest Internet tools. This effort is designed to greatly extend the textual/graphic curriculum Web page to a medium that incorporates scientific visualization and/or full interactivity into the lecture material. Towards that end, we have been engaged in the production of original animation to visually explain some physical concepts. We have used various software tools (Renderman, WaveFront) to make small MPEG simulations to conceptually explain physical or abstract events. Each animation is approximately 1–5 MB in size; hence access by students is best done on campus (i.e., it would take about eight to nine minutes to download a 1-MB file via modem).

... can colleges and universities really marshal the resources to engage in a system-wide revamping of traditional curriculum sources?”

2 MPEG refers to a standard for data compression and storage of full-motion video produced by the Motion Picture Experts Group.
To date, we have produced about fifty original scientific animations to explain concepts in physics and astronomy. These are shown in class and accessed outside of class by the students. Links to various animations produced by large supercomputers are also integrated into the curriculum. The power of visualization cannot be overstated—most humans learn best when engaged in that mode of thinking and presentation. While it is not difficult to think of what concepts could be animated, it is extremely difficult to find the time, resources, and talent necessary to produce them. Figure 2 shows a still from one of our more successful animations, which is designed to demonstrate the concept of curved space-time and how that affects the orbit of Mercury around the Sun.3

While these animations are highly valuable in helping to explain key concepts, they still remain a static piece of curriculum material; there is no way that the student can interact with them. Hence, we shifted away from the animation effort and began a vigorous effort to program curriculum in the truly interactive interface known as Java. Java is essentially a collection of C++ instructions which are downloaded as compiled source code and executed within the browser window. This functionality makes it well suited for distance education. The remote user can essentially download a fully interactive curriculum page or lesson plan. Once the download is complete, the user is no longer dependent on the network connection to examine the course material.

We are using this interface to code up virtual experiments that become part of the Web-based curriculum. The students can then do the experiment while they are engaged with the lecture material. These interactive experiments are embedded directly into the Web page and can therefore be accessed by any Java-aware browser (such as Netscape 3.0 or Internet Explorer). These interactive experiments allow the student to immediately see how the input variables determine the output.4 Moreover, this introduces experimentation into a curriculum in which normally there are no labs. We also attempt to perform the actual physical experiment in class to alleviate the fears of students that physics is magic. All too often in these classes experimental results are opaque by described by a set of textbook equations that the student then tries to memorize.

The main objective is to develop interactive experiments in physics and astronomy for a large audience of introductory students. The network will be used to deliver interactive experiments that can be done anywhere the student finds a network connection (e.g., these could be done from the campus computer lab, student’s dorm, library, or place of residence). This allows the student to perform the experiment in relative privacy, which turns out to be important. We find

Figure 2: A sample frame from an MPEG animation that depicts curved space-time

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3 The space-time curvature animation can be viewed at http://zebu.uoregon.edu/images/precess.mpg (see also /lightbend.mpg).

4 The interactive experiments can be viewed at the Java server http://jersey.uoregon.edu/vlab/
that many students today are quite timid in the physical lab. They are afraid of doing the experiment “wrong.” The use of virtual experiments done in privacy hopefully can achieve an important pedagogical goal: namely that experiments produce results and data, not answers and dogma. The network delivery mechanism also makes it possible for groups of students to do the same experiment and then compare their data, much the way the real scientific experimental community functions.

The main pedagogical idea behind the introduction of Java virtual experiments through the network is to reproduce the philosophy in the real life laboratory, namely, “What happens if I do this?” There will be no pathway to the right answer as none exists, hence there is no fear of failure. Instead, the only thing that exists is experimental results.

Increasingly there is a call for more hands-on curriculum activities in science. How can this be done in a cost-effective manner with class sizes of 150-200 students? We believe the interactive character of the Java programming language has provided the solution. With Java we can design experiments that are physically correct and show the relation between input and output parameters. This is a powerful and engaging interface to the equations of physics and astrophysics that has been designed by content experts, and which can be delivered to any network access point. The goal is to create a networked environment where the student can retrieve the notes and the demonstrations that were done in class, as well as engage in experiments with apparatus that are not possible to duplicate for a physical demonstration. In so doing we hope to show these students that science is a process and not just a collection of facts that are “known” about the physical world.

Summary remarks
While the use of technology certainly allows for a more effective integration of research into the teaching curriculum, this does not come easily. There are serious development issues, which range from simple word processing to create an HTML page to full C++ programming to make a Java applet. There is also legitimate skepticism about whether electronic courseware can really produce better student comprehension. To be sure, there are difficulties with this attempt at a new pedagogy but an honest trial must be run to assess its effectiveness.

This article has attempted to summarize networked courseware efforts at the University of Oregon. While we are cautiously optimistic about our results to date, we emphasize that it is much too early to declare technology-based instruction either a success or a failure. What is clear, however, is that for colleges and universities to make an impact on this new virtual mode of learning, they must invest resources in their own expert faculty to develop content. If this new programming interface is taken over by the commercial sector whose motivation is sales rather than education and transmission of knowledge, then the academy of 1,000 years may find itself rapidly replaced by the point-and-click virtual reality of the future. The Internet was born in the research environment of the university system. It is up to us as educators to avoid its death amidst a commercial avalanche of style over substance.

Endnotes:
The courseware discussed in this article can be viewed at the URL http://zebu.uoregon.edu/ with the following folders appended to that path:
1996/phys161.html (Physics of Energy and Environment)
1996/phys162.html (Alternative Energies)
1996/astro123.html (Cosmology and the Origin of Life)
1996/es202.html (Data Methods in Environmental Studies)

A Web version of this article is available at http://zebu.uoregon.edu/special/cause.html. The online version includes detailed descriptions of five experiments utilizing Java interfaces that the author has developed and employed in introductory physics classes. A snapshot of applets is included with each description.
Reengineering Higher Education: Reinventing Teaching and Learning

by Herbert F. W. Stahlke and James M. Nyce

Successful reengineering in higher education must begin with teaching and learning, rather than administrative processes. Addressing educational processes first will naturally force a reconsideration of such features as the student credit hour, faculty load, space utilization, the academic calendar, course scheduling, instructional resources like technology, and the design of student-faculty interaction. This article reviews selected literature in this area and develops a principled framework within which to think about reengineering teaching and learning in higher education.

Organizational reengineering owes much to the work of Walter Deming, who, at the invitation of General Douglas MacArthur, applied his management principles to rebuilding post-war Japan. Deming’s principles, under the rubric of Total Quality Management (TQM), require a business or industry to evaluate processes, from supplier through customer, in order to achieve maximum efficiency and customer satisfaction. The effects of Deming’s principles can be seen and measured in efficiency, productivity, customer satisfaction, and, ultimately, profitability. TQM and its variants have brought to universities and colleges a new awareness of these measures and of overall accountability, although such metrics have been applied proportionately more often to administrative organization and processes than to academic affairs.

NOTE: The CAUSE/EFFECT articles referenced in footnotes in this article are available online through http://www.cause.org/cause-effect/cause-effect.html

Dr. Herbert Stahlke (hstalke@bsu.edu) is a Professor of English at Ball State University in Muncie, Indiana. He is a linguist with field experience in West Africa and eighteen years’ experience in computer and information technology in higher education. From 1988 to 1995 he served within Ball State University Computing Services as Associate Director for Academic Support and Planning. Stahlke’s work in educational technology has included instructional software development, faculty training, and the development of software for distance education. Since 1990 he has been closely involved with the development of community-based Internet access in Indiana.

Dr. James M. Nyce (nycejame@esumail.emporia.edu) is an Associate Professor in the School of Library and Information Management at Emporia State University in Emporia, Kansas. For ten years, he has studied and published on information technologies built for higher education and medicine, the workplaces and institutions these technologies have emerged from, and the uses the various communities that comprise higher education and medicine have made of them. With Paul Kahn, he published From Memex to Hypertext: Vannevar Bush and the Mind’s Machine (Academic Press, 1991).
Massy and his colleagues point out, many academics would contend that academic process is of a fundamentally different order from business process: it resists business models of productivity.\(^1\) It also resists the sort of quantification commerce requires. Attempts to quantify, as in debates with state legislatures about productivity, lead to serious misunderstanding of what goes on at a higher education institution.

For this reason, James Porter argues that reengineering should be applied only to administrative processes, namely the support processes that are the business-like side of higher education.\(^2\) Porter acknowledges that the core processes—teaching, learning, and research—remain resistant to standard business process reengineering. He ascribes this resistance in part to the fact that attempting to reengineer these core processes requires a degree of agreement among administrators, faculty, and trustees that is unlikely to be achieved. This confounds any attempt to build instruments to measure, quantify, and rationalize these core processes. However, Porter’s division of institutional processes into support and core academic processes follows perhaps too closely a traditional distinction between academic and administrative spheres in a college or university. Core business processes in higher education can be viewed as including, as in commerce, links between suppliers and customers. While payroll and student records may be core processes, a case can be made that recruitment and placement are. These are the processes in which academic personnel meet high school teachers, counselors, and employers, the groups most clearly identifiable as suppliers and customers.

Carol Twigg argues that higher education must reengineer in order to improve productivity and to serve new and broader constituencies.\(^3\) However, she does not broach the issues of reengineering teaching and learning; rather, she argues that, just as IBM achieved savings and efficiencies using technology to reengineer training, higher education can use technology to make teaching and learning more effective and efficient. Twigg’s argument makes the common mistake of assuming that corporate training is enough like college and university teaching and learning that what works in the corporation will work in higher education. However, the goals and motivations of faculty and students differ enough from those of supervisors and employees to make the comparison at least questionable. Reengineering efforts that rest on analogy and resemblance misread fundamental differences: the driving force for business is profit; the driving forces for higher education are quite different. They include increasing the body of knowledge and preparing young people for productive, satisfying membership in society. The word “profit” does not appear in many college or university mission statements.

Twigg’s more recent work adopts an enhanced distance-learning model as a basis for rethinking the infrastructure of higher education.\(^4\) She argues that campus-based, lecture-mediated higher education limits access in the very ways that have led to the increased use of distance education. The physical plant, in her model, will diminish in importance as a network-based national infrastructure becomes more available. Twigg foresees replacing the existing campus-based infrastructure with an infrastructure that is entirely electronic and that is, therefore, accessible to anyone with appropriate computer and Internet access. In this way, she suggests, teachers and learners will have greater control of learning situations and of the scale of application within them.

To further reengineering, Ellen Wagner proposes that universities first apply technology to improving the delivery of distance education courses and then transfer those methods to the campus-based course.\(^5\) In 1992, the first author of this paper, collaborating with several colleagues, took a similar approach.\(^6\) However, we examined the question of how technological tools can be scaled to the teaching-learning environment and argued that course planning must consider the question of scalability.

Warren Baker and Arthur Gloster also address campus-based academic reengineering.\(^7\) They describe a massive effort to use technology to improve teaching and learning, one which requires the resources of a large research university and partnerships with major vendors and is therefore difficult to replicate in much of higher education. Such models do not implement well in smaller institutions.

William Massy and Robert Zemsky, in a lucid analysis of the economics of higher education, conclude that higher education cannot become more productive or hold costs down unless colleges and universities embrace technological tools for teaching and learning.\(^8\) They argue that information technology offers mass customization and economies of scale that are not achievable through traditional models. By appealing to the ability of technology to ease limits of time and space, Massy and Zemsky, in effect, allude to the sort of asynchronous model we present below. William Plater makes a similar proposal, recognizing how intrinsically time-linked the various elements of teaching and learning are.\(^9\) However, Massy and Zemsky, like

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Plater, appear to accept uncritically the proposition that information technology can, in fact, mediate productivity increases without concomitant losses in quality. Further, they provide for no mechanisms to ensure this result. Finally, the economies of scale that they propose are less likely to be achieved in areas like composition, literature, foreign languages, history, music, the arts, and some of the social sciences, where the medium of teaching, content, performance, and evaluation relies heavily on natural language.

In 1995, Stahlke presented an alternative, arguing that reengineering must begin with teaching and learning and that administrative changes should be driven by the results of academic reengineering. To reengineer, this work argued, one has to start with, and pay serious attention to, those categories and enterprises that define the college and university. For reengineering to succeed, for innovation to occur, it must start from teaching and learning, and a second parameter — appropriateness — must be added to scalability. Together, scale and appropriateness provide a principled matrix for designing teaching-learning tasks and matching them with appropriate tools. Finally, this work argued that reengineering is not primarily a question of using technological tools but rather that the process requires that faculty members regard traditional methods and technological tools as a set of resources to be interrogated, not taken for granted. Each tool or method has appropriate uses and scalable implementations which are not fixed.

It is within these parameters that we will discuss reengineering. In this article we will develop a principled framework within which to think about reengineering teaching and learning in higher education.

Extending reengineering to higher education

As Twigg has shown in her National Learning Initiative papers, teaching and learning in higher education have changed only very slowly since the first American universities were founded in the 17th century. Curricula have been modernized periodically, and new technologies, including low-cost publication, electronic media, and the computer, have had significant impact on the means and accessibility of higher education. However, little has changed in the basic assumptions as to how higher education is to be carried on: the lecture hall, the library, the tutorial, and the laboratory remain the structural constants of college and university education. These constants assume that higher education is best carried on by bringing the learner to the repositories and masters of learning and by organizing teaching and learning according to certain economies of scale.

The basis of our argument is that if teaching and learning in higher education are to be reengineered, then a different set of assumptions must be embraced and implemented. A strong program of reengineering must proceed from the following assumptions:

- the fundamental teaching-learning unit is the teaching-learning task;
- the relationship of teacher, learner, and content varies from one teaching-learning task to another;
- traditional methods and modern technological tools together form a unified set of tools and methods, each of which is appropriate to some teaching-learning tasks and not to others; and
- methods and tools must be scaled to fit the learning environment.

We argue that these assumptions will require a rethinking of teaching and learning that can profoundly affect the roles and responsibilities of the student and the instructor, administrative support processes and calendars, and, in short, the entire structure and delivery of higher education. The resulting reengineering promises to increase the effectiveness of the teaching-learning process, to lead to more efficient use of resources, and ultimately to increase both the effectiveness of and accessibility to higher education.

An asynchronous model of teaching and learning

Teaching and learning require relationships among teachers, learners, and content, where content is understood as including learning materials. These relationships may combine any two or, on occasion, all three components. Since all three are not necessarily or, perhaps, even frequently involved at the same time, the overall relationship among them is largely asynchronous. (We are using the term “asynchronous” to refer to activities and relationships that do not require complete simultaneous involvement of all participants and elements; rather participants and elements are present as needed for appropriate, scalable design of teaching and learning.) In the typical lecture hall, for example, teacher and learner are together, but the role of learning materials depends on lecture methods. In a laboratory, learner and learning materials are present, but the teacher plays a more limited role. By providing parameters for the design of teaching-learning tasks, an asynchronous model lends itself to considering questions as to what is taught, what is learned, who is involved, and
what relationships hold among these elements.

Technology has a potentially rich, but largely unrealized, role in teaching and learning. This role is defined variously by what the teacher has available, has had time to learn, or can find an appropriate use for, and by what students have access to, are familiar with, and are willing to use. In all of these ways, technology usually plays an adjunct role to other, more traditional modalities for teaching and learning, including lecture, laboratory, library, textbook, tutorial, and practicum.

Successful reengineering of teaching and learning requires the realization that the putative distinction between technological tools and traditional methods must be rejected. Reengineering will require the use of both traditional and technological tools and modes, building on and extending traditional social forms of teaching and learning. Using appropriate tools and modes requires assessing carefully the teaching-learning task and the suitability of method to task. What we are proposing here is a research agenda in which we would apply the critical skills we associate with discipline-based research to the work we do as faculty members. This agenda promises pragmatic yield. Reform efforts in higher education would have, for once, an empirical base. Another result would be that efforts like these would no longer be driven predominantly by policy and administrative interests. A research agenda of this sort could also have significant intellectual yield, for it would throw light on categories and resources that inform much of the work we do.

Rather than assume, as most high school and post-secondary teaching models do, that the default mode is the lecture hall, one must question what lecture is appropriate for. Surely certain thought processes and types of teaching can be encouraged better by lecture than by most other means. Dialectic rhetoric, for example, incorporates an element of drama and of suspense that lends itself particularly well to a presentation whose intent is to give students the experience of seeing knowledge unfold and grow through the use of the scientific method. And few methods can match the effectiveness of lecture in presenting a new synthesis or a new discovery that has not yet appeared in print. However, most expository modes can be as well managed in print, since the typical student needs opportunity to review details of exposition while learning new material. Computer simulation is appropriate especially for teaching-learning tasks requiring large numbers of variables that interact in complex ways and that can be mastered only by experiential methods. A self-directed hypertext model may work well for exploratory learning but is less than adequate for content requiring precision, attention to detail, and broad command of factual knowledge. Just as no single traditional method is appropriate to all teaching-learning tasks, no technological tool is either, as Gail Bader and James M. Nyce argue with respect to hypermedia.11

A similar argument can be made about the more recently popular World Wide Web pages that are beginning to be used widely for teaching and learning. Web pages bring together a variety of technologies, but an examination of existing Web-based courses suggests that more thought has gone into what one can make available through the Web than what one should use it for. The Internet abounds with text-based course material that is, arguably, not an appropriate way to use the Web. Printed text is cheaper, more easily accessible, and in many ways easier to use. Few online, Web-based courses have taken full advantage of the hypertext potential of HTML. Further, Web-based courses sometimes depend on the availability of materials on foreign servers, where the institution hosting the course has no influence over the maintenance and accessibility of those materials.

There are several reasons why the Web has been used as it has for teaching and learning. First, there has been a tendency to let technological possibilities drive Web instructional design and use. Second, the theoretical rationales that have been invoked to justify commitment to Web efforts have tended to be weak: ad hoc and post hoc appeals to post-modernism.12 However, perhaps more than anything else, these efforts build on and reflect a kind of naive optimism about technology, particularly new technologies, and the role they should have in higher education. Characteristic of such optimism is the statement that the World Wide Web “may have 1000 times more ‘pedagogical power’ than two-way TV.”13 Crucially missing from almost all these Web efforts is any discussion of what is a suitable or appropriate use for the technologies. Rather the tendency has been to assume appropriateness. Further, there has been little in the way of attempts to establish research agendas that address the issue of appropriateness. However, as American colleges and universities begin to assert property rights to the virtual university, there will be both a real need and an opportunity for such research.

Some examples of tools or modes and their appropriate uses are laid out in Table 1. Table 1 combines technological and traditional tools and modes because they are alike in one way: each has appropriate uses and must be examined

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13 Glenn Ralston (gralston @in.net), “Educational Standards,” In AI-in-Indiana (ai-in-indiana@lotus.doe.state.in.us), September 30, 1996.
The focus of reengineering must be on the relationship among teacher, learner, and materials if the appropriate tool or mode is to be chosen.

Scaling tools to context

Scalability is rarely considered a parameter in itself in the design of teaching and learning. However, choices like whether or not to use a microphone and whether to conduct a particular class in a lecture hall or a seminar room are examples of scalability, scaling room size to the size of the class and scaling audio amplification to room size. When taken up at all, scale has generally been addressed as an economic parameter. It is more economical to present a lecture to a section of 300 students than to one of thirty. As an economic parameter, scale has been outside the control of teachers and learners, manipulable only by administrators, not by faculty. We argue that design of educationally and economically effective teaching-learning objects requires that faculty members be able to make judgments of scale as well, whether in response to real conditions in which teaching and learning occur or with the intention of selecting a method and a learning group appropriately. Table 2 illustrates how a variety of tools can be scaled to the context.

Achieving appropriate matching of tools and tasks in instructional design

The design of teaching and learning as it is carried on in most of American higher education presupposes a small number of default methods. Most of undergraduate education is centered on the lecture-discussion mode, with textbook and, perhaps, library-centered storage of and access

<table>
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<tr>
<th>Tool or Mode</th>
<th>Appropriate Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>Economical compilation of established knowledge Some learning aids</td>
</tr>
<tr>
<td>Lecture</td>
<td>Economical presentation of new knowledge and new syntheses Limited interaction</td>
</tr>
<tr>
<td>Library</td>
<td>Convenient, economical mass storage, access to hard copy, collaborative learning environment, requires learner to acquire search and retrieval skills and to exercise critical selectivity</td>
</tr>
<tr>
<td>Classroom</td>
<td>Real-time, physically proximal exploration of discussion topics</td>
</tr>
<tr>
<td>Electronic Mail</td>
<td>Confidential communication One-to-one or one-to-several information distribution One-on-one dialog, not time-sensitive</td>
</tr>
<tr>
<td>Usenet News Groups</td>
<td>Access to many and diverse topical discussions Open discussion groups, not exclusive membership Tracking multi-threaded discussions Posting to multiple groups</td>
</tr>
<tr>
<td>Closed BBSs</td>
<td>Restricted discussion groups, not publicly accessible Tracking multi-threaded discussions</td>
</tr>
<tr>
<td>Internet Relay Chat</td>
<td>Online, real-time exploration of topics</td>
</tr>
<tr>
<td>Gopher</td>
<td>Hierarchical menu access to the Internet Easy search and downloading</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>Hypertext and multimedia accessible through Internet browsing software, e.g., Netscape</td>
</tr>
<tr>
<td>One-Way Video</td>
<td>Limited simulation of lecture environment</td>
</tr>
<tr>
<td>Two-Way Audio</td>
<td>Limited real-time interaction</td>
</tr>
<tr>
<td>Two-Way Video</td>
<td>More complete simulation of lecture/discussion environment</td>
</tr>
</tbody>
</table>

Table 1: Tools, modes, and appropriate uses
to information. Certain disciplines make use of additional modes: the sciences use laboratories, teacher education uses supervised practicums and internships, business uses case studies, and architecture and music emphasize studio work. In any discipline, video technologies and, sometimes, computer technologies augment the dominant modes of teaching and learning but remain largely ancillary to the modes favored by disciplinary traditions. The classroom lecture remains the basic unit of instructional and fiscal planning.14

In order to begin reengineering teaching and learning, educators must first challenge the notion “default mode.” Instead of designing for economical scheduling and movement of people, academics must attend to the teaching-learning task and its properties. With the teaching-learning task as the unit of organization for course content, we can borrow the concept of “object” from contemporary software technology, where an object is a self-contained block of information with certain intrinsic relationships to other objects. These objects can be designed in such a way that the necessary combinations of learner, content, tool or method, and teacher are most effectively associated. The nature and design of these objects will have to emerge from experiments, innovation, and reflection: if reengineering is to succeed, the artifacts of a new model cannot simply be built out of traditional elements of higher education. Teacher-learner communication can be mediated electronically by means of fax, electronic mail, electronic bulletin boards, or online conferencing systems as appropriate. Learner and materials can be associated by appropriate library or text assignments, laboratory experiences, database searches, or small group efforts. Evaluation can be carried on individually, peer-to-peer, in groups, or by various electronic means.

Such an approach to reengineering offers opportunities to test and extend notions of learning and teaching in higher education by appropriate matching of tool/mode, learning task, and participants, and by scaling the design of the object to the environment of the task. Among the consequences are more precise definitions of teacher and learner responsibilities. For example, instructor responsibilities include selecting and sequencing learning materials and activities, monitoring and evaluating student progress and performance, tutorial interaction with the top 15 percent and bottom 15 percent of students, lecture/discussion as needed and appropriate, and online discussion as needed. Student responsibilities include performance of teaching-learning tasks as prescribed or recommended, completion of evaluation exercises, and interaction, live or electronic, with the instructor or other students.

Some benefits of an asynchronous model
Reengineering teaching and learning along lines required by an asynchronous model will stimulate the evaluation and reevaluation of the

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"... if reengineering is to succeed, the artifacts of a new model cannot simply be built out of traditional elements of higher education.”

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14 Twigg, 1994, 9.
role of teaching and learning in higher education. The parameters of appropriateness and scalability will allow us to ask questions about matters that even reform efforts in higher education have frequently taken for granted: the basic objects and structures of the college or university. It is these objects and structures that a successful program of reengineering must both work through and challenge.

For students, an asynchronous model will provide greater responsibility for learning, control over pacing of learning activities, and multiple modes of interaction with instructors and peers. For instructors, the model presents research opportunities in teaching and learning and in higher education itself. It allows greater control over interaction with students, greater ability to direct attention to individual needs, and the ability to adapt modes/media appropriately to tasks. For the organization of learning, the model extends widely accepted practices in teaching and learning. Because students control the pace of their learning, learning is no longer restricted to traditional calendar terms. Because the instructor selects media/modes, traditional definitions of course, student credit hour, faculty course load, and all they entail could change radically and become dependent on teaching-learning tasks and the pace at which students can complete them.

Potential areas of application for the asynchronous model

The most natural arena in which to apply an asynchronous model is distance education, where the asynchronous relationship among teacher, learning, and content is unavoidable. However, much of the design of distance education courses has attempted to replicate the on-campus lecture hall and discussion format. The use of one- or two-way television and two-way audio is clearly a compensatory measure that has led to significant investment in infrastructure and facilities simply to preserve a default mode of teaching and learning. Instead, the fact that teacher and learner cannot be in the same place at the same time should form the basis for redesigning distance education courses around modular learning objects that use appropriate and properly scaled tools and methods.

Implementing an asynchronous model

Implementing an asynchronous model of teaching and learning in higher education requires recognizing broad principles of reengineering that have been applied effectively in business and industry. However, the model also requires addressing the fact that colleges and universities differ from businesses in some fundamental ways, differences that, if not recognized early, will cause any reengineering effort to founder. Finally, the range of types of institutions of higher learning, as defined, for example, by the Carnegie Foundation, is varied enough to require radically different approaches to reengineering.

Identifying educational analogs to the primes of business process reengineering forces us to examine the role of the institution in the society it serves. The state university, for instance, receives tax money to prepare young people for successful, productive lives, preferably in the state providing the funding. Teaching and learning are overwhelmingly the primary sets of processes supporting this goal. However,
the university must also recruit and must place these students with employers four or five years later if it is to fulfill its mission. It follows that recruitment of students and placement of graduates are also core processes in higher education.

We propose that the recruitment process be viewed as closely related to the design of curriculum and of teaching and learning. Those responsible for teaching and learning can contribute to the preparation of students for admission to their academic programs only if faculty work with the secondary school teachers who are preparing students for college. Building the preparation of applicants into the reengineering of higher education opens up new questions of how the secondary and post-secondary arenas can interact to the benefit of both.

Further, recruitment and placement can be linked through the curriculum so that relationships are established early between potential employers and potential college or university students. In order to serve as the connection between these groups, the institution will have to ask new questions about the nature of preparation for college, about the conduct of higher education, and about the relationship of the academy to the society it serves.

Back to principles

Reengineering concepts arise from the experience of business and industry in implementing Deming’s principles. Applying reengineering concepts to higher education teaching and learning requires that these concepts be rethought. For example, some of the basic terms in reengineering, terms like “internal and external customers,” are poorly defined in higher education. Further, administrative processes, as similar as they may seem to primary business processes, are not the primary processes of higher education. Here, they are support processes.

Any approach to reengineering higher education that begins from such processes will distort the mission of the institution: the goals and evaluation measures will address administrative rather than academic values, and attention will be paid to management of resources, faculty, and students rather than to teaching, learning, and research. For reengineering to be effective in higher education, the process must be driven by academic goals; issues such as appropriateness and effectiveness in teaching, learning, and research must count for more than administrative measures like efficiency and profit.

Because the research university, the liberal arts college, the comprehensive university, and the community college represent such varied manifestations of higher education, no single approach to reengineering is likely to work for all. However, for reengineering to succeed, it has to put academic priorities first. What the parameters and principles described here offer is the possibility of tying teaching, learning, research—traditional academic priorities—to recruitment and placement. In short, what reengineering offers is an opportunity to ask fundamental questions about higher education structures, processes, and the relationships they have to each other. This reengineering proposal offers a set of parameters and principles with which to rethink higher education while preserving the value and values American higher education has represented for over a century. Our proposal can lead to a reinvention of higher education that would serve us well—students, faculty, administrators alike—as we go into the next century.

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“… no single approach to reengineering is likely to work for all. However, for reengineering to succeed, it has to put academic priorities first.”

15 Robert C. Heterick (ed), Reengineering Teaching and Learning in Higher Education: Sheltered Groves, Camelot, Windmills, and Malls, CAUSE Professional Paper Series, #10 (Boulder, Colo.: CAUSE, 1993). This paper is available online through http://www.cause.org/information-resources/ir-library/abstracts/pub3010.html
Graduate Admission Processing on the World Wide Web

by John C. Cavanaugh, Mary J. Martin, and Susan A. Cover

The University of Delaware is able to distribute up-to-the-minute information about graduate school applicants to forty-six authorized departmental admissions committee faculty and staff—whenever they want to access it, using their preferred workstation—through a newly developed Netscape-based decision support application. This article describes this World Wide Web application and its successful implementation.

Processing admissions applications from prospective graduate students presents institutions with interesting challenges. As more universities and colleges desire to take advantage of information technology, most of the technology-based innovations involve administrative tasks that are relatively centralized. However, at most institutions, graduate student admissions is a highly decentralized process, with each department or program establishing its own admissions committee. Typically, graduate school offices serve more of a coordinating function.

Clearly, such highly decentralized processing requires that whatever system is designed and implemented be easy to learn and use, have adequate security, and be customizable for specific situations.

This article reports the successful design and implementation of a new process for handling graduate applications at the University of Delaware using a Netscape-based application in conjunction with the University’s mainframe student system.

In brief, all graduate admissions are now facilitated by a World Wide Web application that has replaced paper flow with electronic work flow. The application uses a Web interface to distribute information to departments and to return decision information to the Office of Graduate Studies (Graduate Office) and the central administrative system. A process that once took two weeks now takes minutes.

The institution

The University of Delaware is a Research II comprehensive land-grant, sea-grant, and space-grant institution with an enrollment in 1995-96 of 15,400 undergraduates, 3,200 graduate students, and 2,800 students in continuing education. The University employs over 900 faculty in ten colleges.

Students and faculty use a high-speed campus network to access on-campus and off-campus computing and information resources. The central systems are accessible twenty-four hours a day, seven days a week via the network from many campus locations, including faculty and staff offices. Faculty and staff are connected via Ethernet to University computing resources. Dial-in access is also available from off-campus sites.

The problem

The University has forty-six departments offering graduate programs, and the admission decision is made separately in each department. Graduate applications are received centrally in the Graduate Office and entered into the admissions component of the mainframe student information system, SIS/PLUS. Until the development of our new graduate admissions application, the applications, transcripts, paper copies of graduate record exam (GRE) scores, and decision sheets were sent using campus mail services to the department for each applicant.

To further the University’s goal to recruit the best possible graduate students, and as a way to evaluate the existing method of processing applications, a full review of Graduate Office processes was done in June 1995. The study revealed numerous problems, including too many “touches” of the application materials by Graduate Office and departmental staff, long delays in
were familiar with Web browsers, although specialized training in the new procedures would be necessary.

Timeline

A three-person development team started detail design in early October 1995. Weekly meetings allowed us to quickly refine the specifications. Our goal was to switch from the paper process to the Web processing by January 2, 1996. Two additional staff were added to the team on a part-time basis in December to incorporate real-time updating of SIS/PLUS. Four workshops were held to introduce the faculty and staff to the application in mid-December, and we successfully met our implementation goal on January 2.

The application

The graduate admission application consists of four reports, one detailed information sheet, comment input, comment review, admission form, financial aid offer form, rejection option and confirmation, change of degree/major/concentration form, and a deferral of admission form. Specifically, the application includes:

- daily e-mail notification to faculty and staff of new applications entered into the system;
- four Web reports—pre-decision processing, applicants with missing credentials, post-decision processing, and rejected applicants list;
- detailed data hyperlinked to each applicant's name;
- electronic forms for admission decisions, financial aid offers, admission rejections, and comments;
- real-time updating of the central administrative system from Web forms;
- automatic Graduate Office notification by e-mail when a decision is made;
- GRE tape display with sorting capability;
- automatic department notification of updated information such as new GRE scores;
- applicant ranking algorithms that are customizable by department;
- list of applicants to be reviewed by specific committee members; and
- ability to download information into software packages for customization in individual departments.

All documents and electronic forms are displayed on faculty and staff workstations using either Netscape or Lynx. Netscape is the standard Web browser at Delaware because it has market share, supports SSL, and is available at no cost. Netscape can be installed on workstations by downloading from the network, eliminating the need for support staff to visit every office and

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"The application was inexpensive to develop and deploy, and went from design to production in three months."
install a specialized client. Lynx, a character-based browser, was used by the few staff who did not have workstations capable of running Netscape. Lynx was modified by the project team to incorporate SSL security.

The graduate admission application is secured in three ways: (1) Social Security number (SSN) and personal identification number (PIN) to provide authentication; (2) a table that associates an SSN with more than one major code and an access type to provide authorization; and (3) encryption to provide privacy. The application only displays applicants in the designated majors or concentrations within majors; for example, users in the clinical psychology program only see applicants to the graduate program in clinical psychology, and no other applicants to other programs in the psychology department.

The application also supports three access types: view-only, decision-maker, and omnipotent. The view-only class allows for reviewing the applicant’s data on file and for making comments to other reviewers and to the Office of Graduate Studies. The decision-maker class has additional options to admit or reject an applicant. The omnipotent designation is reserved for Graduate Office staff only, and allows them to enter any major code to review the applicant list in any department. These different classes are used to ensure faculty participation in the selection and admissions process, as stipulated in each department’s program policy statement. The SSN and PIN numbers provide the means to create an audit trail should there be any questions about the admissions process.

Data stored in the University’s mainframe student information system are easily downloaded using end-user reporting tools into word processing and database applications. In this way, departments and administrative offices can create customized reports and correspondence without having to re-key all of the information.

How it works

Each time a graduate admission reviewer or coordinator uses the graduate admission application, a program on the University’s MVS main-frame reads the SIS/PLUS admission file and returns a hyperlinked list of every applicant currently in the file for a designated major. When the reviewer clicks on an applicant’s name, another program generates the information sheet for that applicant. The information sheet includes demographic information, the application status, undergraduate and graduate institutions attended, GPA, degree, major, concentration, and test score information for each testing occasion. The information sheet is generated in real time and includes up-to-the-minute information about the applicant. For example, an e-mail is generated to departments if new test scores become available. The information sheet also provides detail as to whether degrees are pending or have been conferred, whether test scores are official, and whether letters of recommendation have been received.

An additional feature pertains to situations in which students apply to multiple programs. In such cases, the graduate admission application shows only the application data relevant to the specific reviewer. New and previously unreviewed applications are denoted by an asterisk before the name. Additionally, the data are matched with requirements specific to individuals, such as certain special requirements for foreign students. There is also a built-in notification system in the event of a systems failure.

Several additional helpful types of information are included on the pre- and post-decision lists. The pre-decision list provides a snapshot of the applicant’s admission status (complete or not complete), admission term, and application date. The post-decision list includes two important pieces of information in addition to the admissions action: whether or not a required form has been sent to foreign students, and the student’s response to the admissions offer.

Admission offers, financial offers, and rejections are instantly updated in SIS/PLUS for viewing by the Graduate Office, department, Financial Aid Office, Cashiers Office, Accounts Receivable, Foreign Student Services, and Public Safety. Interfacing to a screen scraper program that is part of our interactive voice response system gives the University the ability to populate data on a screen just as an operator logged onto SIS/PLUS would do. This technology gave us the ability to do real-time updates rather than relying on batch transactions taken in overnight.

Evidence of success

During the 1996 recruitment year, the Graduate Office has processed more than 4,900 applications. Well over 2,000 final admission actions were made in that time period using the graduate admission application for a savings of many person-hours. The paper information sheet is no longer generated and mailed to departments. GRE paper test scores are no longer mailed to departments. Admission and rejection actions are no longer done manually, and there is no need to manually open envelopes returned from departments and enter the admissions action in SIS/PLUS.

In the department, manually maintained lists of applicants are a thing of the past. An up-to-the-
minute (literally) list of applicants is available by clicking on hyperlinks to pre-decision, post-decision, and rejected status. Accuracy in the processing of applications has increased significantly; the Office of Graduate Studies has found far fewer processing errors with the new system as compared to the old paper system. Additionally, departments have reported having a much easier time tracking applicants whose addresses change, as the system permits continual updating of this information.

It is no longer necessary to make separate mailings to Foreign Student Services, the Financial Aid Office, or Cashier’s Office to inform these units of pending funding offers. These units have access to screens in SIS/PLUS where funding type, tuition percentage, and stipend amount display moments after the offer is made through the graduate admission application in the departments.

Future directions and conclusions

We are currently working to expand the electronic processing to include transcripts and letters of recommendation. The plan is to begin a pilot project in which these materials will be imaged and linked to the existing electronic files. Thus, faculty on admissions committees would have all of the key components of the files available electronically for their review at their convenience. One of the challenges in this regard is the highly variable quality and physical size of transcripts. To date, we have successfully handled many of these problems, but scanning technology and other limitations currently limit the total conversion from paper to electronic media. For letters of recommendation, we have posted the forms on our Web site along with the various application forms.

In sum, the University of Delaware has successfully begun a conversion from paper processing and review of applications to its graduate programs to fully electronic files. We have already saved hundreds of person-hours, avoided roughly ten days of delay during recruitment per file due to campus mail, and documented significant cost reductions in paper and photocopying expenditures. We believe that this approach is easily transportable to other institutions, and has considerable potential in any situation in which review of files is done in a decentralized fashion.

Acknowledgments:

The authors wish to acknowledge the contributions of the programming and implementation team of Kevin Belles, Roger Cole, Thomas McDonald, Raja Rao, Nanette Risor, and Paula Spang. Portions of this article were presented in a plenary session at the American Association of University Administrators (AAUA) annual meeting in Ontario, Canada, in June 1996. AAUA presented the Office of Graduate Studies with an Exemplary Model of Administrative Leadership Award for this project.
“[Schrage] believes that organizations have over-emphasized the use of teams…”

No More Teams! Mastering the Dynamics of Creative Collaboration
by Michael Schrage
(Doubleday Dell Publishing Group, Inc., 1995, $14.95, 241 pages)
ISBN 0-385-47603-6

Reviewed by Jill B. Arnold

I thoroughly enjoyed No More Teams! and definitely recommend it. Originally published in hardcover as Shared Minds: The New Technologies of Collaboration (Random House, 1990), Michael Schrage views the retitled work as a “revised, updated, and improved version,” more relevant for managers. He believes that organizations have over-emphasized the use of teams and that teams have become a popular management metaphor that misses what we need to be addressing. “The concept of teams obscures, rather than reveals, the real relationship challenges our organizations face.” These real challenges are how people can cooperate and collaborate to create value that they could not achieve as individuals.

This book offers the reader a primer on collaboration in a manner that is intended to make one a “true believer.” It provides pragmatic how-to suggestions within an academic framework, and includes a historical perspective of the study of human interaction and the evolving emphasis on collaboration. Schrage emphasizes the enabling role of information technology in the collaborative process, and envisions a future full of opportunity, including enormous breakthroughs in human experience and learning.

The higher education community is engaged in a number of initiatives focused on collaboration and collaborative technologies. We are involved in efforts “to transform the academy,” to move toward collaborative learning, to work in partnerships, to be interdisciplinary. We are starting to see the potential for making “one plus one equals three” breakthroughs, as exemplified by the new academic area of interest that brings together the study of information technology, information management, and human interaction. The focus of Schrage’s text is very relevant.

Understanding team dynamics and team approaches has proven very effective in processing information in our organizations. Collaboration skills, technologies, and approaches offer us a chance to create information with others, which will be critical to us in the future.

Reviewer Jill Arnold is an Associate Director of the Information Technology Division and Director of Corporate and External Relations at the University of Michigan.

The Skilled Facilitator: Practical Wisdom for Developing Effective Groups
by Roger M. Schwarz
(Jossey-Bass, 1994, $19.95, 314 pages)
ISBN 1-55542-638-7

Reviewed by John E. Bucher

Managers of information technology in higher education are regularly called upon to facilitate and mediate within their constituencies, whether the group consists of staff, faculty, administrators, or, more likely, a combination of these. I didn’t recognize the importance of group facilitation when I first became a director of computing. But I have certainly come to appreciate the importance of this skill in all areas of higher education information technology. As IT leaders, we have a required involvement in almost all areas of our campus. We find ourselves called upon daily to help groups reach decisions and plans of action in the use and deployment of technology. Reengineered organizations, flattened hierarchies, matrix or self-managed teams, all demand effective facilitation and guidance.

The Skilled Facilitator, by Roger Schwartz, is designed as a practitioner’s guide to the theory and skills of group facilitation. Although its primary audience appears to be consultants and contractors, its methods can be very valuable to anyone who assists smaller, task-defined groups within larger organizations in defining and solving problems.

The book includes introductory chapters on the definition of facilitation and the role that external facilitators play in organizations. It also provides very important summaries of what are described as “core values” and “core principles” underlying any facilitative approach to increase effectiveness within groups.

Middle chapters on meeting management, dealing with emotion, problem solving, and intervention provide important fundamental information. I found the final section to be most relevant in my role as an IT leader, since it speaks directly about serving as a facilitator in one’s own organization and includes a chapter devoted to becoming and serving as a facilitative leader.

Although some parts of the book are more relevant to contracted consultants, overall I found the book relevant and timely, and believe it will be a valuable reference source for information resources managers and leaders.

Reviewer John E. Bucher is Director of Computing at Oberlin College. He has managed information technology services in small, medium, and large universities and colleges.
Our Year 2000 efforts at the University of Florida formally began in March 1996, with the assignment of a project leader. Since that time, an estimate of impact and a systems inventory has been conducted, system priorities established, a project plan developed, and an eight-member team organized. Each system is currently undergoing a detailed analysis to determine the preferred conversion approach. Approximately 4.4 million lines of code in 4,000+ programs are affected.

In older, isolated systems, a sliding window approach is usually chosen. Otherwise, we are changing the data files. Where there is enough space on the record, we are duplicating each old date with an 8-byte (YYYYMMDD) compliant date. This allows both converted and original programs to access the same file. If there is insufficient space, we are adding a single-byte century indicator for each date. As a last resort, we are expanding and reformattting the file. Our overall target completion date is December 31, 1998.

As of October 1996, four research pilots, one conversion pilot, and two regular system conversions have been successfully completed. Six separate project phases have evolved from these experiences: awareness, assessment, research & planning, conversion & testing, implementation, and monitoring.

Tom Thomas
Director of Information Systems
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At Rollins College (Florida), we went the easy route and decided to completely replace our legacy system before that date with BANNER. We would have needed a several-year effort to rewrite the existing system just to deal with this. Hopefully, we’ll feel we got off easier with the method we’ve chosen.

Les Lloyd
Assistant Vice President of Information Technology
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At Humber College (Ontario, Canada) we started the process of examining the Year 2000 problem in 1994, as a part of our overall administrative system plans. We saw it as an opportunity to begin addressing technical issues and integrating systems. Essentially we are replacing two of our major trio of systems (student and human resource/payroll). We are rewriting our student system using a new application development platform (NATURAL/ADABAS/CONSTRUCT/PREDICT), which was planned ahead of time for technical reasons, with the added benefit of handling the Year 2000 problem (the old system would not handle it without programming).

For HR/payroll, we are participating in the founding of a consortium of Ontario colleges to centralize new hardware, new software (ROSS), and some services. (This will replace our old IA version.) For our financial system, which is currently SCT/IA, we will either apply the updates that should be available in 1997 or perhaps replace it, too. All other systems will be combined with our student system project, rewritten, or dropped.

The student system will roll out in the first quarter of 1997. HR/payroll is scheduled to take a year from commencement. The FRS updates are estimated to take ten weeks to apply (we still have several Canadian mods to reapply), while a replacement is still to be determined and could involve the college consortium.

Peter A. Kahn
Director, Systems Development
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In general, the University of Wisconsin-Milwaukee is planning to modify existing information systems to handle the Year 2000. In fact, this has been a background, ongoing activity for a number of years here. We devised a method to allow us to convert programs as we have done maintenance to them. We estimate that we are about 80 percent complete at this time. Remaining programs will be converted as part of a major rehosting effort from an IBM mainframe to a UNIX platform in the next two years.

Marge Waala
Manager of Application Development
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The University of Arizona evaluated many alternatives. Given the complexities of developing new applications, the fact that the implementation date cannot be adjusted, and having applications that already need Year 2000 dates, we are planning to modify the existing systems, although outright replacement remains an option. Some specific subprocesses of our application systems may be reengineered as an alternative.

The analysis of major systems began in 1995, and a project team was formed earlier this year to coordinate the changes to all systems. This team has been evaluating all aspects of becoming Year 2000 compliant. A project plan has been developed; an initial budget request has been submitted; vendor products for analysis, code change, and testing are being evaluated; a testing environment is being planned; and a position and recommendation paper is being finalized. Actual code changes have started where applications are currently facing Year 2000 issues. Additional personnel resources will be required to implement a full-scale, Year 2000 compliant modification process.

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Editor’s note:
For lack of space, we were unable to print all responses received. All responses to this question have been placed on the CAUSE Web server at http://www.cause.org/cause-effect/cem96/cem964b.html

Also, a current issues session on this topic was held at CAUSE96, and a summary of that session will be available early in 1997 as part of the online conference proceedings.
Florida Community College at Jacksonville instituted a systems development standard of “handling the Year 2000” in all new systems in 1989. It was during 1990 or 1991 that we began reviewing our long-term direction with regard to systems development tools. Our process concluded in late 1992, with the acquisition of new tools. We selected Software AG’s tool set of ADABAS/NATURAL/CONSTRUCT/PREDICT, and some others.

It was our belief that we had to have tools to allow us to change systems more quickly. The growing demands for data from the Florida Legislature, as well as institutional needs, dictated requirements for adding new data elements and systems functionality in a more timely fashion. It was obvious that systems developed with COBOL and VSAM files would not meet future needs in this regard. Another factor driving our systems changes was the need to address the Year 2000 date in existing systems.

About the same time we were acquiring new tools for systems development, there were seven other community colleges that selected the same tools. In 1993 we formed a consortium to rewrite the major applications, i.e., finance, payroll/personnel, student, and facilities. The systems development process began in January 1994. The payroll/personnel system is in production at two colleges. The finance system is being installed at one college, and the student system will be installed beginning in February 1997.

With the consortium we are addressing two major institutional requirements: the Year 2000 date problem and being able to replace our legacy systems using a new tool set. The new systems are providing significant new functionality—it’s not just a system rewrite. With the consortium we are able to address systems replacement significantly faster than we could have if we were rewriting these applications by ourselves. We will have all these systems in production by spring 1998. The finance system will be in production beginning July 1, 1997, the payroll/personnel system by January 1998, and the student system by April 1998.

The members of the consortium are: Florida Community College at Jacksonville, Broward Community College, Miami-Dade Community College, Palm Beach Community College, Indian River Community College, Okaloosa-Walton Community College, Tallahassee Community College, and Edison Community College.

Jack Tinsley
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Syracuse University is planning to replace the majority of its information systems by the Year 2000. An analysis of our legacy systems showed that a few could be modified at a reasonable cost, many should be replaced due to the high cost of modification, and a few would have to be rewritten. The decision to replace as much as possible is in line with our computing strategy, already in place, to move our information systems to newer technologies. Our replacement approach is to purchase software packages where possible, modify a few systems, and rewrite those information systems we cannot purchase. To date, we have replaced many of our smaller systems with purchased packages or in-house written applications. We have selected package replacements for alumni/development, human resources, payroll, facilities management, library, and student systems. Project teams for these areas are in various stages of the implementation process, with target dates during 1997 and 1998. Other teams are in the process of evaluating telecommunications, accounts payable, and purchasing software. Modifications to systems we expect to run after the Year 2000 are under way and will be completed before they begin to encounter problems.

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The California State University (CSU) Office of the Chancellor has launched three IT initiatives related to impending Year 2000 date issues:
- The Collaborative Management Systems Initiative aims to achieve cost savings and efficiencies through multi-campus cooperation and collaboration in the operation and management of administrative software portfolios. Year 2000 readiness is part of a larger reengineering effort, as this initiative identifies target administrative processes and computing platforms for the CSU—some of which may involve new purchases and development, and others which will call for upgrades to existing systems.
- The Streamlining Technology Delivery Initiative addresses as one initiative component the currency of administrative computing hardware and operating system software, including the ability to function properly with 21st century dates. Computing center consolidation activities that are currently being considered under this initiative may provide an opportunity to enhance Year 2000 support of some administrative systems. Several CSU campuses have already purchased main-frame hardware and operating systems, software upgrades toward the ends of: Year 2000 platform readiness, increasing computing capacity, and capability to participate in future computing operation consolidations.
- The Year 2000 Readiness Initiative provides an overall framework for identifying and addressing 21st century date issues with information systems, hardware, software, and processes. The
Chancellor’s Office/campus task force working under the auspices of this initiative is charged with such issues as:

- coordinating activities with the other CSU I/T initiatives related to resolution of Year 2000 issues,
- identifying processes that will require coordination with state and federal agencies when deploying redesigned “Year 2000 ready” data, and
- working with appropriate technical groups to identify CSU information systems that have Year 2000 date dependencies and to recommend methods and parameters for their resolution.

More information on these and other CSU I/T initiatives can be found at: http://its.calstate.edu/

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The Board of Regents of the University System of Georgia is using a combination of approaches to meet the Year 2000 challenge. All of our current financial applications—including payroll—will be modified internally for Year 2000 compliance. We are currently engaged in an RFP process for new financials, but installation will not be complete in time to avoid Year 2000 implications. In addition, we are analyzing our complementary and secondary systems to find out where we need to make modifications to deal with the century change. Along with desktop systems, these are our biggest headaches. There is just that underlying concern that somewhere in there we have forgotten a minor process that will be impacted when, or before, the new century arrives.

One area where we feel confident about this transition is in our student information system, which is BANNER from SCT, and the hardware and technology that support it. SCT is providing the modifications necessary for Year 2000 compliance in BANNER. In fact, this is just a routine update as part of their Technology Currency Program. Our primary hardware vendor, Hewlett-Packard, will be providing an updated operating system; and Oracle is keeping us current to run without a hitch as we approach the Year 2000. Oracle is the database for all our centrally supported applications.

The University system is also participating with the state agencies in a collaborative effort to review and identify problem areas.

Though a challenge as all-encompassing as the Year 2000 is cause for concern, a solid strategy like the one we developed for Georgia (and vendors who take care of their customers) smooth the way for an uneventful transition. Also, because thirty-one of our thirty-four institutions are in the process of installing the BANNER software, we have the added comfort of many people collaborating to ensure our success.

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Purdue University developed a Year 2000 solution in 1994. It consists of COBOL programs to scan and subroutines to insert, where appropriate, to solve the problem. The solution also consists of a user guide with instructions and examples.

Our solution does not expand files or fields. We continue to utilize two digits. We found this to greatly reduce the number of programs needed to modify and test.

We have approximately 10,000 COBOL programs. As of October 1996, we are approximately 54 percent completed. That includes scanning, modifying, testing, and putting back into production. Of the approximately 5,000 programs we have put through the scan, we average about a 40 percent hit rate. This means we do not have to modify about 60 percent of the programs. On average, taking into consideration all 5,000, we are averaging less than 1.5 hours per program. Over two years, we have averaged using 2-3 FTE per year to make these modifications.

We sold the distribution rights to this solution to Venture 2000, Inc. (904-731-1622). They also have translated the solution into multiple languages that run on MVS and VSE.

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“There is just that underlying concern that somewhere in there we have forgotten a minor process that will be impacted when, or before, the new century arrives.”

Selected responses to the Spring 1997 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://www.cause.org/cause-effect/cause-effect.html
Feature Articles

de Vry, Janet R., Judy A. Greene, Sandra Millard, and Patricia Sine. “Teaming Up to Develop a Faculty Institute on Teaching, Learning, and Technology.” Fall, pp. 22-27, 32-34.

CNI Report

_________. “Future Perfect.” Spring, pp. 3, 8.
_________. “Real Savings—Real Benefits.” Winter, pp. 3-4.

Current Issues

“Current Issues for Higher Education Information Resources Management.” A summary of issues identified by the CAUSE Current Issues Committee. Summer, pp. 5-7, 17.
Krauth, Barbara. “Principles of Good Practice for Distance Learning Programs.” Spring, pp. 6-8.

Campus Profiles

California Lutheran University. Spring, pp. 30-33.
Santa Barbara City College. Winter, pp. 30-33.
University of Phoenix. Fall, pp. 28-31.

Viewpoints

Callum, Robert. “Spinning the Web: The Design of Yale’s Front Door.” Fall, pp. 49-51

Good Ideas

Callum, Robert. “Spinning the Web: The Design of Yale’s Front Door.” Fall, pp. 49-51.